INSTITUTE OF GEOPHYSICS
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D-67 (382)

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SOLAR RADIATION
2004-2005

WARSZAWA 2006

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Total Amount of Atmospheric Ozone and its Vertical Distribution Belsk 2004-2005

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Ozone observations have been made by means of Dobson spectrophotometer No. 84 in the Geophysical Observatory at Belsk since March 1963. This publication presents all total ozone values and vertical distribution of ozone over Belsk in 2004 and 2005 obtained from the conventional Umkehr observations.

Vertical distributions of ozone from Umkehr observations have been evaluated by the World Ozone Data Centre, Atmospheric Environment Service, Downsview Ontario, Canada. Vertical distributions of ozone as well as daily values of total ozone are also published by the Atmospheric Environment Service of Canada in cooperation with the WMO (Ozone Data for the World).

Monthly mean values presented in Table 1 and Table 2 are based on the daily values of total ozone obtained according to the recommendations of the WMO. According to the International Ozone Commission of IAMAP and WMO recommendation, new ozone absorption coefficients (Bass–Paur scale) have been used in processing Dobson spectrophotometer total ozone data beginning on 1 January 1992.

In June 2005 the instrument No. 84 from Belsk took part in the WMO Intercomparison of Dobson Ozone Spectrophotometer in Hohenpeissenberg, Germany; first set of corrections to N-values resulting from the comparisons and the wedges recalibration have been applied since 1 July 2005.

The total amount of ozone and Umkehr observations have carried out and calculated by: Wiesława Szpikowska, Dorota Sawicka, Anna Głowacka, Wiesława Zawisza.

Table 1

Comparison of monthly mean values of amount of atmospheric ozone for 2004

Month	Number of observation days	Mean ozone amount [D]	Number of Umkehr series
January	27	352	–
February	24	375	7
March	31	377	9
April	28	374	24
May	30	372	15
June	29	354	19
July	30	329	21
August	31	314	17
September	30	297	20
October	29	280	13
November	28	291	3
December	26	308	4

Table 2

Comparison of monthly mean values of amount of atmospheric ozone for 2005

Month	Number of observation days	Mean ozone amount [D]	Number of Umkehr series
January	28	343	7
February	26	362	11
March	28	368	15
April	30	380	22
May	31	353	18
June	15	358	6
July	31	332	19
August	31	312	19
September	30	286	31
October	31	278	29
November	29	291	6
December	25	322	1

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TOTAL AMOUNT OF OZONE

Observations are entered in the column in accordance with the codes explained below:

YY – Greenwich day of the month on which the observation is made.

GG – Time of observation to the nearest hour, Greenwich Mean Time.

μμμ – The relative path-length of sunlight through the ozone layer.

λ – Wavelengths used, reported according to the following code:
- **0** – wavelengths AD, ordinary setting,
- **2** – wavelengths CD, ordinary setting,
- **4** – wavelengths AD, focussed image,
- **6** – wavelengths CD, focussed image,
- **9** – wavelengths CD, focussed image with $NiSO_4$ filter.

S – Kind of observation, on sun or sky, reported according to the following code:
- **0** – on direct sun,
- **2** – on blue zenith sky – ZB,
- **3** – on zenith cloud – ZC (uniform stratified of small opacity),
- **4** – ZC (uniform or moderately variable layer of medium opacity),
- **5** – ZC (uniform or moderately variable layer of large opacity),
- **6** – ZC (highly variable opacity, with or without precipitation),
- **7** – ZC (fog).

ΩΩΩ – Total amount ozone in D (1 dobson = 1 milli atm-centimeter).

JANUARY 2004

YY	GGμμμ	λSΩΩΩ
01	11370	26330
	11377	26321
	12400	26324
03	10365	22300
	11363	25306
04	11361	25293
	11369	25285
	12378	25283
	12388	25290
05	10373	26326
	10363	26324
	11359	26322
	11371	25338
	12381	25332
06	10374	26347
	10365	26340
	11357	26341
	11356	26342
	11365	26340
	12379	26325
	12391	26338
07	10377	22294
	10361	23283
	11355	23282
	11354	24286
	12369	24288
	12377	24281
08	11352	26287
	11351	26288
09	10376	25277
	10369	22277
	10356	22279
	10350	22281
	11349	24267
	11353	22279
	12364	24266
	12375	24269
10	11348	27297
	12359	27297
	12368	27292
11	11343	26322
	11350	26325
	12357	26320
	12363	26314
13	10357	26321
	10343	26311
	10339	26328
	11337	26334
	12350	26340
13	12363	26338
15	10354	26354
	10343	25343
	10335	25342
	11331	25343
	11338	26345
	12346	26357
	12356	26367
16	10347	26333
	10337	26335
	11329	25322
	11328	26327
	11330	26327
	11338	22334
	12342	22334
	12349	22338
17	10332	26379
	11299	26390
	11306	22383
	11316	25376
	12340	25374
18	10346	24366
	10340	24365
	10327	26376
	11322	25371
	11321	24367
19	10342	26406
	10333	26395
	10324	26401
	11318	26393
	12330	23382
	12340	25390
20	11316	25489
	12320	26498
	12324	25486
	12326	25486
	12332	26503
	12340	26511
21	10332	20463
	10329	22469
	10323	22469
	10318	22467
	10314	22464
	11311	22462
	11312	22464
	11315	22479
	11318	22481
	12322	20465
	12334	20463
23	11306	25421
	11304	26424
24	11301	26377
24	12309	26374
	12331	26370
	12346	26371
	12360	26364
25	10300	26349
	11297	26333
	11303	26342
	12318	26346
26	10311	26326
	10299	26327
	11294	26328
	11294	26325
	11298	26333
	12311	26328
27	10309	20315
	10307	22318
	10295	22321
	11291	26314
28	12317	25359
	12328	25356
	13338	25359
29	10297	25377
	10291	25380
	11285	25378
	11284	25372
	11289	22387
	12296	22396
	12308	22402
	12321	26401
30	10290	26483
	10284	26477
	13352	20454
	13362	20461
	13370	22467
31	11277	23358
	11278	22351
	12302	24346
	12319	23353
	13340	22348
	13358	22345

FEBRUARY 2004

YY	GGμμμ	λSΩΩΩ
01	11274	26280
	12280	26289
	12296	26291
	13381	26298
04	9314	26304
	9298	26299
	10284	26306
	10267	26325
	11264	26319
04	13370	26325
	13380	26332
05	9358	25274
	9295	24273
	10287	24268
	11260	06279
	11260	06278
	11261	26278
	12285	25281
	12299	22285
	13308	22282
	13327	26284
	13354	26275
06	9344	25309
	9328	25304
	10273	25306
	10272	25301
	10262	25284
	11258	25308
	11257	05304
	11257	05305
	12275	26310
	12282	26301
	13304	26310
	13322	26301
	13349	25301
07	10270	26317
	10261	26322
	10258	06322
	11255	05312
	13306	20339
	13316	22327
	13330	20344
	13352	20343
08	11252	25396
	11251	25404
	11251	05401
	12256	25410
	12265	24400
	13290	26406
	13337	24395
09	10263	26400
	11249	26412
	11248	06402
10	8343	20399
	9331	22399
	9327	20409
	9304	20397
	10256	22402
	11246	00384
	11245	00383
	11245	02382

YY	GGμμμ	λSΩΩΩ
10	12267	05393
	13309	26438
11	9301	24438
	9289	24435
	10260	22451
	10258	02434
	10255	00436
	10243	00440
	11242	02432
	11242	00433
	11245	00424
	12250	00429
	11224	03382
	12259	00429
	12263	02430
	12270	00449
	13289	20466
	13301	20472
	13331	22477
	13341	20474
12	9301	25454
	9280	22447
	10251	02421
	10250	00422
	11240	05415
	11240	02418
	11239	00423
	11240	02418
	12243	00420
	12245	00422
	12247	02417
	12257	00418
	13276	22446
	13279	20444
	13297	20445
	13301	22445
	13326	22446
	13343	20438
13	10249	06395
	10243	06397
	11236	06403
	12259	06407
14	11234	06361
	11233	06362
	11237	06372
15	11230	06375
	11231	06379
	12243	06379
	12256	06375
	13281	26389
16	9301	26389
	9293	26383
16	10241	06373
	10231	06371
	11277	06369
	11229	06366
	12239	06368
	13273	06370
17	9294	26348
	10239	06345
	11226	06343
	11225	06341
	11225	06341
	12232	06356
	12238	06355
	12252	26366
	13270	26359
19	12231	06411
	13256	06409
	13287	26415
20	8300	22351
	8287	20362
	9267	20361
	9253	00351
	9244	02347
	10230	02345
	10227	00346
	10219	00348
	11217	02348
	11217	00351
	11219	00349
	12227	00348
	12230	02351
	12238	00350
	12243	02351
	13248	00350
	13266	22368
	13289	20362
	13300	20367
	14353	20371
21	11214	00343
	11217	00340
	12219	02334
	12223	00340
	12232	00336
	12238	02331
	13250	20342
	13254	00335
	13277	02328
	13294	00335
	14303	20347
	14347	20346
22	11212	06346
	11214	06360
22	12216	06358
	12227	06348
	13248	06353
	13285	26361
23	9241	06353
	10227	06355
	10216	06354
	11210	06351
	11209	05352
	12213	06357
	12220	06352
	13281	26363
24	10209	06381
	11207	06376
	11208	06381
	11209	06380
	12229	06379
	13244	06374
	13247	02373
	13251	02373
25	8279	20410
	9242	02393
	9227	02395
	10219	00392
	10217	02396
	10211	02397
	10207	02398
	11205	00295
	11205	02400
	12208	00397
	12212	02403
	12222	02403
	13233	02403
	13253	02399
26	8293	20411
	9250	04401
	10216	04408
	10206	04406
	11202	02410
	11205	05403
	12210	05405
	12220	05407
	13240	26417
28	11198	05446
	11200	06454
	12210	06464
	13226	06454
	13244	06446
	13272	26465
	14287	26467
29	11196	06467
	11197	06452
26	12207	06455
	MARCH	**2004**
01	9210	06432
	10203	06427
	10196	06433
	11194	06431
	12197	04426
	12200	04422
	13256	04419
02	13220	06424
	13232	06423
	13249	06429
	14267	06433
03	8258	00447
	8249	02445
	9238	00452
	9209	00457
	9206	02459
	10199	00460
04	9201	06461
	11188	06463
	12197	06467
	14257	06463
05	8258	05388
	8238	00381
	9231	02390
	9227	00381
	9225	02391
	9213	02396
	9211	00388
	9200	02398
	10187	00392
	11185	02396
	11185	00394
	12190	03387
	12196	00390
	12198	02395
	12217	02393
	13220	00393
	13232	02392
	13239	00391
	14260	02392
	14264	00385
06	11183	00343
	11184	00343
	11185	02346
	12197	00338
	12199	00343
	12205	00337
	13222	00338

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
06	13235	02342	11	13201	00379	17	11166	05295	22	8201	04328
	13239	00345		13227	00377		13200	06299		10159	04339
	14251	00346		14235	02374		14219	06301		11158	06344
	14257	20351		14256	00377	18	8240	03302		14213	00349
	14264	02348	12	7354	20370		8232	03298		14228	02350
	14306	20364		8258	00369		8225	03296	23	6359	20340
	15358	20362		8232	02369		8203	03295		7259	02332
07	11182	05371		8226	00371		8198	03294		7234	02331
	12187	04377		8213	00369		9192	03295		8229	00334
	12192	04380		9196	00377		9185	02298		8210	00338
	12198	02377		10180	00374		9178	02298		8199	02333
	13222	05379		10175	02378		9176	02298		9186	00336
	14258	02379		11173	02380		11164	02297		10158	02335
08	8256	05420		11173	02381		11164	02296		11157	00331
	8231	05418		13198	04386		13183	02300		11157	02336
	9210	05414		13203	04391		13192	02300		12164	02344
	9200	04415		14240	04400		13203	02299		12166	00355
	10187	02409		14259	04395		13209	00301		13180	00359
	10182	04404	13	8250	06358		14241	00300		13184	02351
	11180	04400		8222	05361		14257	00300		13196	02355
	13202	06403		9199	06349		14261	20310		13201	02358
	13211	06403		9188	04349		15306	20308		14235	03353
	14261	06410		10177	04348	19	7262	02329		14267	04365
09	8258	06427		10173	02353		8236	02331	24	11156	05370
	9217	06420		11171	00340		8197	02329		11156	04364
	9206	06422		11172	00338		9185	03329		13179	04380
	11178	06433		11172	02343		9177	03331		13199	06381
	12199	05414	14	8260	05313		10171	02338		14263	06390
	13203	06417		8229	05315		10168	02339	25	9169	06400
10	9208	05420		9199	05312		10166	02340		9164	06396
	9199	05415		9190	05310		11163	02344		11154	07402
	10185	00413		11170	05318		12173	04343		13196	07406
	10183	02418	15	8251	04329		13181	05347		14205	07426
	11176	04416		8236	04327		13195	04348	26	13191	06444
	12196	02409		8214	04328		14231	06358		14204	06439
	13200	04404		9201	04326		14258	05363		14256	06446
	14258	05408		10177	02331	20	11161	06415	27	11154	06420
11	8258	00380		10172	02331		11162	04420		12157	06422
	8252	02379		10170	00333		12164	02416		12167	06415
	8234	02380		11168	02337		12164	00426		13181	06418
	8228	00381		11168	02335		12166	00427		14199	06421
	9203	00384		13196	04337		12171	00431		14230	06426
	10182	00381		13202	02338		13190	05423		14254	06432
	10177	00382		13218	00344		14261	05426	28	11152	05431
	10175	00381		14239	00346	21	11160	03310		14199	05405
	11175	02385		14259	04332		11161	03308		14207	05410
	11175	00382	16	7257	05304		13194	02304		14222	05405
	12182	00381		8220	05308		13204	05306		14231	02410
	12184	02382		9201	04306		14217	06316		15261	06421
	12187	00379		9186	03309		14259	02303	29	7249	06402
	13195	00380		11167	04315	22	7263	04329		7224	06400
	13198	02379	17	11165	05298		8233	04329		8201	06398

YY	GGμμμ	λSΩΩΩ
29	8191	05393
	10150	06409
	11149	06412
	13192	06407
	14199	06414
	15264	06416
30	7213	06366
	8203	06363
	9172	04362
	9162	02358
	9156	00361
	10153	00361
	10149	05358
	13168	06353
	13180	06355
	14197	06352
	14212	05352
	14241	05352
	15262	05360
31	7260	06321
	7241	06324
	7228	06319
	8188	05316
	9171	05313
	11147	06314
	12156	02321
	12162	02322
	14197	00328
	14213	00327
	15256	02324
	APRIL 2004	
01	8192	02325
	8174	02324
	9169	00322
	9165	02323
	9161	00325
	9154	00325
	10150	00326
	10148	02326
	10147	00328
	11146	00334
	12153	00336
	13163	00337
	13175	02326
	13176	00336
	14193	00333
	14198	02327
	14226	00335
	15252	00334
02	6353	20354
02	6300	20355
	7260	02337
	7253	20354
	7246	00344
	7216	00350
	8196	02339
	8189	00351
	9160	00355
	9153	02343
	9152	00351
	10148	00349
	11146	00345
	13161	00345
	13164	02339
	13183	00344
	13187	02335
	14217	00340
	14224	02332
	14238	00340
	15251	20343
	15261	00346
	15306	20339
	15355	20340
03	11146	02332
	11147	00335
	12149	00334
	12160	00334
	13170	00334
	14190	00335
	14197	02331
	14234	00335
	15263	00334
	15309	20349
	15356	20355
04	11146	02380
	12148	00384
	12153	00384
	13162	00381
	13163	02380
	14203	06380
	15259	05384
05	8169	06394
	10146	05383
	10143	05379
	11142	06388
	13158	03384
	14189	04388
	15257	03392
06	7261	04394
	7241	04393
	8192	03399
	8173	03397
06	10142	03391
	11141	05392
	14202	04412
	15247	02410
	15261	02416
07	8191	04419
	8173	04422
09	6264	06418
	7234	06419
	8174	06426
	9159	06427
	9151	06420
	10142	06410
	13169	05399
	14189	05415
	14203	05414
	15233	00401
	15240	02396
	15251	00402
10	6260	06415
	7199	06409
	8162	06412
	9157	06408
	10142	06407
	10139	06411
	11138	06416
11	10139	06436
	10137	06429
	11137	06430
	11138	06423
12	11138	00355
	12140	00349
	13155	00357
	13158	02351
	13170	00357
	14194	00359
	14207	00357
	15222	02348
	15248	00354
	15270	00359
13	6259	06384
	7200	05373
	8181	05371
	10136	02373
	11135	02372
	11135	00375
	11136	00376
	14200	06377
	15227	06378
	15261	02367
	15266	00372
14	6353	20383
14	6300	20381
	6261	00370
	6250	20379
	6244	00370
	7222	00373
	7202	00372
	8175	00375
	8162	00376
	9149	00373
	9144	00372
	10137	00373
	10135	02371
	11135	00372
	11137	00376
	12147	02373
	13151	00378
	13156	02370
	13165	00379
	13167	02372
	14178	00378
	14187	02370
	14216	00375
	15242	00372
15	6349	20359
	6261	00351
	6253	20359
	7230	02346
	7219	00357
	7196	00358
	7182	02348
	8175	00358
	8161	00358
	8158	02348
	9141	00357
	10139	02345
	10135	00352
	10134	00354
	11134	02341
	12137	00347
	12139	02337
	12146	00346
	12148	02337
	13153	00344
	13169	00345
	14183	00342
	14194	02337
	14204	00339
	15222	00340
	15252	20351
	15270	00343
	15295	20355
	16361	20357

YY	GGμμμ	λSΩΩΩ
16	5358	20356
	6312	20352
	6257	00343
	6251	20349
	6239	02338
	7222	00346
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	8168	02344
	8162	00357
	9151	00354
	9147	02342
	9142	00348
	10137	02338
	10136	00345
	10133	00343
	11133	02337
	12140	02346
	14193	04350
	14208	03351
	15262	05349
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	7192	05379
	8156	04373
	8151	02374
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	10133	06386
	11132	06377
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	12136	06428
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	6302	20355
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	6251	20353
	6247	00351
	7201	00350
	7199	00350
	7184	02344
	8168	00349
	8152	02347
	11131	06344
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	13162	05346
	14172	06344
	14200	04352
	15214	04357
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	7190	00366
	7184	02356
	8164	00362
	8157	02354
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	13146	02345
	14204	02355
	15212	02354
	15265	04353
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	6298	20346
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	6225	02341
	7207	00349
	8169	00353
	8152	00351
	8149	02349
	9147	00352
	10132	02363
	10132	00370
	11130	02362
	11130	00370
	12142	00381
	13161	00398
	14173	00399
	14198	02388
	14201	00394
	15215	00394
	15263	00387
22	7214	03397
	7195	03397
	11130	06385
	12142	05373
	14203	05376
	15241	06375
	15265	06392
23	5354	20366
	6301	20366
	6258	00356
	6225	00357
	7195	00355
	7187	02344
	7173	00352
	8159	00351
	8149	00362
23	8146	00363
	9145	02351
	9135	00360
	9134	02348
	11129	02346
	11129	00358
	13158	00353
	14181	00348
	15203	03336
	15244	02338
	15623	02339
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	10131	06368
	10130	06366
	10128	06368
	10128	06368
	11127	06366
26	5352	20356
	5300	20359
	6260	00349
	6151	20361
	6241	02347
	7201	00356
	7182	00356
	7174	02352
	8160	00355
	8145	00358
	9140	02354
	9137	00356
	9132	00358
	10129	00358
	10127	00358
	11127	00360
	13153	02367
	14195	02363
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	15237	00367
	15252	20375
	15262	00365
	16300	20374
	16353	20371
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	5301	20375
	6260	00359
	6251	02372
	6247	00363
	6233	02356
	7229	00367
	7201	00366
	7195	00370
	7172	00372
	7166	00369
27	8158	00371
	8151	00370
	8145	00370
	9139	00370
	9134	00372
	10129	00371
	10127	00371
	10127	00369
	11126	02370
	12137	02372
	13139	00369
	13142	02369
	13143	00372
	13148	02371
	13149	00372
	13156	02370
	13157	00374
	14184	02374
	14187	00375
	15200	02372
	15216	02369
	15235	02368
	15260	20378
	15270	00365
28	6256	03369
	6228	03372
	7205	03376
	7185	03375
	8144	04375
	9138	04372
	10130	03372
	11126	05377
	11127	02382
	11128	02377
	13153	06371
	14172	05376
	14193	02385
	15217	04379
	15269	02385
29	5358	20373
	5302	20375
	6265	00358
	6246	02350
	6228	00360
	7194	00367
	7177	00368
	8162	00366
	8156	02359
	8146	00373
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	9130	00370
	10127	00366

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29	10126	00368
	10125	00366
	11125	00364
	11126	00366
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	13140	02360
	13147	02361
	13155	00362
	14168	02357
	14171	00365
	14184	00367
	15197	02361
	15202	00368
	15225	00362
	15232	02355
	15252	02354
	15262	20361
	16268	00360
	16304	20366
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	5303	20355
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	6228	00346
	6217	02337
	7194	00348
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	9130	00344
	10128	02345
	10126	00345
	10126	02346
	11125	00347
	11126	00344
	12129	00346
	12132	00349
	13140	00350
	13147	00352
	13157	00353
	14174	00351
	14182	00352
	14193	00350
	15198	02341
	15201	00349
	15223	00347
	15233	02337
	15245	00343
	15253	20344
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	16301	20351
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	12136	00338
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	13154	00349
	14171	00349
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	15193	00351
	15197	02343
	15216	02338
	15260	02356
	16356	20358
02	11125	02352
	15218	06366
	15239	06370
03	12129	06355
	13137	06358
04	12126	06345
	12129	05346
	13139	05347
	14159	05350
	15193	06354
	15216	06352
	16257	06354
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	6235	06363
	6201	06353
	8148	05350
	9132	05357
	10126	05347
	12134	05344
	14180	04359
	15190	06348
	15197	04357
	16258	04361
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	6224	04365
	6201	05361
	7162	05365
	8153	03368
	8146	03367
	10125	00382
	10124	02371
	10123	00378
	11122	02380
	11123	00384
06	14165	05390
	15195	05368
	16266	02375
	16273	02374
07	8146	06381
	8143	06380
	9131	05368
	11123	02377
	13148	03383
	14160	06387
	15203	03380
	15218	03380
	16262	05387
08	12125	05391
	12126	05389
	13146	05377
	14156	05377
	15202	06389
09	6241	04386
	6200	04386
	7173	04388
	8141	06398
10	10121	06406
	10121	06395
	11121	06394
	11121	06390
	14153	05391
	14155	02396
	14170	06395
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	6215	02377
	6195	04375
	8134	02376
	9128	00376
	10123	00376
	10122	00375
	10121	02373
	10120	00374
	11120	00371
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	16245	05379
	16254	00378
	16260	02376
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	6244	06383
	7175	06385
	7164	06388
	9123	00367
	10122	00367
	10121	00367
	10120	00366
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	13144	00374
	13147	02364
	14171	00374
	15181	02361
	15186	00372
	15202	00371
	15220	02359
	15231	00370
	16253	20379
	16263	00368
	16251	20367
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	7185	05373
	7171	02372
	9130	04363
	9126	04370
	11121	06383
14	5247	20370
	5299	20379
	5262	00364
	5256	02353
	6206	00366
	6203	02359
	7178	00367
	7161	00366
	9124	00369
	9123	02373
	11119	00367
	11120	00368
	13146	02367
	14153	00369
	14167	00372
	15198	02362
	16259	04370
16	8136	06391
	8132	06388
	9123	06382
	10120	06386
	10119	00388
	11119	00388
17	5262	02397
	5245	02397
	6229	00397
	6225	00398
	6197	04387
	7157	04386
	8134	06394
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YY	GGμμμ	λSΩΩΩ
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	16246	04372
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	6203	02368
	7175	04363
	7161	06363
	8147	02360
	8145	00362
	8135	05356
	9126	05354
	9122	02365
	9122	00368
	10118	06367
	11118	06364
	13145	05360
	14166	06375
	16262	06376
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	6224	05327
	6198	05329
	7175	02334
	8140	02331
	9128	04322
	9122	04321
	11118	04321
	13143	02340
	15183	06332
	15197	06338
	16236	06333
	16257	06341
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	5140	02331
	6194	02335
	7163	02338
	8148	00342
	8132	00340
	9126	00344
	10118	02346
	11118	00339
	14170	00345
	15200	02339
	16261	00344
	16266	00343
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	5239	06356
	6201	06358
	7149	06356
	8130	06337
	9128	06337
21	10120	02346
	10117	00338
	11117	02337
	11117	02339
	11120	00340
	15185	04340
	15199	04342
	16232	04336
	16266	04343
22	12122	06372
	12127	06365
	13129	00364
	13141	06365
	15191	06364
	15199	00368
	15204	00367
	15221	00368
	16228	00368
	16235	00368
	16260	00368
	16265	02367
23	12123	05423
	14153	05414
	14157	05412
	15196	06417
	15206	06411
	16239	06412
	16263	05406
24	5259	05380
	6228	05379
	7151	06390
	9121	00392
	10119	00396
	11117	00397
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	11117	02395
	11118	00403
	13128	03389
	15177	04391
	15201	03388
	16232	04390
	16261	03385
25	6225	06381
	6201	06388
	8136	06377
	9128	06366
	11116	05367
	11116	06379
	15174	06380
	15180	06384
	15202	02374
	16237	06362
25	16261	02371
26	5255	06364
	6219	06366
	8136	02366
	8184	00359
	8129	02363
	8129	05354
	9128	00357
	9120	02355
	11116	06356
	12125	00364
	12126	02363
	13127	00362
	14151	02369
	14169	06385
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	5249	02375
	5241	00387
	6214	00386
	6179	00393
	7169	02386
	7165	00393
	7153	00388
	8131	00393
	8128	02401
	11116	04397
	15182	06397
	15193	00397
	15204	00397
	15210	00397
	16261	09408
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	5301	20413
	5261	00397
	5251	20410
	5247	00396
	6228	02388
	6221	00398
	6196	00399
	6191	02393
	7173	00399
	8141	03390
	8134	03393
	11116	05387
	14156	06392
	15182	04397
	15201	05395
	16231	05399
	16262	04399
29	12123	02399
	13126	02394
	13133	00397
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	15177	00395
	16219	00386
	16248	02384
	16258	02382
	16265	00384
30	12119	05365
	13129	02373
	13130	00377
	14141	00377
	14153	00376
	15184	00373
	15204	02371
	16262	05361
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	5240	02343
	6228	00352
	6201	00344
	6195	00356
	6181	02344
	7166	00354
	8144	00354
	8139	02343
	8131	00353
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	16233	02346
	16244	00354
	16262	00354
	JUNE 2004	
01	5262	00343
	5254	00345
	5249	20355
	6208	00345
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	6199	02341
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YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
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	8128	00349		15205	02356		7166	00337		13124	00408
	10118	00348		16217	02353		7158	02333		14158	00413
	10117	02343		16243	02354		7152	00336		15170	02404
	10116	00352		16262	02353		9123	04325		15201	02392
	11115	00351	04	5263	02363		9121	04326		16231	00399
	12118	02345		6203	02360		11114	04323		16242	00398
	13134	02348		6192	00367		11115	02329		16257	02383
	14155	02350		7147	03354		15177	04337		16263	20405
	14165	00355		8132	00362		15193	04339		17305	20403
	15170	02348		8129	00363		15206	04342	14	4254	20368
	15187	00355		9126	02362		16231	04342		5303	20366
	15197	02353		9121	00371	09	4356	20347		5260	00356
	16221	00356		13139	00370		5300	20348		5250	20360
	16233	02346		14165	00370		5247	00340		5232	02350
	16250	20367		15200	00371		6224	02332		6199	02345
	16261	00355		16220	00367		6222	00339		6195	00356
02	4355	20338		16235	00366		6198	02332		6178	00354
	5303	20349		16251	00362		7145	00340		7152	03344
	5263	00344		16260	02359		8132	00340		7145	02348
	5252	20341	05	12122	06367		8131	02337		8140	00351
	5235	02347		13139	05356		11114	03337		8128	02344
	6199	02346		14157	05359		11115	03336		8126	00349
	6185	00357		15172	06376		13128	04339		9121	00349
	7167	00357		15201	06368		14161	04333		10117	03338
	7164	02354		16228	06379		15180	04333		10114	05329
	7148	00354	06	12124	05348		15190	02337		11114	05323
	8143	02355		13125	05350		15208	04331		14151	06328
	8134	00352		13131	05348		16257	04337		15166	06330
	8132	02356		14158	06356	11	5262	02345		15194	06337
	8127	00351		15201	05354		6222	02343		16261	06327
	9126	02352		16263	05356		6217	00340	15	5260	06336
	9121	00350	07	5332	20332		6196	00340		5235	06339
	10118	02354		5261	02322		6186	02345		6207	06338
	11115	03347		5254	20321		7148	04337		7144	06324
	13139	06347		5246	00323		8132	04335		8130	02336
	15172	02368		6208	02322		11114	03336		10117	02331
	15194	02366		6194	00323		13136	02341		11114	06326
	15203	02368		7158	02322		14144	02341		14143	06329
	16226	02375		8136	00321		14158	02351		14154	06330
	16261	03363		8132	02323		15183	04343		15196	06327
03	5262	02361		8127	00327		15202	04347		16260	06337
	5228	02362		11115	05314		16257	05349	16	5261	06371
	6203	02349		15167	05325	12	5260	06380		5257	02377
	6183	02349		15185	00333		5231	06394		5252	00373
	8138	02356		15201	05328		6219	06397		6205	00382
	8132	02356		16224	00336		6195	06375		6189	06379
	9125	02358		16230	00335		6180	05369		8140	06389
	9121	02358		16248	00334		7151	03359		9125	06376
	10116	02360		16262	04332		10114	06368		10115	06381
	11115	02362	08	6204	02336		10114	06366		10114	00375

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
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	15189	06386		16262	02367		8129	06337		10116	06353
	15201	06397	22	5307	20354		10116	06341		11115	06352
	16218	06392		5261	00343		11114	05341		12116	00346
17	5262	00360		5252	20355		11114	05338		12116	02353
	5252	20357		5229	02342		14158	05338		14144	06356
	5248	00359		6206	00345		15174	06347		14146	00356
	6222	00358		6190	02342		15191	06347		15164	02351
	6213	02354		7144	00345		16209	06348		15194	02345
	6201	00359		8131	02339		16260	06345		16213	00345
	6189	00358		9126	00339	26	5287	20368		16231	00344
	7171	00355		9121	00340		5260	00361		16242	02339
	7167	04347		11114	00340		5252	20367		16258	00340
	8136	00351		13136	00348		5238	00363			
	9122	00349		14139	02345		6200	00365		**JULY 2004**	
	9120	00348		15191	04355		6276	00366			
	11114	00347		15203	02350		7160	06368	01	5262	02323
	11114	06348		16223	00349		7152	00363		9124	00327
	13143	00345		16254	00349	27	12118	02329		11114	00332
	15201	06351		16262	02344		14138	04323		14137	02337
	16223	06361	23	5251	02343		14149	04328		14148	02340
	16253	06361		6193	04347		15175	04346		15162	02342
18	6187	02363		7144	04340		16207	04344		15174	02343
	6182	00366		8130	00347		16255	04341		15197	02340
	7148	06369		8128	02344	28	5260	02336		16231	02337
	8129	00359		10117	02335		5236	06342		16263	02330
	9118	00359		10116	00348		6204	05333	02	5257	06361
	11114	06365		10115	00349		7153	02345		6225	06366
	14140	06359		11114	00351		9124	00334		7156	06362
	14148	06361		14156	06356		9121	02341		8141	06374
	15162	06374		15179	00349		10114	00332		10117	06367
	16217	06367		15188	02349		10114	02335		10115	02378
	16260	06374		16258	00340		15182	06345		11114	00371
19	13135	05356	24	5236	06341		15201	06339		11115	02379
	14144	02364		6199	06332		16261	06358		15163	04371
	14148	00361		9124	02336	29	5261	03349		15194	02372
	15165	02359		9120	00333		6211	00347		16206	00373
	15180	02356		10114	00345		6206	00346		16214	02367
	15202	00360		11114	02343		6201	02349		16223	00371
	16217	02355		11114	00342		6197	00350		16241	00369
	16252	00359		14140	00346		8137	00350		16256	02361
	16261	02352		14144	02347		9119	00355	03	12118	00364
20	16217	02372		15179	06348		9119	02361		12119	02359
	16232	06370		15204	00346		11114	00356		13123	02359
	16261	06379		16213	00347		14147	00367		14154	06360
21	10114	06362		16217	00345		15173	00373		15170	03357
	11114	06363		16261	06344		15204	00362		15189	04354
	11114	06360	25	5263	00339		16209	02367		16206	05355
	11114	06362		6225	03340		16229	00363		16247	03356
	15178	04370		6101	00346		16255	02355		16254	00356
	15201	06364		6194	00346	30	6187	06360		16263	02353

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
04	12122	02362	07	16260	00320	11	13136	00353	16	6197	06330
	13127	02360		17301	20324		14139	00354		8131	06333
	14156	00359		17358	20328		14155	00354		9127	06330
	14149	02355	08	5266	02315		15167	00357		10118	06312
	15164	02351		6235	02316		15190	00355		11116	06324
	15166	00356		6227	00316		15200	00356	17	13135	02317
	15185	02352		6202	00319		15203	02348		13139	00318
	15198	02355		6189	00318		16227	00352		14148	02307
	16227	04363		8139	02321		16233	02347		14159	02312
	16260	00353		8135	00319		16250	20356		15172	00315
05	5265	06354		9126	00317		16261	00351		15203	00318
	6227	05336		9120	00318		17355	20359		16232	02312
	6200	06342		10118	00319	12	8139	06377		16259	00318
	10114	05326		10116	00323		8132	06382		17330	20323
	11114	05324		13132	02324		9127	06377	18	12122	00320
	14142	00321		14138	00325		10116	05366		12125	02319
	14143	00322		14159	00328		11115	05367		13125	00317
	15202	03316		15170	02324		15195	06369		13140	00320
06	5300	20312		15183	00329		15200	06372		14147	02319
	5262	00303		15198	02320		16228	06365		14152	00325
	5251	20306		15202	00326		16260	04364		14161	00324
	5247	00304		16222	00326	13	5263	06360		15189	00327
	6200	06307		16245	00320		6235	06354		15200	02321
	7166	03302		16262	02317		6193	06352		16242	00322
	8128	00305	09	5268	04317		9128	00344		16262	00322
	11114	00304		6235	03319		9128	02350	19	5254	00309
	14155	04316		6204	02321		10118	00347		6242	02311
	15162	00319		6194	00313		10118	00348		6185	00313
	15168	02318		8144	00318		11115	06354		7180	02314
	15182	00323		8138	00314		13130	04351		7152	00311
	16253	02322		8135	02313		13135	02362		8149	02312
07	5297	20309		9128	00315		14142	05359		8138	00315
	5269	02300		9120	00315		15197	06361		9131	00313
	5255	20305		10116	05307		16220	06355		9127	02309
	6205	00314		10115	05309		16240	06359		11117	00314
	7170	02312		13128	06303		16266	06370		11117	00309
	8145	02316		15167	00335	14	6192	06360	20	5265	02301
	9122	02325		15201	06320		11116	06343		6190	02306
	9121	00316		16212	03328		11116	06339		7174	02306
	10118	00322		16255	00335		14142	06349		9125	02307
	11115	06323		16259	00335		15186	06354		10121	02309
	11115	04330		16264	00333		15206	06354		10119	02310
	13131	00338	10	10006	04338		16227	06356		10119	00301
	13135	00333		13126	02353		16262	06366		10118	00301
	14157	00332		13133	00358	15	5264	02342		11117	00306
	15171	02327		14158	00358		6231	04348		11117	02305
	15182	00331		14156	00360		6193	05348		11117	00304
	15198	02320		15172	04340		7176	05336		13138	00306
	15202	00325		15190	05352		7158	06336		15176	00309
	16226	00324		15207	05343		8146	06337		15198	02309
	16243	02318	11	12120	00350		8136	05331		15203	00312
	16252	20226		12122	00352	16	5261	02331		16229	00312

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
20	16233	02309	24	6212	00290	29	7189	02330	31	16257	00312
	16260	00311		6199	02285		7180	02329		16262	00314
21	5254	05309		7175	00288		7172	00331		16303	20319
	6226	02308		7161	00289		8137	03322		17352	20322
	6217	00304		8151	00291		10122	00327			
	6202	00306		8139	00291		10120	00325		**AUGUST 2004**	
	6198	02308		9132	00291		11119	00326			
	6193	00309		9124	00291		11120	02329	01	12126	04305
	7183	00307		10122	02298		13141	00330		14170	03313
	7176	00305		10121	00293		15199	00332		15185	03312
	7177	04338		10119	02295		15208	02331		15189	00316
	8145	00304	25	12126	05317		15222	00330		15203	03316
	9122	00304		13131	00319		16244	04337		16266	00309
	11117	02304		13131	02322		16255	00329		16279	02319
	15205	06314		14143	00320		16261	00330	02	6266	05320
	16231	00311		14156	00316	30	5354	20319		7194	05316
	16252	00311		14158	02315		5302	20318		7176	05319
	16262	03310		15177	00315		6261	00313		8150	06322
22	5260	02303		15213	00314		6252	20314		9135	06323
	6198	02299		16242	00313		6234	02312		10121	06325
	7178	02301		16265	02311		6230	00314	03	6229	06325
	7159	00302	26	5355	20311		6202	00316		8155	06319
	7153	00305		5301	20311		6198	02314		11121	06322
	8132	02310		5261	00307		7170	00318		12123	06333
	10118	00304		6251	20311		8147	00318		15184	06330
	10118	02308		6247	00308		8143	02319		15208	06324
	11117	00304		6233	02306		9125	00318		16248	06324
	14142	02311		6201	00309		10122	02323		16272	06327
	14155	02310		6198	02307		11120	02326	04	6266	04318
	15172	03306		8152	00303		11120	00322		6236	04319
	15195	03305		8134	00306		13130	00324		6214	05317
	16231	02313		9123	00310		13136	00326		8147	04314
	16263	04307		10122	00312		14153	00326		8138	06316
23	5260	04314		10120	00308		14167	00326		10122	05313
	6235	04314		10120	00308		15198	02315		11122	04318
	6200	04313		11118	02310		15201	00326		11122	02321
	9128	06306		14151	04319		15222	00327		14170	00319
	10118	00305		15190	03317		16256	20338		15184	00320
	10118	02309		15210	05312		16258	02320		15198	02316
	11118	00305		16233	06317		16263	00322		15200	00322
	11118	04302		16264	06318		16300	20335		15220	00322
	14148	00314	28	7165	06328		17351	20334		15233	02317
	14162	02313		8151	06330	31	12125	00315		16238	00319
	15174	00316		9127	06333		12129	00315		16251	20324
	15198	02310		9124	06338		12129	02322		16261	00317
	15203	00312		10121	06343		13137	00316		16302	20322
	16234	02311		11119	06348		14154	00312		16351	20321
	16260	02313		14170	06333		15182	00316	05	5352	20329
24	5314	20289		15191	06331		15198	02311		5300	20330
	5272	00290		15210	06343		16233	02310		6262	00323
	6244	20832		16263	06333		16241	00314		6251	20325
	6234	02289	29	6246	02327		16252	20317		6243	00322

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
05	6232	02319	08	14163	00330	11	14182	00312	16	15264	00316
	6227	00323		14167	00331		15187	02304		16272	02316
	6201	00325		14169	00330		15204	00310		16286	02316
	7198	02319		14172	00330		15232	02300	17	6287	20319
	7168	00322		16261	06325		15238	00309		6260	00312
	8152	00324	09	6264	06320		16257	20313		6251	20318
	9131	02320		6217	04324		16262	00306		6246	00312
	9130	00318		7204	04320		16301	20310		6222	00313
	10123	02326		8145	05314		16370	22306		6218	02309
	11122	00329		9139	05313	12	6245	02285		7201	00312
	11122	00327		9130	06311		7171	02291		7189	02310
	13139	02325		10126	02324		8159	03282		9135	04313
	13147	00327		10124	00318		8143	03283		11128	03310
	14159	00324		14154	05322		10129	03286		13148	04318
	15192	02324		15208	05327		11125	03290		14191	03323
	15203	00325		15224	05319		13150	02301		15202	03325
	15217	02324		16260	05319		14181	02305		15231	06323
	15226	00325	10	6262	02320		15201	02307		15265	03330
	16270	02322		6251	20321		15223	00310	18	6264	02328
	16300	20339		6223	00312		16260	00298		6243	02327
06	5344	20334		7202	00312		16267	02297		7213	00319
	5308	20328		7177	00311		16359	20311		7202	02321
	6262	00326		8161	00309	13	6261	05301		7190	02326
	6234	02324		8142	00311		6226	06300		8157	00316
	7199	02321		9137	02316		6213	06313		8147	00320
	7191	00331		9135	00313		7196	06310		8146	02317
	7169	00327		10125	00316	14	15243	06329		9137	00319
	8154	00325		11124	00319		15258	06330		10132	00319
	9136	00322		11124	00320		16269	06328		10130	00320
	9134	02328		13144	00326	15	12133	00310		11128	00317
	11122	02337		14183	03320		12136	02312		14161	00317
	11123	00337		15197	05317		13138	00314		14168	02311
	12124	00338		15202	05318		14159	00313		14179	00317
	13148	02334		15226	05323		14162	02308		15219	00314
	14152	00340		15261	05325		14173	00318		15235	02313
	15202	02330		16340	20322		14185	00312		15255	20315
	15212	00332		16349	22319		15201	02303		15265	00309
	15240	02327		16358	02321		15234	02299		16361	22319
	16251	00331	11	6281	20298		15241	00309	19	6249	02297
07	12130	04330		6261	00291		15254	20312		6231	00304
	13137	04340		6250	20296		16264	00308		7203	00305
	13146	04337		6243	00290		16357	20319		8166	00307
	14172	00333		6211	00293	16	6269	02316		8159	02301
	14176	02333		7201	00295		7209	02312		9140	00305
	15203	02329		7197	02293		7195	00312		9137	02310
	15223	02335		7190	00294		8164	02313		11129	00305
	15232	02333		9141	02301		9133	02319		13142	00307
	16245	00335		9131	00300		10129	00317		14168	00306
	16272	00335		11125	00307		10128	02314		14170	02301
08	12130	02333		11125	02316		11127	00318		14181	00307
	12133	02333		13147	00311		13149	00317		14191	00305
	13140	00332		14167	00311		15200	00317		14198	02305

YY	GGμμμ	λSΩΩΩ
19	15201	00304
	15216	00306
	15232	02301
	15239	00303
	15252	20308
	15256	00300
	15261	00299
	16285	22308
	16302	20308
	16354	20305
20	6262	03299
	6237	03296
	6225	00295
	7211	00294
	7200	00294
	8160	03292
	9138	00289
	9136	02292
	10133	00292
	11130	00297
	11130	02297
	11130	00298
	12139	00302
	13144	00304
	14169	06297
	14198	06346
21	12142	00306
	13143	00306
	13158	00308
	14192	04300
	14201	04303
	15222	04309
	15240	04308
	15261	02309
	15266	02309
22	11131	06316
	11132	06317
	12137	05318
	13153	05317
23	6263	00316
	6247	02311
	7216	00318
	7207	02313
	7195	00321
	8169	00324
	8154	00318
	9143	00318
	9140	02314
	10136	00314
	10132	00314
	11131	00312
	14192	00309

YY	GGμμμ	λSΩΩΩ
23	14200	02302
	15246	02301
	15256	00307
24	6262	02305
	6238	02305
	7228	00310
	7213	00309
	7199	02304
	8177	02306
	8152	02307
	9147	00312
	10132	02310
	13160	00314
	13164	02309
	14199	02310
	14202	02310
	14205	00312
	15228	00311
	15234	02309
	15246	00312
	15255	00309
	15261	00308
	16301	20312
25	6261	06321
	6231	06315
	7201	06314
	8152	00320
	9151	00321
	9146	00320
	9142	00320
	10138	00324
	10137	06327
	11133	06319
	11133	00313
	11134	00314
	13162	00310
	14189	00316
	14191	02311
	14201	06319
	15213	02309
	15233	00316
	15261	00312
26	6260	05314
	7231	06312
	7206	05309
	8156	05304
	9142	04307
	10134	03311
	11134	02316
	13156	03315
27	6263	05301
	7226	05307

YY	GGμμμ	λSΩΩΩ
27	7203	05308
	8178	05304
	8163	05304
	9141	05308
	10137	02318
	10134	00314
	11134	02320
	14186	05323
	14202	05314
28	7204	06287
	8159	06295
	9152	06297
	10136	06293
	11135	06290
29	12142	00303
	12145	02300
	12145	00307
	13167	00307
	13173	02300
	14190	02303
	14202	00307
	15256	02305
30	6262	06302
	6246	00295
	7222	00298
	7202	00299
	7200	00300
	8159	00303
	9153	00302
	9143	00300
	10138	00301
	10138	02300
	10137	00302
	11136	02305
	12148	00307
	13151	02309
	13162	04303
	14187	02309
	14199	00308
	14211	02305
	15231	02308
	15242	00304
	15262	02307
31	8165	06308
	9152	06304
	9145	06302
	10142	06299
	10138	06309
SEPTEMBER 2004		
01	6300	20323

YY	GGμμμ	λSΩΩΩ
01	6261	00316
	6251	20326
	7240	00323
	7233	02317
	7216	00325
	7200	00326
	7198	02320
	8169	00329
	9153	00331
	10143	00327
	11138	00333
	13175	04324
	14194	06327
	14205	04324
	15263	05325
02	6269	20319
	6261	00309
	7237	00309
	7233	02304
	7211	00311
	7201	02304
	8182	00308
	8163	00307
	8161	02303
	9151	02303
	9150	00303
	10141	00301
	11139	06305
	11142	00297
	12145	00299
	13161	00297
	13164	02298
	13170	00299
	13175	02301
	14188	00299
	14198	02304
	14206	00297
	15232	02304
	15238	00301
	15267	02304
03	6253	00294
	7235	02293
	7226	00301
	7205	00302
	7197	02294
	9160	00298
	9153	02295
	9150	00299
	10140	00298
	13170	00296
	13172	02298
	14216	00297

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
03	15264	00299	07	12151	00291	10	14222	00289	14	14251	02278
	15269	00298		13169	02285		14239	02284		14260	00286
	15302	20305		13182	02286		15262	00291		14266	20295
04	6260	05273		14202	00288	11	7262	00281	15	8176	06283
	7222	02293		14246	02292		7211	00285		9167	06288
	7206	00287		15263	05300		8196	00283		11152	06284
	7193	02279		15268	00289		9168	00284		13200	05272
	8173	04279	08	7260	00315		9161	00286		14232	06274
	9151	05286		7238	00313		9153	00287		14248	06278
05	6262	03279		7229	02311		10152	02286		14265	06282
	6258	00279		7214	02308		10150	00285	16	7262	02301
	7223	00278		7206	00314		11147	00284		7235	00300
	7213	02273		8194	00315	12	7260	02295		7214	00302
	7202	00278		8181	00317		7238	02294		8211	02294
	8178	00274		8177	02312		7206	02294		8199	00303
	8172	00274		9159	00312		8172	03284		8187	00304
	8165	06273		9151	02315		9164	03285		8183	02298
	10145	00271		10149	00315		9155	03283		9169	02295
	10142	06271		11146	04318		10151	02288		9162	00302
06	7257	05254		12149	00318		10149	02287		11153	00307
	7250	00265		13186	06314		11148	03281		11154	02304
	7207	00269		14229	00312	13	6350	20303		13177	00308
	7199	02261		15264	00311		6303	20305		13189	05314
	8182	00263	09	7262	06301		7261	00300		13201	00310
	8174	02261		7256	06297		7247	02292		14254	00313
	8171	00265		8194	05288		7230	00299		14262	02306
	9154	02265		8180	05294		8201	00304	17	7264	00289
	10147	05259		9166	05289		8193	02291		7255	20290
	10143	02270		10147	05296		8178	02289		7247	02283
	11143	04262		11145	06293		10153	03280		7234	02280
	11114	00264		11145	06293		11150	06280		7222	00290
	12154	00268		12163	00303		14203	03277		8205	00289
	13162	00268		13165	02298		14214	02279		8199	02280
	13186	00272		14204	00302		14255	02279		9171	00292
	14200	00271		14230	05307		14265	02279		10157	00288
	14201	02267		15262	00302	14	7260	00274		10154	00292
	14212	00272	10	7253	02285		7248	02268		11159	00290
	14232	02266		7226	00293		7237	00275		12167	00286
	15263	02263		7212	02283		8205	00277		13189	00285
07	7258	04285		7202	00294		8197	02270		13198	02277
	7228	02290		8181	00291		8187	00276		13206	00285
	7221	00280		9157	00289		9160	00272		14222	00285
	7207	00281		9154	00290		9159	02269		14233	02275
	7204	02275		9153	02288		11151	00271		14244	00284
	8190	00278		11146	00289		11151	02265		14253	20289
	8166	00277		11147	02286		11152	00274		14263	00282
	9162	02281		11147	00288		13175	00278		14279	22288
	9150	02280		12154	00286		13181	02277		15308	20289
	11144	02287		12157	00289		13197	02275		15351	20292
	11144	00280		13174	00290		13201	00277	18	12164	00279
	11147	00286		13190	00289		14231	02276		12167	02273
	12148	02294		14207	00290		14238	00279		12175	00281

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
18	13193	02272	24	10168	06346	30	13232	06295	06	8256	02238
	13208	00283		10165	06338		14270	06302		8218	00245
	14229	02273		11163	06340					9208	00250
	14257	02273		13210	00349		**OCTOBER 2004**			10186	00248
19	6355	20275		13231	00339					10185	02241
	6305	20274		14236	02333	01	7261	06297		10183	00244
	7268	00272		14269	00337		8232	06293		11184	02241
	7257	02279	25	11169	02317		8216	06291		11186	00249
	7234	02275		12173	00318		8205	06288		12193	00246
	7226	00279		13194	00323		10174	06280		12202	02240
	8199	02278		13204	02318		11175	06281		13230	00251
	8192	00283		13219	00323		13208	05288		13236	02242
	9174	00285		13232	02318		13220	05292		13261	00252
	9169	00284		14250	02315		13253	05294		14308	20266
	9164	00284	26	11172	05324		14265	05290	07	8262	06260
	10158	00290		12181	04332	03	12188	05240		8237	06266
	11157	02289		12189	05328		12202	04244		9212	06261
20	6354	20278		13201	05332		12210	05235		9203	06261
	6305	20277		13212	04337		13231	06245		9196	06261
	7264	03281		13231	06339		13253	06254		11186	06269
	7232	03279		14263	06341	04	7263	02235		13243	06269
	8195	02287	27	7254	05290		8250	00244		13256	06273
	8184	02288		8221	05293		8226	00246	08	9206	07266
	11158	06290		8206	05293		8221	02238		10187	02256
	12181	04298		9174	05282		8208	02237		10187	02261
	13192	06300		10168	05288		9204	00245		11190	02260
	13213	02305		12185	00290		10181	02240	09	12200	06298
	14222	02306		12186	02288		11179	02241		12206	06310
	14265	04304		12191	00289		12206	02243		12216	06310
21	9178	06297		13207	00289		12209	00248		13230	06314
	9173	06309		13219	02283		13232	02240		13267	06309
	9168	06315		14250	00286		13266	02239	10	10194	06310
	11160	05298		14259	02278	05	8357	02227		10192	06308
	11161	06302	28	8221	00276		8239	02233		10191	06307
22	9177	06329		8217	02275		8216	03229		11191	06309
	9172	06326		8211	02275		10187	02240	11	8268	06311
	11161	05324		11170	04277		10186	00243		8241	06317
	11162	04321		13208	06274		10184	02238		9202	06312
	14236	05330		13323	06276		10182	02238		11193	06312
	14261	05325		14248	05270		11182	02236		12208	06318
23	7263	06350		14269	06273		11183	00240		12214	00307
	8197	06351	29	8241	06288		11189	02237		12216	00309
	8191	06344		8219	06283		12191	00241		13265	06318
	10166	02347		8200	06285		12200	00241	12	8246	00289
	11162	02343		10171	05275		13226	00244		8233	02284
	11163	02336		11171	05277		13233	02235		9220	00290
	13212	02338		13229	06285		13250	00243		9208	00291
	13215	00335		14252	06292		13254	20248		9207	02286
	14234	05340		14265	06289	06	7320	20240		10195	00292
24	7255	02348	30	9195	06287		7294	20240		11195	02286
	8216	06347		10173	06286		7267	20242		12207	00295
	8203	06344		12199	06299		8262	00246		12215	02289

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
12	12233	00294	17	12249	02282	26	10236	02269	03	9282	25240
	13239	02290		13264	04299		10231	02261		10261	25242
	13254	00291	18	8265	04314		10229	00262		10259	02235
	13268	00292		9243	06323		10229	02261		10257	02237
13	7347	20283		10215	06334		11232	02260		11255	02236
	7315	20276		11209	06323		11236	00265		12271	02232
	8256	20283		11211	06317		11238	02260		12284	22251
	8250	00283		11219	06319		12261	02271		12303	22249
	8234	02275		12225	06324	27	9244	06276		12313	22246
	9226	00284		12227	02319		11232	05271	04	9291	22249
	9221	02279		13276	06326		11239	05278		10264	22243
	9218	00282	19	8259	06314		12263	06292		11258	02235
	10198	02279		9228	06322	28	9264	06292		11273	22252
	10198	00284		9219	06327		9249	06291		12281	22257
	11198	02280		11214	06305		10241	06289		12297	22255
	11200	00283		12223	06309		10234	06290		12317	22257
	11207	00283		12247	02306		11237	06290	05	10261	06259
	12215	00283		12258	02304		11242	06290	06	9279	25275
	12226	02278		13269	06298	29	9266	02276		10261	06279
	12235	00283	20	8265	02301		9259	00282		11263	06280
	13248	00284		11216	02287		10238	02276	07	11265	06303
	13251	02279		11219	02287		10237	00282		12316	26303
	13266	00285	22	8263	02275		11240	00283	08	9309	26319
14	7351	22296		8258	00282		11242	02276		9291	26311
	8263	05288		9249	00281		12259	00280		10278	26312
	9230	06289		9227	02275		12262	02275		11269	06326
	9219	00299		10218	02276	30	9267	06260	09	9317	26292
	9216	02292		11228	02279		9258	06261		12349	26278
	9210	00302		12245	02280		9250	06264	10	10285	22300
	10200	00304		12260	02277		10247	06263		10279	22300
	10200	02295		12267	02280		10242	06261		11276	25285
	11199	00306	23	11221	02272	31	10249	06261		12296	25296
	11200	02297		11223	02268		10243	06258		12316	26298
	11207	02296		11231	03271		11243	06256		12346	25275
	12216	02295		12254	02273		11247	06261	11	9322	26319
	13264	05297		12261	02275		11253	06261		9306	26315
15	8266	02293	24	8266	02268					10289	26305
	9234	02294		9253	02264		**NOVEMBER 2004**			10279	26305
	9219	02297		9234	02262					11278	26308
	11202	05296		10224	02259	01	11248	06261	12	11285	26298
	11205	02305		10223	02258		11256	26266		12307	26296
	12217	02291		11224	02258		12263	26263		12330	26297
	12243	04292	25	9261	00260		12305	26257		12356	26296
	13264	05298		9249	02252	02	9288	25245	13	10285	26314
16	8259	06312		9247	00263		9271	24239		10284	29309
	8241	06306		10233	02256		10257	24234		12361	26315
	9213	04301		10231	00265		10254	05241	14	9341	24312
	10210	02304		10226	03255		11250	05237		9309	22320
	10204	02304		11226	02256		12267	25248		9307	22320
	11204	06300		11238	04260		12282	26245		10299	29318
17	11213	02287		12247	02256		12308	26247		10289	22324
	12220	00289		12265	05261	03	9291	25234		11289	22322

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
15	9343	26275	24	12349	26338	04	10353	25333	16	11374	20272
	9312	26268		12416	26336		11354	26332		11377	22260
	10304	26267	25	9394	26256		11361	26325		11383	20276
	10291	26261		10342	26261		12379	26337		11386	22260
	10291	22268		10327	26267	05	9386	24285	17	10382	26248
	12318	22266		11326	26267		10362	23284		10374	24245
	12346	22280	26	9406	24237		10354	24286		11375	24245
	12371	22376		9392	24241		11361	23284		11379	24248
16	9350	22311		9362	22240		12381	23281		11384	22262
	9332	20309		9353	22244	06	9384	26315		11388	22259
	11296	22317		10331	23224		11357	26308	18	11375	26310
	11300	22315		11328	24239		11380	22306		11377	26304
	12320	20315		11337	24236		12384	22303		11384	26303
	12326	20316		12355	24227	07	10381	26292	22	11376	26375
	12334	22314		12423	25243		10366	26292		11378	26373
	12363	22318		12441	25230		11359	26291		11384	26368
	12376	22319	27	11352	26293		11381	26285	23	11377	26314
17	9354	26307	28	11340	26286	08	10382	26340		11386	26319
	9328	26305		11347	26284		10368	26332	24	11375	26324
	10311	26307		12361	26285		10361	26333		11379	26319
	11298	26296	30	9369	26288		11366	26330		11383	26317
18	12362	25323		10354	26282		11383	26321	25	10381	22277
	12389	25313		10341	26288	09	10386	22319		10376	22279
20	11314	25331		12408	26290		10369	25315		11375	25267
	12333	25334		12435	26295		10363	25311		11382	26266
	12362	26332					11376	25324	26	10381	25290
21	9374	24317	**DECEMBER 2004**			10	10388	26324		10374	26291
	9335	23309					10383	26321		11373	26292
	10327	23304	01	9427	26269		11383	26307		11379	26294
	10314	25310		9369	25243	11	10383	22303	27	10382	26307
	11313	26312		10364	24251		10372	22300	29	10381	26361
22	9372	25293		11344	22267		10370	20304		10372	26359
	9341	24284		11352	22267		11367	22301		11370	26378
	10329	24278		12374	22267		11372	20305		11379	25383
	10317	26297		12402	22270		11378	22298		11384	25382
	11316	26295		12441	22270	12	11369	26318	30	10405	26339
23	9377	26317	02	9371	25297		11375	26314		10382	26327
	10334	22311		10363	22301		11381	26318		10376	26324
	10323	20321		10346	26301	14	10378	26322		11369	26315
	10318	26320		12373	26302		10371	26317		11380	26321
	11333	20314		12414	26290		11382	26319		12387	26320
	12345	22314	03	9377	26305	15	10378	26312	31	10371	26279
	12373	22309		10355	26299		11372	26309		11367	26279
24	9382	25329		11351	26298		11375	26304		11370	26278
	10334	25326		12381	26304		11383	26303		11381	26280
	11322	26341		12387	26306	16	10381	20277			

YY	GGμμμ	λSΩΩΩ
JANUARY 2005		
01	11365	26296
	11368	26301
02	10366	26272
	11363	26276
	11376	26278
03	10388	26359
	10369	22341
	10367	20344
05	11357	22314
	11357	22316
	11361	22310
	12381	22312
	12391	22308
06	12383	26313
07	10375	26278
	11353	26276
	11352	26271
	12372	26275
08	10352	22270
	11349	22272
	11360	22271
	12370	22268
09	10349	22309
	11347	20306
	11349	22306
	11356	20312
	12369	20319
10	10366	24245
	10356	25253
	10349	24248
	11345	24246
	11344	25252
	12368	26254
11	10368	22273
	10351	22277
	10348	20274
	11342	20278
	11341	20283
	11341	22282
	11343	20288
	12361	26288
12	10365	22296
	10358	20309
	10346	20310
	10341	22299
	11338	20313
	11338	22302
	11339	20313
	11344	22300
12	12350	20315
	12359	20313
	12364	22299
13	10357	25304
	10339	25307
	11335	25322
	12351	22325
	12356	24308
14	11332	26348
15	11329	25311
	11328	25312
	11331	24296
	12347	25299
	12354	24299
16	10337	26297
	11325	26290
	11333	25292
	12346	25292
17	10340	20334
	10329	20337
	10327	22326
	11322	20334
	11323	20339
	11327	22331
	11328	20342
	12342	20347
	12345	22333
18	10335	22310
	10329	22307
	10321	22306
	11319	22311
	11328	20320
	12331	22317
	12342	22318
	12349	20330
	12354	20329
19	10317	25439
	11316	25437
	11315	25436
	12333	26442
	12345	26444
21	10311	26456
	11309	26459
22	12326	24433
	12332	24428
23	11303	26412
	11302	26413
	11309	26399
	12321	26383
24	11298	26408
25	10312	25443
	10300	25436
25	11295	24422
	11302	25450
	12321	26455
26	10298	26391
	11291	26396
	12312	26396
27	12305	26352
28	10296	26386
	10287	26365
	11284	26378
	11289	26371
	12308	26364
29	10283	26366
	11282	26363
	12296	26368
	12303	26364
30	11278	26360
	11281	26356
FEBRUARY 2005		
01	9353	26387
	9315	26410
	9308	26414
	10299	26402
	10286	26415
	10275	26422
	11271	26404
02	9355	26355
	10270	26349
	11268	26349
	12297	26361
	13334	26367
	13350	26361
03	9364	26310
	10292	26309
04	9294	26338
	11262	26332
	13356	26321
05	9286	26323
	11258	05317
	11259	02316
	11261	02316
06	11256	02312
	11256	00318
	11255	00318
	12265	20321
	12273	22318
	12279	20317
	12287	20322
	13317	20324
	13344	22314
07	9343	22345
	9338	20343
	9301	20347
	9286	22346
	10276	20347
	10260	20350
	11252	00342
	11252	02339
	12260	20358
	12269	20361
	12275	22359
	12288	20363
	13313	20365
	13340	22354
08	9338	20348
	9330	22341
	9293	20345
	9283	22344
	10272	20349
	10254	02330
	10251	00330
	11248	00332
	12266	20343
	12269	22345
	12278	20353
	13326	22349
	13332	20335
	13352	20353
09	8360	20375
	9316	20367
	9304	22365
	9294	20387
	9287	20385
	10253	00368
	11247	00369
	11246	02363
	11245	00368
	12263	20377
	12274	22380
	13291	20381
	13315	20388
	13346	22396
	13356	20394
10	9327	20337
	9313	20339
	9290	20341
	9286	22339
	10260	02326
	11242	00328
	12257	20351
	12260	22354
	12267	20360

YY	GGμμμ	λSΩΩ	YY	GGμμμ	λSΩΩ	YY	GGμμμ	λSΩΩ	YY	GGμμμ	λSΩΩ
10	13339	20360	23	9236	06366	04	9203	03446	15	13190	03369
	14366	20362		10214	06382		10189	04451		13198	03372
	14373	22353		11208	06374		11188	04447		14227	04369
11	9327	20337		13236	06380		12196	04449		14244	04364
	9276	26347		13257	06375		13213	04453		14261	04359
	10260	06352		13278	26384		13233	04456		14292	00358
	10257	06348	24	10217	06390	05	11187	04436		14298	00355
	11239	06345		10207	06390		12190	04438	16	8226	06342
12	11237	06330		11205	06390		12196	06442		8212	06340
	13285	26321		12221	06386		13219	06450		9201	06340
	13293	26323	25	10206	06373		13242	06457		10172	04330
13	11234	02405	26	11201	06357		14260	06450		10170	06330
	11236	04404		11201	06357	06	12188	06453		12172	06326
	12243	00418	27	8285	22384		12194	06444		13188	06338
	12245	02409		8258	22386		12205	06449	17	7258	02327
	13275	02403		9239	00369		13230	06456		8228	02335
14	11232	05372		9216	00373	08	10189	06413		8204	05323
	11231	05382		9215	02369	09	9198	05425		9175	06336
	12245	06384		10204	00370		9193	05419		11166	02342
15	9292	25385		10200	00377		12191	06434		13190	05334
	9269	25381		11198	00379		14244	03432		13193	06341
	10248	05381	28	7338	20392		14255	04430	18	7259	06320
	10231	02377		8303	20401	10	8259	04416		8248	06327
	11228	04377		8297	22396		9199	04417		9190	06312
	12250	06396		9227	20391		10183	04403	19	11162	05347
	13273	06404		9217	00386		11177	05421		11164	00360
	13287	26408		10206	00385		14260	05417		11164	02354
16	10237	06395		10200	00388	11	11175	06428		12167	00363
	10229	06397		10198	02386		11175	06433		13184	00355
	11225	06397		11196	03383	13	11174	02378		13199	02340
	12236	07405		12209	05395		11175	02375		13200	00355
19	11218	06371					12187	00376		14226	00351
	12221	06372	**MARCH 2005**				12188	02378		14258	02332
	12234	06374					13203	00369	20	11161	06344
	13281	26371	01	13260	04339		14253	02380		13191	00332
20	11215	06352		13265	03338		14266	20375		13201	06340
	11215	06351	02	8260	05324		14300	20371	21	7261	00321
	12221	06354		9239	04324	14	8260	04386		7251	00321
21	10230	06341		10193	04330		10175	03374		8238	00322
	10219	06342		11192	02333		10171	03373		8221	00322
	10214	06344		12199	04334		11170	02377		8193	02328
	11212	06342		12204	04333		11170	03371		9172	06328
	12225	06353		13245	04335		13196	05373		10163	06326
	13246	06347		13261	04336		13221	05376		11160	06327
	13286	26357	03	8260	04428	15	8257	02375		13185	06337
22	10220	05359		9234	04430		8253	00354		14213	05330
	10213	06365		10194	03428		8222	00358		14234	04330
	11211	05358		11190	03432		9202	02367		14261	06346
	11210	06352		12203	03432		9201	00360	22	6354	00311
	12215	06369		13253	02428		9189	00363		7300	00310
	13238	06376		14263	02424		10177	02368		7257	00306
23	9267	26380	04	8254	03446		11169	04370		7250	00308

YY	GGμμμ	λSΩΩΩ
22	7243	02305
	8214	00314
	8198	02304
	9181	00313
	9178	02306
	10166	00310
	10159	00313
	11158	02306
	11160	00316
	12162	02303
	12165	00315
	12171	02301
	12174	00314
	14211	00312
	14219	02298
	14251	00303
	15302	00304
	15350	00299
23	6347	00289
	7286	00290
	7256	00290
	7249	02279
	8230	00289
	8199	00290
	8189	02283
	9180	00291
	9172	02282
	9169	00293
	10160	00296
	10158	00296
	11157	00289
	12164	02280
	12167	00282
	12174	00287
	13194	00288
	13199	02282
	14233	02287
	14259	02286
24	7259	04304
	8224	04303
	8194	04306
	9176	05306
	10162	05306
	11156	05310
	13179	05324
	13187	05324
	13201	05322
	14262	05329
25	7261	07335
	8224	07333
	8200	07330
	10155	06328

YY	GGμμμ	λSΩΩΩ
25	13178	02318
	13185	00330
	13200	00328
	14236	02312
	14256	02313
27	10152	06342
	11152	06342
	12156	06338
	13190	06337
	14201	06336
	15263	06339
28	11151	05336
	11152	02341
	12164	02339
	13172	02341
	13174	00345
	13192	02337
	14204	00345
	14257	02335
29	7250	02345
	7234	02342
	8190	02353
	8188	00355
	9168	00355
	10155	02358
	11150	00370
	12159	00373
	12161	02359
	13191	00362
	14203	00367
	14232	00366
	14250	02358
	15256	00360
	15291	00360
30	7257	00373
	7246	02368
	7214	00379
	8203	00377
	8198	02372
	8175	00378
	9156	00383
	10153	02374
	11149	00388
	13169	02389
	13171	02389
	13191	00395
	14197	02385
	14206	00395
	14226	00384
	15263	02383
	15273	00390
31	7221	00385

YY	GGμμμ	λSΩΩΩ
31	8196	02381
	8193	00389
	8174	00383
	9162	00386
	9158	02379
	10154	00383
	11148	02375
	12153	00382
	12160	00377
	13164	02372
	13167	00382
	14194	02376
	14205	00378
	14231	02375
	14238	00377
	15260	00380
	15291	09375
	APRIL 2005	
01	7279	00360
	7262	00361
	7245	02359
	8193	00368
	8174	02362
	9168	00371
	9156	00374
	10152	02369
	10151	00371
	10148	00376
	11147	00381
	13165	00381
	13178	00382
	14193	00382
	14209	00378
	14219	02371
	14223	02373
	14226	00379
	14234	02377
	15251	00378
	15260	00380
	15353	20381
02	12150	00373
	15158	00378
	13164	02370
	13184	00376
	14197	02371
	14218	00380
	14232	00378
	15260	00377
	15282	02371
	15294	00373

YY	GGμμμ	λSΩΩΩ
03	11145	02357
	11146	02357
	13180	02357
	14202	02354
	14232	02358
	15258	02355
04	7255	00349
	7234	02341
	8196	00350
	8169	00352
	9155	00351
	10149	00357
	11143	00358
	11144	00358
	12154	00356
	13163	00353
	13185	00354
	14198	02344
	14209	00358
	14226	00357
	15252	00352
	15262	00350
	15352	20359
05	6356	20358
	6291	20358
	7253	00350
	7223	00353
	8191	00347
	8188	02346
	9156	00355
	10147	00357
	10144	00358
	12154	00365
	13171	00362
	13174	02357
	13180	00364
	14195	02360
	14198	00367
	14229	02367
	15247	00365
06	8192	05346
	8171	05336
	9157	05336
	9153	02347
	10144	00332
	10142	02341
	11142	00342
	14200	02337
	15244	00330
	15248	00327
	15261	00332
07	7244	06340

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
07	8194	05342	13	7193	02326	17	10135	02373	20	15212	06433
	8173	04340		7187	00331		10133	00382		15241	06444
	8165	04341		8170	00331	18	6261	06388		15267	06437
	10141	06338		8164	02325		7198	06381	22	6258	05413
	11141	06348		9153	00331		8173	06379		7209	04415
	12144	05344		9146	02324		10135	05373		7199	02421
	13160	04349		10138	02326		10132	04370		9141	04414
	14202	05354		10136	02327		11132	04368		11129	06411
	14207	05356		14184	00336		13160	02372		14165	05435
	14217	05354		14196	02331		14173	02371		14182	05428
	15243	05355		14201	00336		14188	02369	23	12135	06423
	15263	06359		15261	00332		14199	02368		12141	04420
08	12144	05380		15277	00333		14210	00378		13143	00430
	12154	06394	14	6262	00333		15236	00375		13144	00429
	13164	06397		6257	02337		15263	00368		14179	04417
	14199	06390		7232	00332	19	8151	02390		14196	00422
	15272	05394		7200	00333		9141	02382		14198	00422
09	12148	06438		7186	02335		9137	02382		15207	00422
	14179	06439		8162	04334		10132	00380		15215	00423
	14199	06443		10139	00340		11131	00385		15228	04422
10	12145	06415		10139	02335		11131	00383		15262	06426
	12148	06415		11135	00347		13162	00390	24	12131	00419
	13166	06417		13166	02349		14191	00391		12134	02408
	14201	06422		13171	00356		14207	06394		12141	00422
	15233	06419		14193	00351		15248	06397		13148	00425
	15261	06422		14200	02344		15252	00381		14165	00422
11	6261	05372		15233	02347		15257	20386		14185	00419
	7216	05379		15260	02347		15262	20388		14193	02403
	7200	04379	15	6257	04335	20	5354	20389		15204	00413
	8159	02372		7220	04337		6261	00386		15241	00413
	9152	00365		7200	04335		6252	00389		15253	00413
	10142	04362		8175	02344		6238	02379		15264	00409
	10138	02367		8165	02339		6232	02380	25	6259	00392
	10137	03365		9139	02337		7213	00389		6222	00397
	11137	04363		10135	02337		7174	00393		7197	00399
	13169	04366		11134	05334		8160	00394		8150	00405
	14199	04368		12138	06350		9146	00396		8146	02397
	15247	05364		12143	06351		9137	00397		9137	00407
	15264	05367		14180	06345		10131	00401		9135	00401
12	6261	06352		14195	06348		11131	02393		10131	00396
	7218	06345	16	11134	02372		11131	00399		13151	02399
	7201	06347		11135	00377		11155	00399		14174	02400
	10141	05338		13160	05386		13161	02394		15206	04392
	10139	05338		15246	06396		14169	00399		15223	02398
	11136	05340		15263	05390		14197	00400		15239	02398
	13169	05332	17	6275	00362		14199	02391		15269	02399
	14200	05341		6261	02362		15240	00394	26	6229	06407
	15223	05343		6234	02368		15266	00393		7199	06400
	15249	05344		7194	00370	21	6260	00422		7184	06400
13	6265	02335		8169	00373		7191	00433		10129	05384
	6253	02336		8152	00368		8153	02436		11127	06397
	7202	00328		9138	00374		13162	06432	27	6264	02384

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
27	6243	20385	01	12136	06334	06	9129	05364	12	9128	02417
	7200	02391		13141	04333		9127	02380		13133	00424
	7193	00387		13145	00343		10124	06377		13134	02421
	7177	02386		14166	06332		10122	06385		13147	00423
	9137	02385		14178	00338		11122	02386		15192	00417
	11126	05384		14186	00339	07	11122	06390		15209	06417
	13158	02384		15197	00336		11123	02395	13	6244	00387
	13159	00385		15209	04331		11124	00395		6207	00389
	14191	00384		15261	02331		11124	02393		7185	02379
	15207	02379	02	6259	02309		13147	00399		7159	02382
	15229	04375		6244	02306		14168	02389		10121	05382
28	8142	06413		6221	02308		15193	06398		13140	02387
	9139	06412		7187	02308		16259	06397		13141	00387
	11126	06414		8153	04307	08	9127	06411		14151	02385
	13149	06422		8148	02306		10124	06405		14161	04387
29	5353	20389		8141	00312		10121	05402		15204	02380
	6262	00385		9137	02309	09	5262	06409		16240	00388
	6251	00388		9131	00311		5220	06405		16265	00385
	6214	02382		9128	02309		7189	06401	14	13134	02351
	6209	00387		11124	00319		8138	05398		13145	00362
	7198	02384		11125	02313		9133	06406		14150	00360
	7194	00388		13153	00307		9128	02410		14151	02351
	7176	00389		13153	20308		10123	00408		15191	00357
	8153	00389		15202	00309		10121	00406		15220	00357
	8143	00387		15202	20308		10121	02407		15237	00353
	9134	02385		15208	00310		14175	02413		16253	02346
	9129	06382		15208	20310	10	5354	20408		16261	04346
	10126	00388		15212	02306		6251	00412	15	9122	02339
	11125	00386		15238	00310		6210	00414		11119	05346
	11126	06377		15238	20311		7187	02407		13144	06356
	11148	00371		15242	02307		14173	00413		15204	05366
	14158	02375		15260	02307		14175	02408		16258	04348
	14164	02369	03	11125	02303		15196	00413	16	6225	20361
	14177	00374		11126	00312		15207	02407		6225	00360
	14193	00374		13141	00319		16256	00407		6204	02356
	15197	02372		13148	02307		16263	00408		7169	02363
	15212	00371		14158	00316	11	5315	20405		7157	00364
	15232	02371		14178	00315		6208	00402		8132	02357
	15237	00370		14186	02309		6204	02391		9123	02363
	13271	00371		15236	02308		7182	03392		9122	00363
30	11126	02350	04	6255	06343		7154	00404		11119	00370
	11127	00356	05	9132	06346		7153	02399		11120	02363
	11144	00358		9130	06352		8149	00403		13145	02366
	13151	02351		10125	06345		9131	00403		15190	04355
	14170	00356		14182	06346		10123	06401		16261	02363
	14177	02345		15197	06355		10122	00406	17	5259	06378
	15196	02343		15227	06361		11121	05405		6226	06366
	15208	02349		16260	06358		12124	02407		6207	06366
			06	6260	06375		12126	02402		7151	06376
	MAY 2005			7185	06375	12	5263	05413		8141	06375
				7159	06378		6205	05409		14160	02380
01	12131	06336		8138	06371		9129	00419		14161	02378

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
17	14173	02377	21	8132	00337	25	10118	00333	28	15198	02300
	15183	00378		9127	00338		10117	00330		15202	00306
	15202	02376		9121	00334		11116	02330		16226	00306
	15211	02373		10119	00337		13139	00337		16233	02302
	15214	00381		10117	00334		14167	00334		16238	00306
	16257	04377	22	11117	02329		15176	00334		16255	00306
18	5252	06352		11118	00334		15181	00336		16262	00306
	6228	06354		12123	02329		15194	00333		16304	00306
	6205	06349		12125	00339		15198	00326	29	12121	00293
	7176	06353		13131	00337		15206	02325		12123	02292
	7158	06354		13139	00338		16225	00327		12125	00295
	8132	06352		14149	00338		16234	00325		14152	00298
19	5262	05337		14160	00340		16240	00328		14159	02295
	6233	05339		15179	00336		16263	00326		15172	00300
	7173	05337		15198	02325	26	12124	00324		15202	00296
	8145	03343		15221	02324		13127	02320		15210	02297
	8134	03346	23	6197	00325		13142	02318		16253	00301
	8131	03348		6197	20325		14161	02317		16304	00299
	9125	03346		8139	02317		15180	02314	30	4357	20314
	10120	03347		8136	00317		15198	02315		5262	02312
	11118	03347		9129	00315		16232	02314		5254	00310
	14159	03349		9123	02319		16262	02315		6226	00311
	15178	03345		9121	02320	27	5300	00310		6198	02312
	15187	00360		10120	00318		5256	00308		6181	00312
	15194	00359		10118	02318		5245	02307		7166	00313
	15203	02350		11117	02321		6221	00310		8137	00309
	15229	00356		11117	00326		6200	02302		8130	02318
20	5259	00350		13136	00330		7174	00310		9126	00314
	6219	00346		14146	02324		8141	00302		9121	00314
	6195	00354		14147	00330		8131	00305		10118	00314
	7164	00352		14161	00330		9125	00307		10116	02315
	8148	00353		15176	00326		10119	00308		11117	02312
	8138	00352		15201	00325		11116	00307		13129	00315
	9129	00352		16246	00320		12122	02310		13131	02316
	9124	00352		16265	00321		12124	00311		13139	00316
	10120	02348	24	6211	06338		13134	00312		14145	02317
	10118	00353		6200	06335		13136	02309		14154	00318
	11117	02352		8142	05326		14142	00309		14157	00318
	12122	00355		10117	06332		14144	02306		14167	02320
	12126	02349		11117	06332		14151	00313		15180	00324
	13130	00356		15202	06331		14166	00310		15197	02321
	14149	00356		16246	06326		15178	00314		15209	00321
	14168	00356	25	5260	02335		15202	02308		16240	00316
	15193	00353		6232	02333		15211	00312		16259	02324
	15225	00352		6200	02328		16231	02308	31	8143	06336
	16245	00346		7146	00323		16260	02308		10117	05339
21	5355	20331		8138	00325	28	12126	02301		10117	02343
	5262	00333		9128	00330		13137	00301		10115	06342
	6192	00338		9127	02320		14149	00305		11115	05338
	7169	00339		9122	00320		14152	02299		14163	05339
	7152	00341		9120	02324		15172	00309		15177	02337
	8139	00335		10119	00331		15189	00309		15207	04349

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
31	16236	00339	05	9120	06384	10	9125	05359	29	15198	06319
	16247	02329		10115	00386		11114	06372	30	4357	20313
	16255	00335		10115	03384		15164	06373		5305	20313
				11114	00385	11	12119	06379		5253	20315
	JUNE 2005		06	5253	06388		12120	06381		6217	00319
				6198	06381		14161	00363		6196	00317
01	6192	00373		7160	06380		15164	02360		8142	02319
	8138	00374		9126	05385		16222	00358		8138	00319
	8133	02378		10115	00396		16237	02358		9120	02324
	8132	00378		10115	05395		16243	00355		9120	00314
	10118	00380		11115	00398		16262	02354		11114	02328
	15186	06380		15168	00383	27	9118	02333		11114	00322
	15201	06386		15183	02376		10116	00330		14137	00338
	16230	06378		15196	02380		10115	00325		14139	02338
	16261	06385		16241	05376		10114	00331		15193	00338
02	6185	06377		16262	05378		14146	00326		15205	00333
	8141	06370	07	5304	00378		15164	02332		16232	03327
	8136	00370		5262	00381		15175	02329			
	8136	00369		5251	02378		15191	00327		**JULY 2005**	
	8134	00366		5232	02381		15194	02332			
	8133	00368		6209	05380		16225	00332	01	5256	04332
	8131	04363		7146	02394		16232	02332		5254	04335
	9124	04358		8135	00390		16255	02330		6196	04331
	9120	00364		11114	06383	28	5263	02327		7171	04321
	10115	00361		14164	06394		5235	02326		9124	04324
	11115	00361		16215	00392		6199	02331		11114	03332
	15176	05361		16251	02389		6193	00341		11114	02338
	15202	05364		16262	00392		8128	02335		15171	05342
	16231	04370	08	5261	00394		11114	02330		15195	02338
	16262	04369		5252	00399		15191	00341		16225	00337
03	6175	06350		6224	00398		15194	00339		16263	02338
	7163	06350		6216	02392		16234	00334	02	12118	00339
	7151	05341		6203	00399		16238	02335		12122	06336
	8137	06343		6196	00398		16250	00334		13126	00340
	9126	06343		6175	02400		16258	00333		13128	00341
	10116	05332		10114	04403	29	5298	00314		14142	00343
	11115	06336		15198	06410		5262	00317		14148	00341
	13135	05340	09	5262	06385		5251	00319		15181	00339
	14145	05337		6216	06379		6227	00317		15194	00341
	15214	00346		6198	04376		6223	02313		15205	00342
	16254	02342		8128	02374		6201	00312		16251	00343
	17320	00341		9121	02376		6191	00311		16260	00344
04	12118	04349		9121	00368		6189	02307		17302	00343
	12121	06356		10115	00371		6176	00311		17353	00337
	13125	06365		10115	00367		6160	00310	03	12118	00349
	15183	04356		11114	06374		7153	02308		13124	00348
	15203	05356		14147	05366		7148	00309		13125	02348
05	5261	00359		16237	04357		8132	00311		14143	00343
	5253	00360		16264	04346		9122	00314		14151	00343
	6210	02362	10	6197	05345		10117	00314		14156	02341
	6200	00364		6182	05345		11114	00318		15180	00340
	6188	02363		8132	05360		15177	04320		15193	00339

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
03	15198	02335	05	16255	00332	08	15198	02345	12	8143	00334
	16211	00337		16260	00329		16222	02345		9121	02339
	16233	02331		17301	00328		16241	00344		10118	02336
	16250	00333	06	4353	20325		16263	00346		10117	00337
	16261	00333		5302	00328	09	12121	06340		10116	00343
04	4358	20321		5260	00326		13125	06352		11115	00334
	5299	20321		5251	00329		13134	06347		13129	00338
	5251	00327		6233	02325		14149	06331		13135	00340
	6199	02323		6215	00332		15176	05333		13137	02339
	6193	00328		6198	02327		15199	05334		14148	00341
	7172	00326		6195	00328		16222	05345		14160	00337
	7155	00328		7159	00328		16250	05342		15174	00336
	8141	00332		7148	00331		16264	05346		15183	00336
	9127	02333		7147	02330	10	12190	04333		15198	02330
	9126	00333		8129	00330		13127	05331		15205	00332
	9119	02333		9118	00336		14140	04338		16225	00333
	10116	00332		11114	04342		14155	04338		16233	02328
	11114	00333		15171	04343		15182	05332		16255	00331
	11114	02335		15191	04343		15201	05339		17302	20328
	12122	00335		16216	04341		16230	06342		17353	20328
	13127	02336		16236	04343		16262	04342	13	5354	00326
	13128	00334	07	5265	04338	11	5299	00329		5266	02325
	14145	00336		6216	04335		5262	00331		6206	04329
	14153	00335		6188	04332		5250	00333		7179	04326
	15182	00332		7163	04332		6234	02330		8141	00329
	15193	00333		9121	04337		6227	00335		9128	02333
	15198	02326		10118	04337		6204	00335		9126	00333
	15204	00332		10115	03340		6198	02331		9121	00335
	16233	02330		11115	02342		7163	00336		10118	00334
	16252	00330		13131	05348		7156	00337		11115	02337
	16260	00330		15170	04347		8142	03340		14162	00336
	17299	00329		15197	05345		9125	00335		15185	00337
05	5264	02326		15205	05346		10116	00338		15194	00337
	5250	00337		16227	05349		11115	00338		15200	00336
	6211	00332		16260	05346		13124	04338		16235	03334
	6198	02329	08	5303	00340		13132	02341		16261	03339
	6188	00333		5261	00343		14138	02344	14	5305	00329
	7173	00335		5252	00346		14143	00338		5294	00329
	7156	00334		6233	02346		14151	02338		5261	00331
	8144	00332		6226	00353		15176	00340		5251	00329
	9125	00335		6203	00350		15183	02337		6207	00330
	9119	00336		6198	02346		15197	02339		6196	00329
	9118	02338		7173	00348		15204	00338		8144	02332
	10116	00338		7152	00344		16226	00338		8145	00332
	11114	00332		7150	00345		16232	02335		8130	00330
	14139	00333		8132	00345		16264	02334		9128	00333
	14143	00333		9127	02344	12	5266	00330		10118	00336
	14151	00331		10117	00344		6235	02324		10116	00337
	14157	00333		11115	00340		6228	00329		11116	00338
	15195	00332		14145	00344		6199	02327		13139	00342
	16211	02331		14156	02347		7176	00336		14140	02344
	16233	02328		14161	00346		7156	00336		14150	00344

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
14	15172	00343	19	6200	06327	25	6257	00331	28	15191	00313
	15176	02343		7177	06330		6215	02328		15198	02316
	15190	00340		9126	06333		6197	02325		15206	00310
	15203	00342		15176	06340		8143	00331		16226	00311
	16212	02344		15191	05339		8136	03325		16233	02315
	16232	02341		16224	06339		10120	05320		16242	00310
	16250	00336	20	5291	00316		11118	05326		16260	00308
	16262	00339		5262	02317		13129	06344	29	5305	00295
15	5265	02324		6249	00315	26	6236	02331		6261	00296
	6234	02325		6206	05327		6225	00334		6251	00297
	6228	00327		7180	06327		6201	00337		6227	02300
	6199	02324		8144	04334		7159	00341		6202	00301
	6190	00331		8138	00320		7154	02339		7190	00301
	7174	00333		9129	00327		8151	00340		7179	02303
	7166	00331		10118	00321		9133	00344		7161	00303
	7149	00333		11117	06335		9130	00343		8145	00302
	8141	00331		14164	05327		10122	00342		8138	00301
	8135	00331		15172	05317		11118	02346		8137	02305
	9128	00323		15196	05317		11118	00346		9133	00304
	9126	02327	21	6240	06349		11119	00345		10123	00299
	10117	00325		6192	06341		13138	00339		10122	00298
	11116	00326		7180	05353	27	5262	02337		10121	02301
	13135	00327		9129	00357		6224	02338		11119	02298
	14142	05320		11117	05357		6200	02334	30	6240	02287
	15186	04325		15185	05359		8151	02330		6204	02284
	15202	02331		15200	04356		8151	00320		7182	02285
	16221	02330		16227	06355		8140	00317		7170	03283
	16260	04330		16257	06355		9125	05309		8155	02283
16	13138	06358	22	5258	06357		11119	06313		8151	00288
	14143	06352		6232	06360		13138	02325		8143	00289
	16250	06347		6203	05359		14146	02325		8137	00292
	16263	06350		10119	00357		14148	00316		9133	02292
17	11118	02349		11117	00365		14157	05315		9129	00296
	14145	02345		11117	02371		16227	05310		9127	02293
	14147	00347		15179	00353		16254	04308		9125	00292
	15169	02339		15189	00354	28	5103	00306		10123	00294
	15183	00338		15204	00353		6262	02306		10121	00292
	15202	02345		16236	00350		6250	00306		12129	02291
	16258	00337		16261	02344		6205	00306	31	12125	06303
18	5262	04328	23	12123	06353		6198	02303		12128	03304
	6229	04328		12126	06360		7175	00310		13144	00304
	6215	04325		14157	06352		8153	00310		14161	00302
	8143	06327		15183	05351		8136	00308		15178	00302
	11116	05328		15202	04359		9134	00308		15188	00304
	14166	00329		16260	06360		9127	00312		15200	02307
	15191	00328	24	12122	06354		10123	02313		15210	00306
	16235	00325		12123	06355		10122	00311			
	16256	03327		14161	06358		11119	00313		**AUGUST 2005**	
	16262	02328		15171	06351		11119	00313			
19	5263	06325		15203	06358		13132	00313	01	6260	00304
	6224	04325		16250	06360		14158	00313		6239	00308
	6209	06326	25	5289	00330		15177	00310		6227	03303

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
01	6208	03304	05	6261	06302	10	11124	00336	15	10127	06322
	8144	00309		6252	06303		13151	02330	16	6265	06322
	8140	02312		6210	06300		14161	00331		6232	06316
	9135	00308		7195	06303		14177	02325		7211	06326
	10121	00314		14166	06331		15187	00326		7179	06320
	11120	02318		15185	06331		15207	02323		9134	06336
	11120	00316		15204	06330	11	6250	02307		10130	06338
	14155	00316		15233	06321		6218	05322		10128	06332
	14157	02318	06	6260	04315		6212	05324		11127	06331
	15200	00315		6239	04316		8158	06310		13139	06320
	15211	02315		6214	04310		9138	06319		13148	05320
	16236	00314		7196	04313		10128	06325		15205	05316
	16259	00314		8154	03313		10125	06327		15228	05312
02	5298	00297		9134	03316	12	6263	06320		15255	05321
	6262	00298	07	12130	05333		6221	06322	17	6255	02311
	6251	00298		13135	00337		7198	06328		6236	02311
	6204	00300		13136	02339		8152	02330		6218	02310
	7186	00300		13148	00334		9139	06316		7210	02309
	7172	00296		14166	04353		11125	06329		9133	00315
	7166	02300		15189	05340		13143	05328		10132	02316
	8158	00296		15207	05338		13152	05321		10130	00314
	8148	00295		16243	02341		15216	05312		10129	00315
	8145	02300		16270	02340		16272	22311		10128	02315
	8143	00294	08	6209	05328	13	11126	05324		11128	00317
	9130	00295		7195	05328		11127	06333		13157	00316
	11121	00295		7179	05328		13142	05321		14172	03317
	11121	02302		8141	05332		13146	00321		15196	03315
	13135	02308		11123	06352		13151	00327		15218	03313
	13141	02308		15222	06341		13153	02328		15235	03312
	14150	02305		16252	06351	14	12132	06323		15261	03314
	14170	04303	09	7199	06328		12135	06322	18	6300	20305
	15196	05295		8159	02331		13145	06321		6262	00308
	15213	05300		9130	02338		14158	06323		6251	00309
03	6261	00310		10127	02337		14172	04324		6233	02306
	6234	02309		10125	05334		14179	00323		7213	00308
	6199	02311		11124	06337		14180	00323		7201	00310
	7176	00316		14164	06326		14182	00322		7198	02306
	8153	00313		15205	06335		15193	00322		7180	00308
	8138	00310		15220	06325		15197	00323		8167	00308
	9128	00313		16261	06332		15205	00322		8147	00307
	9127	02313	10	6262	02327		15237	03317		9140	00307
	10125	00313		6248	02327		15257	03325		9136	00306
	10123	02315		6213	00319		16262	00322		9134	02308
	10122	00315		6207	00317	15	5425	22319		11128	02311
	10122	02316		7199	02313		7213	05325		13148	02317
	11121	00316		7176	00319		7190	05318		13150	00313
	14152	04317		8151	06324		8168	02324		14161	00316
	14159	04316		8148	00319		8164	02323		14163	02318
	15221	04310		9132	00325		8160	02324		14177	00321
	16246	04312		10128	02337		8147	02326		14183	02318
04	8140	06316		10127	00337		9133	04327		14196	00318
	9137	06315		11124	02339		10129	06320		15198	02315

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
18	15264	00313	22	8173	00294	26	8153	06303	30	7203	00281
	16310	00313		9147	00297		9147	06299		7198	02282
19	6264	20307		9139	00299		9140	06302		8170	00279
	6225	00312		10134	00300		11134	06300		9153	00283
	7181	02312		10132	00298		13165	02309		9145	00283
	7175	00314		10132	02300		14179	02308		9145	02285
	8164	00315		11131	00299		15219	02306		10140	00286
	8150	00315		11131	02299		15267	02304		11137	02285
	9141	00316		12139	02302	27	11137	06310		13167	00293
	9135	00316		13144	00304		12141	06311		13169	02293
	10132	00315		13151	00304		13159	04307		14185	02294
	10131	02313		13163	00302		14179	04304		14203	00292
	10129	00315		14189	00300		14191	02309		15224	00291
	11129	00315		14195	02299		14201	02310		15232	02295
	13148	00316		15219	02295		15219	04306		15252	02291
	13155	00315	23	6264	02295		15262	05306		15262	00292
	14185	00312		7220	04291	28	12143	02306		15315	00291
	14193	02311		9148	05297		12145	00308	31	6355	20279
	15204	00312		9139	05300		14192	00311		6312	22279
	15253	00311		10136	05295		15219	00313		6303	00284
	16294	00309		10132	05300		15243	00314		6253	00286
	16307	00307		11131	05302		15256	02310		7222	00286
	16353	20305		13162	05300		15263	00308		7203	02284
20	11131	00300		14190	05302		15305	00305		8185	00285
	12134	02302		14206	05299		16319	22309		8164	00287
	12135	00300	24	6261	06333	29	7220	02280		8160	02288
	13147	00303		8176	06329		7202	02278		9144	00290
	13149	02304		8170	06337		7187	00285		9143	02293
	13157	00306		8151	06336		8181	02282		10139	00291
	14176	00304		9145	06335		8177	00284		10138	00291
	14199	02300		10132	02329		9151	00285		11137	00292
	15204	00305		11132	00318		9150	02283		12150	00293
	15229	00303		11132	00318		9146	00286		13160	00291
	15257	00302		14171	00318		10136	00288		14195	00292
	16309	00302		14173	00317		11136	02285		14198	02288
21	6261	00299		15222	00316		13156	00283		14210	00292
	6248	02298	25	5355	20304		13164	00285		15234	02286
	6244	00303		6262	00311		14189	00284		15262	00294
	7213	00301		6251	00312		14198	02282		15277	00292
	7198	00301		7230	02315		14209	00285		16354	00291
	7177	00303		7199	02314		15220	00283			
	8160	00301		7191	00312		15233	02281	**SEPTEMBER**	**2005**	
	9146	00301		8165	00310		15255	00283			
	9142	02302		9151	02314		15261	00284	01	6302	00282
	9138	00299		9148	00310		15305	00281		6253	00281
	10134	00299		10134	02309		16356	00278		7228	00282
	10131	00302		11133	02308	30	6354	00278		7207	00284
	11130	00307		13149	02311		6302	00278		8175	00284
22	6263	00287		13162	05311		6260	00280		8164	00285
	6243	02283		14197	02312		6251	00282		9154	00285
	7208	02286		15216	04311		7234	02284		9151	02284
	7197	02288	26	8179	06302		7230	00283		9145	00296

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
01	10141	00296	04	9158	00301	08	14213	00278	13	7206	00288
	10138	00287		9150	02299		14232	02277		9156	04286
	11138	00286		11140	04296		14239	00279		10151	02288
	12141	00288	05	7228	00295		15258	02274		10150	02291
	12145	00288		7195	00294		15265	00280		11150	02292
	12149	02287		8180	00292	09	7243	00275		12159	04286
	12152	00288		8174	02289		7234	02272		12164	05281
	13158	00287		9155	00295		7204	00275		14210	05280
	13162	02287		9154	02291		8198	02272	14	6351	00281
	13173	00288		9147	00295		8182	00277		6317	02280
	14187	02286		10146	02292		8177	02276		6303	00280
	14197	02285		10143	00295		9166	00278		7259	00283
	14200	00287		10142	02293		9162	02277		7248	02282
	15239	00287		11141	00295		9155	00277		7237	00283
	15252	02282		14217	02297		9152	02279		8199	00283
	15266	00289		14232	02294		10148	00278		8191	02281
	15323	00287		15261	02296		10146	02282		9166	02279
	16357	00285	06	6264	02296		10145	00285		9163	00286
02	6252	00286		7241	02291		11145	02286		11151	02278
	7214	00288		7218	02292		14193	00292		14205	03278
	8183	00286		7205	02295		14198	02288		14214	03275
	8169	00283		8176	02289		14213	02931		14238	03272
	8164	02282		9150	02293		15256	00295		14241	00276
	10143	00282		11143	02293		15265	02291		14260	00278
	10142	02285		14206	02294		15303	00295		14265	02277
	11139	00290		14223	02295		15351	00292	15	7263	03283
	12151	00291		14238	02295	10	12155	06278		7237	06285
	13156	00292		15263	02295		12159	06279		8201	06291
	13173	00291	07	6301	00291		13190	06277		8187	03280
	14193	02288		6261	00290		14199	03280		11153	06290
	14201	00290		7250	00292		14221	03278		14228	05292
	14225	00289		7234	02289		15261	06277		14255	06282
	15237	02287		7202	00292	11	12151	02284	16	9267	05275
	15245	00288		7198	02291		12154	02287		9163	05274
	15252	00287		8188	00291		13179	03282		11153	06287
	15266	00288		8171	00291		14209	02286		13195	06276
	15307	00287		9159	00294		14217	02284		13198	06274
03	6302	00284		10147	00297		15261	05293	17	11157	06294
	6263	00286		10146	02296	12	7262	05299		12163	06294
	7248	02287		11143	00294		7224	05299		12173	06295
	8187	00291		13181	00297		8201	04306		13186	06295
	8174	00284		14198	02297		9162	04309		13208	06297
	8163	00286		14209	00298		9159	04305		14226	06297
	9158	02286		14238	00299		10150	00311		14256	06301
	9149	00287		15249	00298		10149	02312		14263	06302
	10143	02288		15264	00296		11148	00302	18	7216	02311
	10140	04287		15271	02297		14215	02315		8205	02314
04	6259	02309	08	7236	00277		14245	02311		8200	00316
	7243	02309		7218	00279	13	7264	05295		8195	02312
	7204	04301		7198	00276		7248	02290		8180	00319
	8181	04304		8193	02275		7222	04289		9176	00318
	8168	00297		8177	00273		7214	02289		9170	00323

YY	GGμμμ	λSΩΩΩ
18	9168	02314
	9164	00320
	9162	02311
	10158	00312
	10155	00312
19	6351	00277
	6304	00276
	7265	00277
	7235	00277
	8210	00279
	8186	00279
	9164	00278
	10159	00278
	10158	02276
	11157	00280
	11158	02277
	11161	00281
	13182	00282
	13195	00282
	13208	00283
	14223	00282
	14257	00280
	15303	00283
20	6304	00265
	7263	00266
	7248	02261
	7263	02262
	8117	00270
	8212	00267
	8192	00269
	9181	02266
	9177	00268
	9164	00269
	10162	02266
	10161	00268
	10159	00270
	10158	00267
	11158	02266
	11159	00271
	12176	00271
	12178	02268
	13191	00270
	13211	00269
	14236	00267
	14245	02266
	14252	00267
	15302	00267
	15357	00266
21	6344	00259
	7303	00260
	7262	00260
	7224	00261
21	9182	00260
	9173	00259
	9171	02257
	9168	00257
	9165	02255
	10160	00258
	10159	02254
	10159	00256
	11159	00259
	11160	00258
	12171	00260
	12173	02257
	12181	00257
	13195	00256
	13203	00252
	14236	00252
	14256	00253
	14303	00250
	15355	00251
22	6362	00253
	7256	00249
	9175	00248
	9171	00247
	9168	02248
	10164	00247
	10161	00248
	13188	00254
	13205	00255
	13217	00254
	14239	00256
	14251	00254
	14263	00254
	14301	00254
	15354	00255
23	6354	00255
	7305	00256
	7261	00254
	7251	00257
	7233	02254
	8221	00261
	8201	00263
	8198	02259
	9177	00268
	9170	00264
	10163	00267
	10162	00267
	11162	02266
	11162	00266
	12173	00271
	12175	02269
	12185	00272
	13199	00272
23	13215	00272
	14236	00273
	14244	00272
	14253	00274
	14302	00271
	15353	00271
24	12173	00279
	12177	02280
	13189	00276
	13206	00279
	14237	00279
	14242	02280
	14262	00280
25	11170	04283
	12178	02283
	13194	02285
	13203	02288
	13210	00286
	13226	02286
	14262	02285
26	7241	00282
	8221	02285
	8115	00281
	8202	02285
	8195	00280
	9182	00283
	9178	02286
	9173	00283
	10166	00287
	10166	02288
	11166	00284
	11167	02288
	12175	00289
	12179	02287
	12183	00289
	13199	00287
	13202	02289
	13218	02288
	14262	02286
27	7301	00284
	7259	00284
	7250	02285
	8228	00284
	8204	00285
	10172	02290
	10170	00288
	10168	00289
	11168	02290
	12189	00292
	13200	00290
	13210	00290
	13219	00291
27	13231	00292
28	7306	00280
	7261	00277
	7252	00279
	8223	00279
	8220	02280
	8201	00278
	9187	00277
	9179	02280
	10172	00281
	11169	00284
	12183	00284
	12194	00284
	13198	02281
	13201	00285
	13221	02281
	14264	06283
29	7263	06298
	8235	06295
	8207	05288
	9192	04293
	10171	06305
	11172	06302
	13220	06321
	13234	06322
30	7247	06312
	9188	06315
	9181	06320
	10174	06320
	10172	06316
	11173	06322
	12201	06324
	13233	06321
	14252	06323

OCTOBER 2005

YY	GGμμμ	λSΩΩΩ
01	10174	05306
	11175	06311
	12184	06314
	12202	06318
	13227	06317
	14268	06326
02	7262	05292
	8235	05291
	8204	04291
	9198	02294
	9187	02296
	9182	02298
	10180	02299
	10177	02291
	10176	02293

YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ	YY	GGμμμ	λSΩΩΩ
03	8239	06277	06	11183	02267	10	12225	00278	16	8239	03300
	10178	04273		11183	00272		12229	02277		9233	00297
	10177	04275		12194	00272		13256	00278		10207	06300
	11177	04275		12203	00270		14310	00284		10203	00296
	12196	03276		12217	00269		14351	00279		10203	02297
	12198	02280		13222	02263	11	8256	00277		11203	00297
	13210	04275		13229	00270		8241	00278	17	8255	02309
	13232	04278		13241	00273		8232	02277		9238	06311
	13246	04278		13253	00273		9217	00283		9215	05308
	13261	04280		13261	00272		9202	00282		10206	05312
04	7262	04285	07	9212	00270		10194	00282		11205	02305
	8233	04283		9200	00269		11193	00282		12245	02306
	8213	04281		9195	00267		11198	02278		13269	06307
	9204	04281		10186	00269		11200	00285	18	8267	06297
	9191	00284		10184	00272		12208	00284		9230	06296
	9190	02280		11185	00272		12220	00285		9216	06292
	10183	00286		11185	02268		13239	00284		10208	06288
	10179	00280		12203	00275		13251	00283		11209	06285
	11179	00280		12213	02270		13260	02280		13261	06279
	11179	02276		12220	00275		14306	00282		13267	06279
	11184	02275		13225	02269		14351	00280	19	8264	06280
	11187	00275		13228	00275	12	7305	00295		9241	06277
	11191	00281		13232	02271		8265	02291		9221	06279
	12197	02282		13243	00273		8255	00294		10211	02273
	13213	00280		13255	02271		8231	00293		11210	02269
	13227	00280		14307	00273		9225	02294		11211	00273
	13232	02284		14353	00273		9213	00296		11220	00275
	13264	00281	08	12197	00273		9205	00297		12228	00273
05	7262	02270		12204	00277		10199	02294		12241	00275
	8250	02274		12218	00278		10197	00296		12248	02270
	8230	00274		13245	00280		10194	02293		12254	00277
	8210	02271		13268	00283		12216	04294		13264	00278
	9199	02271		14308	00281		12222	02299		13302	00277
	9189	02271	09	12203	00283		12233	02301		13346	00275
	10183	02271		12208	00282		13259	02305	20	7347	00260
	10181	02271		13232	00286		13271	02306		8303	00259
	10181	00275		13237	02281	13	8231	06321		8264	00259
	11181	00272		13250	00287		10196	06327		8260	02250
	11187	00276		13270	00284		11197	06327		9226	02249
	12190	02274		14312	00285		13270	06326		11214	04246
	12192	00275	10	7362	00277	14	9228	05318		12230	02257
	12203	00275		7298	00278		9221	05316		12243	02260
	12214	02273		8276	00279		10199	02311		12263	02261
	13219	00277		8261	02275		11204	02310		13268	02261
	13252	02274		8249	00278		11206	02310	21	8265	02250
	13261	00278		8236	02276		12221	06317		9244	00252
06	7280	00266		9218	00281		13263	06313		9240	02246
	8262	00266		9210	02278	15	9228	02285		9233	02246
	8231	00267		9206	00282		9219	00284		10219	02250
	9211	00269		10194	00292		9215	02285		10216	02250
	9195	02265		10190	00287		9210	05281		10215	02251
	10183	00267		11192	00284		11201	06290		11217	02254

YY	GGμμμ	λSΩΩΩ
21	12246	02255
	12259	02257
	13267	02258
	13284	22257
22	11221	02252
	11227	02254
	12237	02257
	12248	02258
	12268	02258
23	10221	06279
	10220	06279
	11221	05279
24	9255	02294
	9251	05295
	11225	02297
	11227	00297
	12245	00295
	12246	02294
	12265	06303
25	9242	05277
	9234	05274
	10226	05270
	11226	06270
	11238	06269
26	9259	04289
	9249	02290
	9246	00289
	9244	02284
	10234	02284
	10233	00285
	10228	02279
	10228	02281
	12243	06286
27	9257	06264
	9251	06263
	10231	02257
	10231	00257
	11232	02259
	11233	00260
	11244	02263
	12255	02261
	12261	02262
28	8351	00247
	8302	00247
	9261	00245
	9248	00244
	10240	00248
	10235	00247
	10233	00246
	11235	00247
	11243	00244
	12253	00241

YY	GGμμμ	λSΩΩΩ
28	12257	00242
	12272	00241
	12275	00241
29	11242	00235
	11245	00231
	11252	00232
	12263	00232
	12269	00233
	12290	00231
	13301	00232
30	11250	00234
	12259	00234
	12268	00234
	12287	00233
	13310	00234
	13354	00235
31	8325	00239
	9261	00240
	9252	00241
	10245	00241
	10242	00241
	11244	00239
	11252	00239
	11258	00239
	12273	00237
	12304	00239
	13354	00236

NOVEMBER 2005

YY	GGμμμ	λSΩΩΩ
01	11248	00250
	11256	00250
	11262	00251
	12279	00251
	12303	00252
	13348	00251
02	8314	00260
	9264	00259
	10254	00260
	10248	00263
	11249	02259
	11252	00264
	11257	00268
	11267	00268
	12279	00268
	12303	00268
03	9289	22284
	9274	22282
	10159	22283
	11252	02281
	11262	22276
	11271	22280

YY	GGμμμ	λSΩΩΩ
03	12284	22278
04	9289	22266
	9272	22268
	10262	22266
	10254	22274
	10254	02277
	11257	02277
	12292	22262
	12307	22272
	12316	22264
05	11262	25252
	11262	05260
	11271	25249
	12289	25252
	12321	25254
06	9283	26283
	10269	24271
	10265	04284
	10264	25285
	10261	06282
	11262	02284
	11263	02284
08	9311	22283
	9294	22285
	9281	22283
	9279	20274
	10273	22277
	10268	22278
	10267	20276
	11267	22275
	12287	22267
	12346	20275
09	10270	26255
	10270	26264
	12293	26257
	12340	27254
10	10274	26256
	11275	26248
	12335	27354
	12348	27250
11	11284	25255
	11292	25258
	12309	25258
	12325	26261
	12351	26262
12	11282	25259
	11288	25256
	12302	24253
	12329	26260
	12355	26265
13	11286	26274
	11295	26269

YY	GGμμμ	λSΩΩΩ
13	12307	26270
14	9338	26303
	9314	25303
	10289	22311
	10287	22311
	11288	22306
	11290	22310
	11306	22309
	12320	22313
	12343	22313
	12366	22314
15	9341	22267
	9330	22268
	10295	22272
	10293	20269
	10291	22266
	11292	22270
	11294	20273
	11297	22270
	12319	22260
	12326	20267
	12343	22260
	12357	20267
	12370	22261
16	9346	24284
	9328	25280
	10306	26277
	10294	26289
	11299	26288
	12390	26293
	12329	26293
	12359	26296
	12376	26291
17	9342	26321
	9314	26318
	11301	22310
	11310	26288
	12321	26288
18	9358	26307
	10308	26307
	10303	26318
	10301	26315
	11304	26307
	12325	26317
	12355	26314
	12386	26313
19	11309	26367
	11317	26360
	11320	22335
	12333	25356
	12359	22345
	12391	22345

YY	GGμμμ	λSΩΩΩ
20	10307	25338
	11308	25338
	12335	22342
	12343	20353
	12352	22343
	12371	26351
21	11314	26370
	11319	26367
	12338	26352
	12382	26339
	12399	26336
22	9372	26306
	9346	26304
	10329	26299
	11317	26308
	11322	26303
	12344	26307
	12373	26305
	12406	26306
23	10319	26301
	11318	26299
	11323	26300
	12351	26299
	12376	26296
	12409	26299
24	9354	26310
	10336	26298
	11321	26295
	11326	26294
	12350	26309
	12387	26307
	12417	26315
25	9349	26320
	10341	26313
	10327	26311
	11325	26312
	11332	26312
	12433	26310
26	11353	26300
	12367	26296
27	9359	26285
	10334	26283
	11331	26285

YY	GGμμμ	λSΩΩΩ
28	9405	22307
	9375	22302
	9371	20304
	10351	20306
	10349	22304
	10336	20308
	10334	22307
	11334	20306
	11349	22301
	11352	20307
	12360	22300
	12387	22295
	12431	22298
29	9414	26292
	9370	22295
	10349	24281
	10340	22299
	10337	20299
	11337	22302
	11339	20302
	12380	20307
	12388	22303
	12403	22302
	12415	20301
30	9419	22340
	9403	22332
	9387	22329
	9367	22330
	10358	22331
	10343	22328
	10341	20333
	11340	20335
	11342	20333
	11359	20318
	12367	20314
	12383	22316
	12407	20306
	12425	20304
	12428	22306

DECEMBER 2005

YY	GGμμμ	λSΩΩΩ
01	9380	26265
01	10358	26257
	10346	26265
	11343	26270
	12385	26267
02	9397	26297
	10355	26292
	10346	26292
	11347	26296
	11351	26299
	12383	26300
03	11351	26307
	11366	26314
	12381	26311
	12387	26312
04	11355	26337
	11371	26333
	12388	26327
05	11373	26329
	12381	26324
06	11362	26317
	11375	26314
	11381	26317
07	11360	27350
	11373	26346
09	11366	26324
	11370	26323
10	11383	26328
13	10380	26306
	11381	26299
14	11371	26307
	11377	26297
	11381	26293
15	10379	26297
16	10380	26333
	10374	26335
	11377	26343
	11384	26343
17	11376	25372
	11384	25368
	11394	25371
18	10380	26328
	10375	24305
	11375	23309
18	11377	24325
	11385	26334
19	10382	22340
	10377	20339
	10376	22333
	11375	20334
	11378	22332
	11383	20324
	11391	22319
20	11380	26327
	11383	26328
	11389	26331
21	10382	26299
	10376	26294
	11377	25292
	11384	26295
22	11376	27330
24	11375	27329
	11379	27329
	11383	27326
25	11392	26346
	12400	26338
26	10379	25358
	10375	25347
	11374	25340
	11377	25341
27	10392	25347
	10377	24334
28	10379	26330
	11372	26325
	11372	26323
	11379	26327
	11385	13329
29	10389	22313
	10375	22306
	11371	22304
	11371	22306
	11377	24283
	11383	25296

VERTICAL DISTRIBUTION OF OZONE, 2004-2005

Since January 1, 1992, the ozone profiles have been evaluated using the Bass–Paur coefficients and a new Umkehr inversion algorithm. The procedures are described in "A New Umkehr Inversion Algorithm" by C.L. Mateer and J.J. DeLuisi, published in the Journal of Atmospheric and Terrestrial Physics vol. 54, no. 5, pp. 537-556, 1992.

The standard ozone absorption coefficients used to obtain total ozone from Dobson spectrophotometer measurements are average values for a wide range of conditions. In the new Umkehr algorithm, an ozone-weighted mean absorption coefficient is calculated for the first guess profile. This mean coefficient is used in conjunction with the standard coefficient to make a small adjustment to the observed total ozone for consistency with the calculations carried out in the inversion. The change is usually less than one Dobson unit.

Date column	– The letters A or P immediately following the date refer to a.m. (morning) or p.m. (afternoon) observations, respectively.		
Columns 10–1	– Layer ozone in Dobson units.		
Total ozone	– "RETR"	– obtained by the calculations carried out in the inversion.	
	"OBS"	– see the explanation as above. The quality of vertical distribution is reflected partly by the "RMS" residual. When the "RMS" residual exceeds 1.00, the vertical distribution is not counted in averages or standard deviations.	

VERTICAL DISTRIBUTION OF OZONE FROM UMKEHR OBSERVATIONS AT BELSK, FOR 2004

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
10 02 2004 A	1.53	3.96	10.10	20.0	33.3	66.2	103.1	82.4	47.2	31.7	399	399.5	0.46
11 02 2004 P	1.46	3.41	8.17	18.0	34.2	65.6	107.7	108.8	67.0	35.8	450	450.1	0.58
20 02 2004 A	1.47	3.61	9.04	18.2	30.8	57.7	91.7	71.1	37.6	29.8	351	351.0	0.45
20 02 2004 P	1.45	3.41	8.53	19.2	36.6	64.2	86.0	69.5	41.0	31.9	362	361.6	0.43
21 02 2004 P	1.41	3.14	7.52	17.9	40.7	68.9	81.1	59.8	34.8	30.4	346	345.6	0.59
25 02 2004 A	1.56	4.50	13.07	24.1	34.0	69.9	117.7	67.5	35.1	27.3	393	394.7	1.36
05 03 2004 P	1.44	3.56	9.53	20.6	36.6	67.9	94.6	78.6	46.6	32.0	391	391.3	0.34
06 03 2004 P	1.47	3.85	10.95	22.8	36.7	66.8	89.4	58.3	30.2	26.6	346	346.9	0.66
11 03 2004 A	1.44	3.72	10.40	20.6	30.0	49.2	80.3	89.5	57.7	36.5	380	379.3	0.85
11 03 2004 P	1.45	3.85	1107	22.5	34.4	58.3	86.4	78.8	47.1	32.8	377	376.7	0.48
12 03 2004 A	1.45	3.83	10.55	19.6	28.3	47.8	79.1	85.4	54.2	37.1	369	367.3	0.60
18 03 2004 P	1.41	3.64	10.74	23.8	39.8	59.9	65.7	44.0	22.8	27.4	299	299.4	0.30
23 03 2004 A	1.37	3.32	9.34	20.0	32.5	53.8	76.5	67.5	39.8	34.2	340	338.4	0.49
01 04 2004 P	1.37	3.55	11.01	23.8	38.6	63.6	77.0	55.7	30.4	28.7	334	333.7	0.26
02 04 2004 A	1.32	3.16	9.46	22.8	38.2	59.3	75.2	63.1	37.5	32.6	344	342.7	0.49
02 04 2004 P	1.31	3.10	9.17	22.6	39.5	60.1	73.5	62.0	38.8	34.0	346	344.2	1.01
03 04 2004 P	1.31	3.07	9.08	23.0	42.4	64.5	73.4	55.4	31.9	30.3	335	334.2	0.39
12 04 2004 P	1.24	2.69	7.52	18.7	36.3	59.5	78.2	70.1	43.3	34.9	354	352.5	0.81
14 04 2004 A	1.27	2.95	8.90	21.4	36.7	59.6	81.1	75.3	47.2	34.7	370	369.0	0.51
14 04 2004 P	1.24	2.71	7.72	19.4	36.8	60.1	80.7	79.4	52.8	36.9	379	377.8	0.89
15 04 2004 A	1.28	3.05	9.30	21.0	35.1	58.8	78.5	68.2	40.9	33.6	351	349.7	0.56
15 04 2004 P	1.26	2.91	8.74	21.6	40.2	64.8	76.9	60.1	34.8	31.0	343	342.2	0.40
16 04 2004 A	1.29	3.15	9.90	22.1	34.6	54.2	73.6	66.8	40.6	34.9	343	341.2	0.63
20 04 2004 A	1.28	3.16	10.15	22.5	35.7	60.8	85.7	73.3	41.9	31.3	366	365.8	0.31
21 04 2004 P	1.25	2.92	9.13	21.9	36.4	60.1	86.7	83.8	51.0	33.6	387	386.9	0.46
22 04 2004 A	1.26	3.03	9.60	21.8	34.2	56.3	84.1	89.9	59.3	36.9	397	396.4	0.56
23 04 2004 A	1.26	3.07	9.98	23.1	36.9	59.3	78.6	68.7	41.1	32.9	356	355.0	0.37
26 04 2004 A	1.23	2.85	8.68	18.8	29.4	49.8	70.4	79.0	55.0	40.7	359	355.8	1.28
26 04 2004 P	1.20	2.66	7.97	19.5	33.3	52.3	76.4	80.2	52.6	37.4	365	363.5	0.95
27 04 2004 A	1.21	2.76	8.55	20.5	32.8	52.6	76.4	83.9	56.9	38.5	376	374.2	0.89
27 04 2004 P	1.18	2.52	7.26	17.7	33.2	56.7	78.2	77.1	52.6	39.3	368	365.6	1.31
29 04 2004 A	1.22	2.80	8.84	20.9	32.8	51.6	77.1	79.2	48.9	35.4	360	358.9	0.68
29 04 2004 P	1.21	2.73	8.43	20.1	32.6	52.1	77.4	78.7	49.3	36.1	360	358.6	0.70
30 04 2004 A	1.21	2.80	8.82	20.4	32.3	51.6	71.4	71.7	45.7	37.4	346	343.4	0.86
30 04 2004 P	1.20	2.71	8.43	20.7	35.0	55.1	74.6	67.8	40.9	34.8	343	341.3	0.69
01 05 2004 P	1.22	2.88	9.20	20.9	33.5	54.1	74.9	68.7	41.6	35.2	344	342.1	0.71
12 05 2004 P	1.18	2.67	8.76	22.3	38.5	62.3	81.3	73.1	45.3	33.9	370	369.2	0.45
14 05 2004 A	1.16	2.56	8.13	20.5	37.0	60.4	79.5	73.2	45.6	34.8	364	362.8	0.62
17 05 2004 A	1.15	2.52	8.24	22.8	41.1	63.6	83.2	82.4	55.3	36.0	397	396.4	0.89
18 05 2004 A	1.14	2.47	7.78	20.2	37.9	60.1	75.4	71.4	46.6	37.1	362	360.1	1.13
25 05 2004 A	1.13	2.47	8.04	21.0	36.2	57.0	81.1	83.5	51.9	34.3	377	376.7	0.91
28 05 2004 A	1.15	2.60	9.05	24.2	39.9	60.9	81.7	83.9	56.5	36.5	397	396.4	0.66
29 05 2004 P	1.11	2.31	7.21	20.3	43.7	72.1	88.3	73.9	44.2	31.4	384	384.5	0.60
31 05 2004 A	1.11	2.36	7.57	20.8	39.7	61.1	75.1	67.4	42.4	35.0	354	352.5	0.87
31 05 2004 P	1.12	2.46	8.20	22.6	41.2	62.2	76.0	66.1	40.3	32.9	354	353.1	0.57
01 06 2004 A	1.15	2.66	9.30	22.7	36.7	62.8	87.2	63.7	32.3	27.3	345	345.7	0.73
01 06 2004 P	1.11	2.35	7.46	20.0	39.3	64.7	80.2	67.1	39.7	32.3	355	354.3	0.51
02 06 2004 A	1.11	2.36	7.48	19.1	34.2	54.8	75.2	72.2	44.9	36.0	349	347.3	0.84
02 06 2004 P	1.14	2.58	8.81	22.0	36.5	59.0	80.7	74.5	44.2	32.9	363	362.4	0.44
03 06 2004 A	1.14	2.57	8.96	23.5	38.4	58.0	75.9	71.5	45.0	34.8	361	359.8	0.64
03 06 2004 P	1.15	2.66	9.51	24.5	39.0	60.3	78.8	67.2	38.5	31.1	353	352.6	0.34

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
04 06 2004 P	1.16	2.79	10.26	24.6	36.7	57.1	79.1	73.7	43.4	32.5	362	361.4	0.51
07 06 2004 A	1.13	2.53	8.55	21.5	37.4	58.1	69.4	56.9	32.8	32.9	322	321.2	0.68
09 06 2004 A	1.12	2.48	8.42	22.7	41.1	63.1	74.7	60.1	34.6	31.0	340	339.3	0.36
13 06 2004 P	1.09	2.26	7.02	19.0	39.4	65.1	86.1	83.0	51.6	33.6	388	388.2	0.93
14 06 2004 A	1.13	2.57	8.96	22.7	38.9	63.4	80.9	67.2	38.7	31.1	356	355.7	0.32
19 06 2004 P	1.12	2.48	8.49	23.0	41.2	65.3	80.3	66.6	39.2	31.2	359	358.8	0.44
22 06 2004 A	1.13	2.56	9.11	24.7	42.5	66.1	77.5	58.1	32.4	28.9	343	343.0	0.30
23 06 2004 P	1.12	2.49	8.54	22.7	40.2	62.0	75.9	64.9	38.6	32.0	349	348.4	0.83
25 06 2004 A	1.12	2.49	8.33	20.3	33.8	55.0	77.1	72.0	41.9	33.1	346	345.2	1.01
30 06 2004 P	1.11	2.45	8.22	21.6	38.4	60.4	75.8	64.9	38.2	32.1	344	343.2	0.85
07 07 2004 A	1.10	2.32	7.40	20.0	36.7	54.1	65.6	55.5	32.6	35.7	313	311.1	1.09
07 07 2004 P	1.09	2.23	6.89	19.6	40.0	59.1	67.6	55.2	32.4	33.8	319	317.9	0.96
09 07 2004 P	1.14	2.67	9.27	22.1	33.8	52.1	71.2	65.4	39.1	34.6	333	331.3	1.48
11 07 2004 P	1.14	2.66	9.60	25.8	39.9	59.4	75.0	64.7	39.2	32.6	351	350.0	0.57
17 07 2004 A	1.13	2.49	8.04	21.3	41.1	63.4	69.2	50.9	28.6	30.6	317	316.7	0.66
17 07 2004 P	1.13	2.53	8.38	22.3	39.9	60.0	69.4	54.3	31.1	31.6	322	320.6	0.63
20 07 2004 A	1.16	2.71	9.39	24.3	39.5	57.3	65.5	48.9	26.3	29.7	305	304.9	0.47
20 07 2004 P	1.13	2.46	7.93	21.3	38.2	57.2	65.7	50.8	29.6	34.0	310	308.3	1.00
21 07 2004 A	1.16	2.72	9.18	22.2	34.8	52.2	66.1	54.2	30.2	33.2	307	305.9	0.57
22 07 2004 A	1.15	2.63	8.85	23.7	40.7	57.1	62.4	46.4	26.1	31.7	302	300.8	0.78
22 07 2004 P	1.21	3.14	11.79	26.2	33.6	44.7	60.9	55.6	32.4	35.2	306	304.8	1.23
24 07 2004 A	1.17	2.75	9.22	22.2	36.0	53.8	62.2	45.7	23.8	31.0	289	287.9	0.52
25 07 2004 P	1.15	2.60	8.61	23.2	39.5	57.5	67.9	52.5	28.8	30.2	312	312.0	0.59
26 07 2004 A	1.14	2.49	7.85	20.8	36.5	52.3	63.2	52.7	30.7	36.1	306	303.8	1.15
30 07 2004 A	1.21	3.07	11.12	27.1	41.9	63.5	71.2	48.4	25.6	26.3	318	319.4	0.92
30 07 2004 P	1.17	2.67	8.80	23.5	40.3	59.7	69.2	53.3	30.6	31.4	322	320.6	0.50
31 07 2004 P	1.15	2.54	7.99	21.5	38.9	58.3	67.6	52.0	29.7	32.4	313	312.0	0.72
04 08 2004 P	1.17	2.65	8.31	21.1	37.3	58.7	69.9	54.1	31.8	33.6	321	318.8	0.89
05 08 2004 A	1.16	2.57	8.03	21.9	38.1	57.2	68.2	54.9	33.6	34.6	323	320.3	0.94
05 08 2004 P	1.17	2.64	8.24	21.3	37.8	59.7	72.2	55.8	31.8	31.9	324	322.6	0.55
06 08 2004 A	1.18	2.70	8.55	21.7	35.6	53.8	70.2	60.7	36.4	35.0	328	325.8	0.78
10 08 2004 A	1.18	2.68	8.34	22.2	37.9	57.0	68.9	54.9	32.0	32.9	319	318.0	0.66
11 08 2004 P	1.21	2.86	8.95	21.1	34.7	55.8	70.1	52.1	27.4	30.4	305	304.7	0.29
12 08 2004 P	1.20	2.76	8.71	23.0	38.2	52.8	62.9	52.2	30.8	35.6	310	308.1	1.13
15 08 2004 P	1.21	2.81	8.62	22.0	41.0	63.8	68.1	46.1	24.8	28.7	307	307.1	0.52
16 08 2004 P	1.28	3.42	11.46	24.1	35.3	56.7	72.8	53.1	28.0	29.1	315	315.2	0.44
17 08 2004 P	1.24	3.00	9.44	22.1	35.3	56.0	71.7	54.9	29.7	30.5	314	313.8	0.42
19 08 2004 P	1.22	2.86	8.60	21.2	39.6	64.6	69.1	45.1	23.8	28.1	304	304.2	0.61
23 08 2004 A	1.24	2.90	8.68	21.3	36.1	57.1	70.7	54.2	30.4	31.8	315	314.4	0.49
23 08 2004 P	1.27	3.16	10.14	24.0	35.7	52.1	66.2	52.3	28.8	31.7	306	305.3	0.54
24 08 2004 A	1.25	3.00	9.03	21.0	34.5	55.5	70.2	53.2	29.0	31.6	309	308.3	0.40
30 08 2004 P	1.24	2.77	7.74	19.6	37.7	60.4	68.3	47.6	25.9	31.0	303	302.2	0.85
01 09 2004 A	1.29	3.15	9.32	20.9	32.2	51.8	69.6	60.0	36.1	35.7	323	320.2	0.81
02 09 2004 A	1.27	2.96	8.68	22.3	37.4	56.2	67.1	50.3	28.5	32.2	308	306.9	0.69
02 09 2004 P	1.28	3.05	8.80	20.8	37.6	65.8	74.0	43.5	21.5	25.1	300	301.5	0.43
03 09 2004 P	1.26	2.87	7.94	19.5	35.7	57.6	69.5	48.5	24.9	29.2	297	297.0	0.55
06 09 2004 P	1.32	3.30	9.84	22.7	37.6	55.4	57.0	33.2	15.8	26.0	262	262.3	0.32
07 09 2004 A	1.32	3.32	10.05	23.8	38.7	57.8	62.1	38.0	18.6	25.9	279	279.6	0.46
10 09 2004 P	1.33	3.30	9.80	23.5	38.5	57.7	64.7	42.4	21.6	27.5	290	290.3	0.37
13 09 2004 A	1.31	3.13	8.88	22.2	37.5	55.7	65.5	45.1	23.1	28.7	291	291.0	0.53
14 09 2004 P	1.31	3.09	8.59	22.4	44.5	63.1	56.9	34.0	17.7	26.6	278	278.1	1.00

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
17 09 2004 A	1.35	3.33	9.28	20.7	33.1	50.5	63.1	46.5	25.1	33.3	288	286.2	0.78
17 09 2004 P	1.34	3.31	9.14	20.6	35.8	58.6	66.4	41.0	20.1	27.0	283	283.3	0.18
19 09 2004 A	1.35	3.31	9.04	19.9	32.7	50.7	61.4	42.6	22.2	32.9	278	276.0	0.87
20 09 2004 A	1.35	3.26	8.77	19.5	32.7	51.6	64.3	47.1	24.6	31.7	286	284.9	1.08
04 10 2004 A	1.40	3.44	8.75	18.1	30.3	47.6	56.3	31.2	14.6	29.9	243	241.7	0.45
05 10 2004 P	1.42	3.53	9.23	20.1	34.3	52.2	55.3	27.9	12.8	25.5	242	242.3	0.44
06 10 2004 P	1.40	3.41	8.69	19.2	34.5	52.7	56.0	31.1	14.9	28.3	251	250.2	0.29
12 10 2004 P	1.45	3.70	9.72	21.2	35.3	56.2	67.6	44.5	22.7	28.5	291	291.0	0.30
13 10 2004 A	1.46	3.79	10.07	21.8	35.6	54.4	63.1	41.1	21.0	29.1	282	281.5	0.50
13 10 2004 P	1.45	3.64	9.64	22.4	38.7	58.4	63.0	38.7	19.7	27.4	283	283.0	0.39
14 10 2004 A	1.44	3.60	9.07	19.1	31.6	53.7	73.0	50.8	25.9	29.7	298	297.8	0.46
15 10 2004 A	1.46	3.70	9.78	22.3	37.4	57.7	67.5	43.3	22.0	27.3	292	292.5	0.54
22 10 2004 A	1.47	3.70	9.28	20.1	34.7	54.8	64.3	41.6	21.2	29.3	281	280.5	0.72
22 10 2004 P	1.42	3.24	7.63	17.3	33.1	52.5	62.2	42.5	22.8	34.0	279	2767	1.50
25 10 2004 A	1.46	3.55	8.54	18.4	34.3	54.2	58.3	33.6	16.5	29.1	259	258.0	0.66
26 10 2004 A	1.46	3.53	8.45	17.9	32.2	50.8	58.3	36.1	18.1	31.5	260	258.4	1.26
26 10 2004 P	1.49	3.77	9.80	22.8	37.2	52.5	58.5	36.5	18.4	28.5	270	269.5	0.55
03 11 2004 P	1.54	4.01	9.45	17.1	26.7	45.4	61.9	33.6	15.1	29.2	245	244.0	0.48
04 11 2004 P	1.54	4.00	9.60	18.0	28.3	46.4	61.3	36.5	17.1	30.2	254	252.8	0.43
10 11 2004 A	1.57	4.20	10.37	19.8	29.9	49.5	72.0	53.1	27.4	30.8	299	298.6	0.49

VERTICAL DISTRIBUTION OF OZONE AT BELSK, POLAND

SUMMARY FOR 2004

Month	Layer-mean ozone in Dobson units [D]										Total ozone [D]	
	10	9	8	7	6	5	4	3	2	1	n	obs
AVE	1.46	3.51	8.61	18.7	35.1	64.5	93.9	78.3	45.5	31.9		381.6
II											5	
SD	0.04	0.30	0.97	0.9	3.7	4.1	11.2	18.8	12.9	2.3		43.5
AVE	1.43	3.68	10.37	21.4	34.0	57.7	81.7	71.7	42.6	32.4		357.4
III											7	
SD	0.03	0.19	0.68	1.6	4.1	7.9	9.5	16.2	12.6	4.1		31.6
AVE	1.26	3.13	9.72	21.4	36.0	57.8	77.8	71.7	42.3	34.3		357.8
IV											20	
SD	0.05	0.22	0.85	1.4	2.8	4.3	4.1	9.6	7.9	2.6		17.4
AVE	1.15	2.67	8.70	21.7	40.0	61.5	80.1	74.7	47.0	34.4		371.2
V											9	
SD	0.04	0.17	0.65	1.3	3.1	4.9	4.3	7.0	6.0	1.6		19.1
AVE	1.13	2.56	8.76	22.1	38.4	61.0	78.4	67.7	39.8	32.1		352.2
VI											16	
SD	0.02	0.13	0.82	1.8	2.4	3.7	4.3	6.7	5.3	2.1		14.1
AVE	1.15	2.43	7.70	22.7	39.1	58.0	67.5	52.3	29.6	31.7		314.3
VII											14	
SD	0.03	0.20	1.05	2.1	2.0	3.3	3.4	4.7	3.8	2.3		13.8
AVE	1.22	2.71	8.02	21.8	36.9	57.7	69.8	52.8	29.5	31.5		313.8
VIII											14	
SD	0.04	0.23	0.96	1.2	1.9	3.5	1.8	4.1	3.5	2.1		8.3
AVE	1.31	3.23	9.18	21.6	36.8	567	64.8	43.8	22.9	29.2		289.8
IX											12	
SD	0.03	0.16	0.60	1.4	3.3	4.6	5.1	7.3	5.4	3.5		16.0
AVE	1.44	3.61	9.28	20.5	34.9	53.8	62.1	38.2	19.1	28.4		272.0
X											11	
SD	0.03	0.13	0.52	1.7	2.4	2.9	5.7	6.9	4.0	1.3		20.2
AVE	1.55	4.10	9.91	19.4	30.5	47.1	65.1	41.1	19.9	30.1		266.0
XI											3	
SD	0.02	0.11	0.49	1.4	1.6	2.1	6.0	10.5	6.6	0.8		28.9

VERTICAL DISTRIBUTION OF OZONE FROM UMKEHR OBSERVATIONS

AT BELSK, FOR 2005

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
06 02 2005 P	1,49	3,53	8,18	15,9	27,4	50,3	80,4	67,5	36,1	32,1	323	322,9	0,81
07 02 2005 A	1,48	3,47	8,14	16,5	28,4	49,0	78,6	77,6	45,0	33,9	343	342,1	1,10
07 02 2005 P	1,58	4,33	11,61	22,7	33,9	55,4	80,6	73,5	46,1	34,3	365	364,1	0,79
08 02 2005 A	1,51	3,77	9,49	19,9	33,4	56,2	79,8	69,2	40,9	32,8	348	347,0	0,74
08 02 2005 P	1,53	3,95	10,49	23,3	39,4	62,8	79,1	61,1	36,0	30,8	349	348,5	0,36
09 02 2005 A	1,55	4,12	11,01	22,9	37,2	62,8	85,5	72,0	44,5	32,9	375	374,5	0,58
09 02 2005 P	1,57	4,31	11,88	24,9	40,2	67,4	88,4	74,5	47,4	33,3	394	393,8	0,33
10 02 2005 A	1,53	3,97	10,48	22,3	36,9	60,2	78,9	60,1	33,9	30,2	339	338,4	0,24
10 02 2005 P	1,50	3,66	9,01	18,8	33,6	61,1	86,4	65,4	36,1	30,2	346	345,8	0,31
27 02 2005 A	1,35	2,81	6,09	11,5	22,1	48,7	87,4	95,1	57,3	36,0	369	368,4	1,06
28 02 2005 A	1,36	2,87	6,38	12,1	22,1	47,9	86,3	101,3	69,8	40,6	392	390,7	1,10
03 03 2005 P	1,44	3,59	10,03	25,0	47,7	80,4	93,9	77,8	51,0	33,7	424	424,5	0,36
21 03 2005 A	1,33	3,00	7,76	16,6	28,5	47,0	71,0	65,6	39,3	37,9	320	318,0	1,00
22 03 2005 A	1,36	3,28	8,90	18,3	30,5	53,1	76,0	57,2	28,6	29,8	307	307,0	0,29
22 03 2005 P	1,51	4,50	13,22	21,6	28,7	43,6	69,2	62,7	32,7	32,3	311	310,0	0,78
23 03 2005 A	1,34	3,13	8,54	19,1	33,5	51,2	62,7	47,8	25,6	33,9	289	286,9	0,82
28 03 2005 P	1,36	3,40	9,92	21,0	33,5	56,9	81,8	67,8	37,6	31,2	345	344,4	0,20
29 03 2005 A	1,32	3,06	8,63	20,4	36,2	58,1	76,3	69,4	44,0	35,8	355	353,2	0,90
29 03 2005 P	1,38	3,58	11,12	24,8	42,0	72,7	86,0	61,2	35,0	28,7	366	366,5	0,35
30 03 2005 A	1,34	3,23	9,47	21,9	37,3	62,5	84,0	75,6	48,1	34,7	379	378,1	0,54
30 03 2005 P	1,34	3,27	9,70	22,7	39,6	72,0	95,5	74,9	44,1	31,3	394	394,4	0,51
31 03 2005 A	1,32	3,10	9,29	24,7	42,1	64,2	83,7	75,5	47,5	33,4	385	384,7	0,47
31 03 2005 P	1,35	3,39	10,34	24,0	43,2	76,0	89,3	65,0	38,2	29,7	380	380,6	0,30
01 04 2005 A	1,32	3,17	9,37	22,4	39,1	62,9	80,5	70,5	45,5	34,9	371	369,6	0,70
01 04 2005 P	1,34	3,29	9,78	22,3	40,1	71,4	88,6	69,3	41,1	31,0	378	378,1	0,31
02 04 2005 P	1,33	3,22	9,58	22,4	40,5	71,8	89,6	68,7	40,3	30,7	378	378,2	0,33
03 04 2005 P	1,29	2,90	8,26	21,3	42,1	66,2	77,3	62,7	38,7	33,0	355	353,9	0,84
04 04 2005 A	1,32	3,21	9,60	22,2	38,3	62,6	79,2	64,0	37,0	31,1	349	348,4	0,36
04 04 2005 P	1,34	3,41	10,49	23,3	39,5	66,6	80,3	60,8	35,2	30,5	352	351,5	0,60
05 04 2005 A	1,29	2,99	8,73	21,9	41,2	65,6	78,6	62,8	37,4	31,7	353	352,3	0,49
05 04 2005 P	1,32	3,22	9,87	23,8	41,7	67,7	81,5	64,8	39,0	31,6	365	364,5	0,50
06 04 2005 P	1,31	3,15	9,52	22,8	40,3	64,1	74,9	55,3	30,8	29,4	332	331,5	0,44
13 04 2005 P	1,28	3,07	9,87	25,8	43,2	61,7	70,1	54,0	31,3	30,6	332	331,0	0,53
17 04 2005 A	1,27	3,05	9,73	23,3	36,3	55,6	75,0	75,1	51,1	37,5	370	368,0	0,89
18 04 2005 P	1,29	3,24	10,57	23,6	36,0	58,1	82,2	78,0	47,7	33,6	375	374,4	0,53
20 04 2005 A	1,26	3,03	9,69	22,8	35,1	54,1	79,1	86,5	58,9	37,7	389	388,1	0,80
20 04 2005 P	1,23	2,77	8,54	23,8	43,2	67,1	86,5	78,4	49,2	33,3	394	394,0	0,50
21 04 2005 A	1,26	2,99	9,53	22,7	36,4	59,6	88,2	98,5	65,7	36,9	422	422,0	0,65
24 04 2005 P	1,25	3,01	9,82	23,7	38,7	63,9	88,4	88,4	59,0	36,5	413	412,6	0,40
25 04 2005 A	1,24	2,97	9,67	23,7	39,0	61,9	84,4	83,8	54,6	35,3	397	396,5	0,53
29 04 2005 A	1,23	2,91	9,66	24,9	41,4	62,6	80,2	75,6	50,1	35,3	385	383,9	0,69
29 04 2005 P	1,21	2,76	8,89	23,6	40,5	60,9	77,9	76,1	51,1	36,8	381	379,8	0,84
02 05 2005 A	1,26	3,27	11,79	26,6	36,9	47,8	60,1	53,5	32,2	35,8	311	309,3	1,16
10 05 2005 A	1,18	2,71	9,00	22,7	36,8	58,5	84,4	92,9	64,5	38,6	412	411,4	0,66
10 05 2005 P	1,20	2,81	9,53	24,1	39,8	63,9	87,3	87,2	56,3	34,9	407	407,1	0,50
13 05 2005 A	1,17	2,62	8,67	23,2	39,4	60,6	80,8	80,3	53,2	36,2	387	386,2	0,66
13 05 2005 P	1,16	2,59	8,51	22,7	37,4	56,2	78,7	84,8	57,7	37,3	388	387,2	0,96
20 05 2005 A	1,17	2,73	9,22	21,8	35,4	57,8	78,0	69,2	40,5	33,0	350	348,9	0,43
20 05 2005 P	1,17	2,69	9,21	23,4	39,1	60,6	76,0	66,1	39,9	32,9	352	351,0	0,58
21 05 2005 A	1,16	2,66	8,84	21,1	35,1	55,8	73,0	64,9	38,9	34,6	338	336,1	0,77
23 05 2005 P	1,13	2,45	7,81	19,9	34,4	51,0	67,9	62,6	38,0	37,0	325	322,2	1,16

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
25 05 2005 P	1,14	2,51	8,18	19,9	33,3	54,2	66,9	59,5	39,2	39,2	328	324,0	1,60
26 05 2005 P	1,14	2,51	8,37	22,4	41,0	59,6	65,8	51,0	29,2	32,1	314	313,1	0,76
27 05 2005 A	1,16	2,72	9,60	24,4	42,4	63,3	67,1	46,9	24,7	27,4	309	309,7	0,25
28 05 2005 P	1,14	2,53	8,65	24,5	45,5	62,3	63,5	45,5	24,3	27,7	305	305,6	0,60
29 05 2005 P	1,13	2,47	8,10	22,0	44,2	65,6	63,4	41,4	21,2	26,3	295	295,8	0,42
30 05 2005 A	1,13	2,47	8,19	21,9	41,1	60,7	65,2	49,2	27,6	31,6	310	309,1	0,88
27 06 2005 P	1,11	2,39	7,97	22,5	41,6	62,9	73,3	55,1	29,9	28,9	326	325,7	0,50
28 06 2005 A	1,12	2,47	8,28	20,6	33,4	51,9	72,0	66,3	39,9	35,9	334	331,8	0,87
28 06 2005 P	1,11	2,46	8,27	21,8	39,7	62,7	74,3	57,1	31,4	29,7	329	328,6	0,39
30 06 2005 A	1,12	2,53	8,69	23,1	41,7	63,3	69,1	49,0	26,0	28,0	312	312,6	0,21
02 07 2005 P	1,10	2,35	7,64	21,3	41,0	63,6	74,7	59,1	34,1	31,2	337	336,1	0,54
03 07 2005 P	1,11	2,42	8,04	21,7	40,0	61,5	71,6	57,2	33,5	32,4	331	329,5	0,71
04 07 2005 A	1,12	2,52	8,52	21,6	37,1	56,9	69,1	57,0	32,9	33,2	322	320,1	0,74
04 07 2005 P	1,12	2,52	8,57	22,7	40,8	63,7	72,8	53,7	29,4	29,1	325	324,5	0,22
05 07 2005 A	1,11	2,38	7,80	21,9	41,7	62,8	71,6	54,8	30,8	30,3	326	325,2	0,60
05 07 2005 P	1,07	2,10	6,24	18,0	41,3	61,3	69,1	55,4	33,9	35,0	326	323,4	1,34
06 07 2005 A	1,11	2,44	8,07	21,5	39,5	61,7	72,2	55,0	30,3	30,2	323	322,2	0,35
08 07 2005 A	1,12	2,48	8,13	20,5	37,2	61,8	77,0	63,1	36,6	32,1	341	340,1	0,53
11 07 2005 A	1,13	2,57	8,70	22,4	38,8	62,4	76,1	56,2	30,0	28,6	327	326,8	0,33
11 07 2005 P	1,11	2,35	7,45	20,2	37,5	58,5	72,5	60,9	36,0	33,7	332	330,3	0,76
12 07 2005 A	1,13	2,54	8,42	20,9	36,0	58,1	72,5	58,6	33,1	32,2	325	323,6	0,53
12 07 2005 P	1,13	2,55	8,54	22,0	37,8	59,0	72,2	57,9	32,9	31,7	327	325,7	0,40
14 07 2005 P	1,09	2,20	6,57	17,4	34,5	56,6	71,6	61,8	38,3	37,0	330	327,1	1,31
15 07 2005 A	1,12	2,43	7,85	20,4	33,5	52,7	65,0	59,0	37,2	38,0	320	317,2	1,20
28 07 2005 A	1,17	2,70	8,77	21,7	40,6	67,3	68,8	42,5	21,6	25,9	300	301,1	0,33
01 08 2005 P	1,15	2,49	7,66	20,9	38,6	57,1	66,9	51,9	28,9	31,8	308	307,4	0,75
02 08 2005 A	1,18	2,78	9,13	23,0	39,3	58,3	63,9	43,9	22,4	28,1	292	292,1	0,27
03 08 2005 A	1,17	2,63	8,23	20,9	36,8	54,5	63,4	50,2	28,7	34,5	303	301,1	1,17
18 08 2005 A	1,23	2,92	9,13	22,8	38,4	57,6	67,0	48,2	25,5	29,2	302	302,0	0,55
18 08 2005 P	1,20	2,64	7,65	20,3	41,3	63,6	68,0	47,1	25,7	29,4	307	307,0	0,53
19 08 2005 A	1,26	3,13	10,04	23,0	36,3	59,2	73,1	49,0	24,4	26,6	305	306,1	0,77
19 08 2005 P	1,20	2,70	8,02	21,7	40,0	59,7	67,5	48,0	26,0	30,0	305	304,7	0,58
20 08 2005 P	1,25	3,06	9,47	21,9	37,2	60,9	68,7	44,5	22,4	27,1	296	296,6	0,26
25 08 2005 A	1,25	3,01	9,16	22,1	35,6	52,3	64,7	51,6	29,5	34,3	305	303,4	0,96
28 08 2005 P	1,24	2,85	8,27	21,7	40,7	61,3	67,1	45,4	23,9	28,0	300	300,4	0,46
29 08 2005 P	1,27	3,04	9,01	21,9	40,2	61,1	60,7	36,7	18,3	26,2	278	278,4	0,27
30 08 2005 A	1,24	2,78	7,95	21,8	41,5	56,2	56,9	37,1	19,1	28,9	274	273,5	0,57
30 08 2005 P	1,22	2,63	7,11	19,1	40,9	60,7	61,9	40,3	21,1	29,5	285	284,3	0,95
31 08 2005 A	1,28	3,07	8,96	20,9	35,7	56,0	64,1	41,3	20,2	27,7	279	279,1	0,43
31 08 2005 P	1,27	3,04	9,03	22,8	42,1	63,9	63,1	38,4	19,6	25,7	288	288,9	0,66
01 09 2005 A	1,27	2,99	8,74	22,0	39,4	58,5	61,3	37,3	18,2	26,0	275	275,6	0,46
01 09 2005 P	1,28	3,08	9,25	23,3	39,8	57,5	61,2	39,2	19,6	27,0	281	281,3	0,29
02 09 2005 A	1,22	2,64	7,13	19,6	40,0	55,4	59,4	41,2	21,7	30,8	280	279,0	0,93
02 09 2005 P	128	3,06	9,17	23,8	41,3	57,9	59,3	38,1	19,5	27,6	281	281,0	0,35
03 09 2005 A	129	3,13	9,24	22,2	38,1	56,6	61,0	39,6	20,1	28,4	280	279,7	0,29
05 09 2005 A	1,30	3,18	9,44	22,7	37,4	55,0	62,5	43,3	22,7	29,9	288	287,3	0,46
05 09 2005 P	1,27	2,97	8,53	22,2	39,6	56,3	61,3	42,2	22,3	29,7	287	286,5	0,90
06 09 2005 A	1,30	3,17	9,14	20,7	34,3	56,5	68,8	43,4	20,8	27,1	285	285,3	0,69
06 09 2005 P	1,28	2,97	8,43	21,4	38,4	56,4	62,9	43,5	23,0	30,1	289	288,3	0,55
07 09 2005 A	1,30	3,15	9,12	21,7	36,3	54,0	61,7	43,3	23,0	31,2	286	284,8	0,60
07 09 2005 P	1,30	3,12	9,01	22,0	39,1	59,4	64,4	42,0	21,7	28,0	290	290,1	0,25

Date	Layer ozone in Dobson units [D]										Total ozone		
	10	9	8	7	6	5	4	3	2	1	obs.	retr.	res.
09 09 2005 A	1,27	2,86	7,73	19,3	35,2	51,7	58,2	39,0	20,0	32,1	269	267,2	0,70
09 09 2005 P	1,31	3,16	9,04	21,7	38,5	59,0	63,6	40,5	20,5	27,6	285	285,1	0,24
14 09 2005 A	1,30	3,00	8,11	19,9	35,7	53,0	60,7	41,5	21,4	31,1	277	275,8	0,64
19 09 2005 A	1,36	3,42	9,60	21,8	37,7	56,8	59,1	35,9	17,8	27,4	271	270,9	0,70
19 09 2005 P	1,35	3,29	9,22	22,4	39,4	56,6	59,0	36,8	18,5	27,5	274	273,9	0,33
20 09 2005 A	1,35	3,27	8,79	19,6	33,8	52,8	60,0	35,7	16,8	27,6	260	259,8	0,57
20 09 2005 P	1,37	3,45	9,57	20,8	34,0	53,4	60,5	34,9	16,3	26,7	261	261,0	0,28
21 09 2005 A	1,35	3,28	8,73	19,0	32,4	51,4	59,4	34,3	15,9	27,9	254	253,6	0,51
21 09 2005 P	1,36	3,32	8,77	18,4	30,7	48,1	55,4	31,9	15,2	30,9	246	244,2	0,39
22 09 2005 A	1,35	3,28	8,68	18,8	31,2	47,1	53,9	31,0	14,9	31,0	243	241,2	0,54
22 09 2005 P	1,35	3,26	8,75	20,2	36,5	54,4	54,5	29,1	13,7	26,2	248	248,0	0,32
23 09 2005 A	1,35	3,24	8,54	18,9	32,1	47,9	54,1	33,2	16,5	32,8	251	248,5	0,69
23 09 2005 P	1,39	3,57	9,89	20,9	33,1	51,2	60,7	38,1	18,4	28,9	267	266,2	0,21
24 09 2005 P	1,37	3,38	9,31	21,8	37,2	55,2	60,4	38,0	19,0	28,1	274	273,7	0,41
25 09 2005 P	1,46	4,14	12,44	24,8	32,9	46,0	58,9	43,1	22,4	31,7	279	277,8	0,59
26 09 2005 P	1,38	3,41	9,43	22,0	35,8	52,6	60,3	40,9	21,5	31,1	280	278,6	0,57
27 09 2005 A	1,36	3,25	8,76	21,8	37,8	54,2	60,3	39,8	20,5	29,6	278	277,3	0,53
04 10 2005 P	1,40	3,40	8,74	19,2	33,4	54,0	63,8	40,6	20,2	29,6	275	274,2	0,30
05 10 2005 A	1,40	3,39	8,75	20,0	35,5	54,8	61,5	37,2	18,0	27,6	268	267,9	0,60
05 10 2005 P	1,40	3,39	8,71	19,5	34,9	54,9	61,2	37,1	18,1	28,4	268	267,5	0,27
06 10 2005 A	1,41	3,48	8,88	18,8	31,8	50,4	60,4	36,9	17,6	29,4	260	259,1	0,66
06 10 2005 P	1,44	3,75	9,89	20,6	36,1	60,4	61,2	33,2	15,9	25,1	267	267,6	0,50
07 10 2005 A	1,43	3,59	9,38	20,3	35,0	56,4	62,0	34,3	16,0	25,3	263	263,7	0,35
07 10 2005 P	1,44	3,66	9,53	20,2	36,4	62,1	61,5	30,3	14,0	22,7	260	261,8	0,56
08 10 2005 P	1,46	3,84	10,04	19,8	32,7	60,8	70,1	36,3	16,7	23,8	274	275,5	0,57
09 10 2005 P	1,40	3,33	8,32	18,7	33,9	54,8	65,5	43,0	21,7	29,8	281	280,4	0,50
10 10 2005 A	1,44	3,59	9,10	18,6	30,2	49,5	64,5	43,0	21,1	30,9	273	271,8	0,38
10 10 2005 P	1,42	3,50	8,96	20,2	36,1	56,8	62,3	36,8	17,9	27,1	271	271,1	0,14
11 10 2005 A	1,47	3,86	10,15	20,6	33,1	54,5	65,3	38,2	17,9	26,3	271	271,4	0,45
11 10 2005 P	1,45	3,72	9,69	20,5	34,6	56,5	65,1	39,6	19,4	27,5	278	278,0	0,24
12 10 2005 A	1,43	3,51	8,92	19,3	32,0	50,7	65,5	47,3	25,1	32,7	288	286,5	0,71
19 10 2005 P	1,54	4,39	12,34	25,2	37,5	55,5	60,2	34,2	16,5	24,5	271	271,9	1,15
20 10 2005 A	1,48	3,73	9,24	18,8	31,9	53,7	61,5	32,2	14,7	25,9	253	253,2	0,37
20 10 2005 P	1,43	3,36	7,80	15,9	28,7	49,2	61,0	35,8	17,0	31,2	253	251,4	1,10
21 10 2005 A	1,49	3,84	9,48	18,6	30,7	49,8	57,5	30,4	14,1	28,3	245	244,1	0,47
28 10 2005 A	1,51	3,87	9,19	17,2	28,3	49,2	60,4	28,7	12,8	26,7	238	237,7	0,57
28 10 2005 P	1,49	3,68	8,71	17,3	30,0	50,6	58,5	28,4	12,9	27,1	239	238,6	0,32
29 10 2005 P	1,50	3,74	8,92	17,7	30,4	47,5	51,6	23,2	11,1	28,9	226	224,7	0,37
30 10 2005 P	1,52	3,89	9,33	18,0	30,8	51,6	54,2	22,9	10,5	25,3	228	228,0	0,45
31 10 2005 A	1,51	3,83	9,05	17,2	28,5	47,3	56,8	27,5	12,6	28,7	234	232,9	0,39
31 10 2005 P	1,49	3,67	8,59	16,9	29,8	50,3	56,7	26,1	11,9	27,1	233	232,5	0,31
01 11 2005 P	1,50	3,74	8,83	17,5	30,2	50,8	59,8	30,7	14,0	27,4	245	244,5	0,24
02 11 2005 A	1,52	3,90	9,35	17,8	28,2	46,2	62,5	38,0	1,76	29,8	256	255,0	0,60

VERTICAL DISTRIBUTION OF OZONE AT BELSK, POLAND

SUMMARY FOR 2005

Month		Layer-mean ozone in Dobson units [D]										Total Ozone [D]	
		10	9	8	7	6	5	4	3	2	1	n	obs
II	AVE	1.53	3.96	10.26	21.3	35.2	59.5	82.4	67.9	40.1	32.1	8	354.9
	SD	0.03	0.29	1.28	2.9	4.1	5.3	3.8	5.4	5.3	1.5		22.2
III	AVE	1.37	3.38	9.74	21.7	36.9	61.5	80.8	66.7	39.3	32.7	12	354.6
	SD	0.06	0.40	1.42	2.7	6.2	11.9	10.0	8.8	8.0	2.7		40.9
IV	AVE	1.28	3.07	9.54	23.2	39.6	63.4	81.2	72.3	45.5	33.5	19	373.2
	SD	0.04	0.17	0.58	1.1	2.4	4.7	5.3	11.7	9.9	2.7		24.4
V	AVE	1.16	2.63	8.82	22.8	39.8	60.4	73.6	65.0	39.8	32.7	12	347.2
	SD	0.02	0.11	0.50	1.1	3.3	3.0	8.5	18.1	15.0	4.0		42.2
VI	AVE	1.11	2.46	8.30	22.0	39.1	60.2	72.2	56.9	31.8	30.6	4	325.3
	SD	0.01	0.06	0.30	1.1	3.9	5.5	2.3	7.2	5.9	3.6		9.4
VII	AVE	1.12	2.49	8.22	21.5	39.0	61.4	72.6	56.3	31.8	30.9	12	326.3
	SD	0.02	0.10	0.43	0.7	1.9	2.9	2.4	5.1	3.9	2.2		10.0
VIII	AVE	1.23	2.87	8.61	21.7	39.1	59.1	65.3	44.5	23.4	28.8	14	294.6
	SD	0.04	0.20	0.83	1.1	2.2	3.2	4.0	5.1	3.5	2.3		11.9
IX	AVE	1.33	3.22	9.03	21.2	36.3	54.1	60.1	38.5	19.4	29.1	28	272.8
	SD	0.05	0.27	0.88	1.6	3.0	3.6	3.1	4.0	2.7	2.0		13.9
X	AVE	1.45	3.65	9.16	19.0	32.6	53.5	61.2	34.2	16.4	27.5	22	258.8
	SD	0.04	0.18	0.48	1.2	2.5	4.2	4.2	6.6	3.8	2.3		18.7
XI	AVE	1.51	3.82	9.09	17.7	29.2	48.5	61.2	34.4	15.8	28.6	2	250.5
	SD	0.01	0.11	0.37	0.2	1.4	3.2	1.9	5.2	2.6	1.7		7.8

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Total Ozone, Sulfur Dioxide and UV-B Radiation Measurements with the Brewer Spectrophotometer No. 64 at Belsk, Poland 2004-2005

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The Brewer spectrophotometer No. 64 has been installed in the Geophysical Observatory of the Polish Academy of Sciences at Belsk in February 1991.

The Brewer spectrophotometer is an optical instrument which measures atmospheric ozone and sulfur dioxide by examining intensities of the attenuated incident solar ultraviolet radiation at five specific wavelengths. The automatic, computer-controlled operation of the instrument allows different types of measurements and calibrations to be made according to an adjustable schedule. The instrument is capable of taking direct sun, zenith sky, UV-B and Umkehr measurements in unattended operation for several days.

Contrary to the total ozone measurements taken with the Dobson instrument, in the case of Brewer spectrophotometer the effect of interfering absorption by SO_2 is accounted for. The daily means of ozone and SO_2 are computed only from observations with standard deviation less than 2.5 D.

Small negative SO_2 amounts may occur in the data. These values reflect the SO_2 measurement uncertainty to which the main contributions are from small errors in the ozone coefficients and wavelength settings. The SO_2 amounts from observations with slant paths greater than three are unreliable.

The Brewer instrument No. 64 contains also the UV-B monitor which enables it to measure spectral irradiance in the region between 290 and 325 nm by monitoring the photon count rate at wavelengths every 0.5 nm. The irradiance at each wavelength is integrated to produce a damaging ultraviolet radiation value (DU) using Diffey erythemal weighting curve instead of the ACGIH-NIOSH erythemal weighting curve used before.

In May 2004 the instrument was calibrated in Hradec Kralowe, Czech Republik, against the transfer standard instrument (Brewer No 17) by Mr Ken Lamb from International Ozone Services Inc., Canada.

In May 2005 the instrument was calibrated at Lindenberg, Germany, against the transfer standard instrument (Brewer No 17) by Mr Ken Lamb from International Ozone Services Inc., Canada.

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Observations are entered in the column in accordance with the codes explained below:

Day – number of day of the month,

Ozone – total amount of ozone in D (Dobson Units) (zs means zenith sky, ds means direct sun observations),

Dev – standard deviation of ozone measurements,

μ – harmonic mean of the relative slant paths at 22 km for each of the observations used to compute the daily value,

N – number of direct sun or zenith sky observations,

SO_2 – total amount of SO_2 (in milli-atmo-centimeters),

Dev – standard deviation of SO_2 measurements,

UV – daily integral of UV radiation (in J/m^2),

NN – number of damaging UV measurements.

BREWER OBSERVATIONS JANUARY 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	316.6	zs	0.0	3.76	1	-	-	55	12
2	-	-	-	-	-	-	-	109	13
3	332.0	ds	0.6	3.86	4	-1.9	0.3	154	12
4	296.0	zs	1.8	3.69	6	-	-	188	13
5	336.2	zs	5.0	3.70	4	-	-	163	13
6	335.2	zs	6.3	3.68	4	-	-	152	13
7	293.9	ds	2.6	3.72	2	-1.6	0.3	216	13
8	291.9	zs	25.7	3.56	12	-	-	919	9
9	285.5	ds	0.6	3.66	10	-0.4	0.3	241	13
10	281.3	zs	0.0	3.85	1	-	-	76	14
11	310.9	zs	1.0	3.57	2	-	-	105	13
12	-	-	-	-	-	-	-	48	13
13	333.5	zs	2.4	3.50	4	-	-	130	14
14	376.6	zs	2.7	3.38	3	-	-	101	13
15	360.9	zs	7.9	3.44	9	-	-	140	14
16	340.8	ds	5.0	3.50	4	-0.2	1.0	177	14
17	358.1	ds	4.5	3.27	2	-1.3	0.3	135	13
18	391.5	ds	4.2	3.39	9	-2.8	1.0	171	14
19	417.1	ds	1.7	3.32	2	-4.0	0.9	146	13
20	469.0	zs	0.8	3.34	2	-	-	101	15
21	468.2	ds	2.6	3.21	13	-5.5	1.0	196	14
22	471.2	ds	0.0	3.92	1	-21.9	0.0	124	14
23	429.5	zs	2.7	3.17	7	-	-	179	13
24	372.6	zs	3.3	3.28	7	-	-	174	15
25	353.0	zs	2.2	3.26	11	-	-	221	15
26	335.0	zs	1.6	3.15	13	-	-	183	15
27	321.2	ds	1.8	3.26	10	0.1	0.6	294	15
28	357.5	zs	4.9	3.13	7	-	-	186	15
29	382.1	ds	0.7	3.06	10	0.4	0.8	222	15
30	451.3	ds	16.5	3.23	2	-6.0	4.0	149	15
31	359.0	ds	6.9	3.09	18	-0.6	1.0	342	15
	358.9		**4.0**	**3.43**	**6**	**-2.0**	**0.1**	**187**	**14**

BREWER OBSERVATIONS FEBRUARY 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	296.5	zs	4.1	3.09	13	-	-	231	15
2	358.4	zs	16.2	2.80	6	-	-	113	17
3	338.6	zs	3.2	2.89	6	-	-	147	16
4	309.5	zs	4.5	2.96	11	-	-	143	15
5	275.8	zs	2.4	2.90	10	-	-	256	16
6	311.0	ds	3.4	2.77	4	0.2	0.9	291	16
7	346.0	ds	1.8	3.48	6	-1.8	1.1	211	15
8	412.0	ds	9.9	2.86	13	-1.3	1.4	252	15
9	414.3	ds	0.0	3.46	1	-5.6	0.0	255	16
10	395.0	ds	7.7	2.84	33	-1.6	2.1	379	19
11	459.0	ds	6.5	2.72	45	-2.9	4.3	400	19
12	436.3	ds	5.7	2.88	19	-3.0	3.9	382	17
13	402.8	zs	2.2	2.60	21	-	-	277	17
14	360.1	zs	5.3	2.60	8	-	-	156	16
15	378.4	zs	4.6	2.75	20	-	-	305	17
16	374.5	zs	1.0	2.52	24	-	-	336	17
17	354.0	zs	2.7	2.48	17	-	-	238	18
18	391.6	zs	3.7	2.42	11	-	-	224	18
19	413.2	zs	3.1	2.52	10	-	-	196	18
20	356.4	ds	1.5	2.53	68	-0.3	1.1	625	22
21	349.0	ds	4.2	2.55	54	-0.5	0.7	679	20
22	344.6	ds	0.0	2.12	1	2.2	0.0	253	18
23	357.8	zs	2.1	2.37	25	-	-	290	18
24	371.6	ds	2.4	2.46	5	0.1	0.6	453	18
25	402.0	ds	2.3	2.42	65	-0.2	2.1	682	22
26	408.1	ds	1.0	2.41	16	0.5	1.0	581	19
27	383.8	ds	0.0	2.63	1	0.0	0.0	382	18
28	447.0	ds	3.5	2.04	4	0.7	0.3	417	17
29	452.9	zs	5.3	2.21	22	-	-	309	17
	375.9		**3.8**	**2.66**	**19**	**-0.9**	**1.3**	**326**	**17**

BREWER OBSERVATIONS MARCH 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	420.7	ds	2.5	2.26	16	-0.5	0.9	620	18
2	423.6	zs	4.9	2.17	16	-	-	294	18
3	466.8	ds	3.8	2.35	27	-1.2	1.5	614	19
4	452.7	ds	3.2	2.99	2	-3.7	1.6	372	20
5	394.1	ds	5.2	2.27	37	0.1	1.5	905	19
6	348.6	ds	5.5	2.28	68	-0.2	0.9	1117	22
7	377.6	ds	1.8	2.32	11	0.3	1.0	690	19
8	405.2	ds	6.4	1.85	14	1.4	0.2	679	19
9	422.6	zs	3.0	2.08	22	-	-	516	17
10	413.1	ds	3.0	2.20	22	-0.3	2.0	817	20
11	382.1	ds	16.6	2.40	33	-0.3	1.8	4783	26
12	386.6	ds	4.4	2.10	66	0.3	1.2	1018	23
13	341.9	ds	10.3	1.98	33	0.6	0.4	1063	20
14	313.5	ds	1.4	1.75	3	2.0	2.0	576	20
15	342.6	ds	9.5	2.05	38	0.7	1.1	1112	20
16	314.8	ds	4.1	1.89	12	0.3	0.5	882	20
17	310.7	ds	0.0	2.03	1	2.3	0.0	732	20
18	309.7	ds	4.0	2.04	44	0.4	0.5	1111	20
19	343.7	ds	11.6	1.81	55	0.7	0.3	892	23
20	432.6	ds	4.7	1.79	12	0.0	0.7	621	20
21	307.0	ds	6.8	2.33	8	-0.4	0.5	846	22
22	340.8	ds	12.1	2.26	20	-0.3	0.9	1035	22
23	344.3	ds	7.5	1.93	65	0.4	0.7	1235	22
24	374.8	ds	3.8	1.69	5	1.0	0.5	679	22
25	395.4	zs	3.0	1.69	7	-	-	201	22
26	434.9	zs	2.2	1.71	9	-	-	235	22
27	423.7	zs	2.5	1.71	15	-	-	372	22
28	423.2	ds	4.1	2.22	10	-0.3	1.7	818	22
29	405.0	ds	12.1	1.97	3	0.3	0.3	682	23
30	359.0	ds	6.6	1.62	9	0.6	0.6	851	24
31	323.3	ds	3.0	1.74	13	2.7	1.6	1397	25
	378.5		**5.5**	**2.05**	**22**	**0.3**	**1.0**	**896**	**21**

BREWER OBSERVATIONS APRIL 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	337.9	ds	3.8	1.80	83	-0.1	0.7	1787	29
2	349.4	ds	5.0	1.89	109	0.1	1.1	1778	30
3	341.3	ds	1.8	1.92	74	-0.1	0.8	1809	26
4	389.5	ds	4.6	1.59	34	1.0	0.5	1226	23
5	394.6	ds	3.1	1.75	14	-0.3	0.3	1084	24
6	403.8	ds	5.0	1.83	32	0.1	1.5	1338	24
7	428.1	ds	2.3	1.72	8	0.3	0.3	609	24
8	453.5	zs	9.6	1.66	20	-	-	405	24
9	413.8	ds	1.2	2.18	5	-0.3	0.5	948	24
10	417.2	ds	2.4	1.94	13	0.0	0.5	971	23
11	412.4	ds	2.2	1.74	8	0.3	0.3	850	23
12	361.0	ds	2.2	1.81	70	-0.2	0.7	2131	27
13	378.8	ds	2.5	1.58	8	0.1	1.3	1336	24
14	382.0	ds	3.6	1.80	111	-0.5	1.2	2049	29
15	354.4	ds	7.3	1.79	115	-0.1	1.0	2216	31
16	349.9	ds	3.6	1.70	65	0.6	0.6	1890	27
17	376.6	ds	2.8	1.68	8	0.3	0.5	891	26
18	415.6	zs	7.7	1.58	25	-	-	850	25
19	357.1	ds	5.2	2.01	38	-0.3	1.0	1849	27
20	360.4	ds	7.9	1.64	70	0.2	0.6	2063	30
21	370.1	ds	20.6	1.69	91	1.5	1.5	2083	27
22	398.8	ds	8.4	1.73	22	-0.4	1.5	1454	26
23	357.0	ds	3.9	1.82	67	-0.2	0.8	2339	29
24	408.9	zs	6.3	1.56	11	-	-	508	26
25	372.9	ds	0.0	2.26	1	-0.1	0.0	766	25
26	364.8	ds	6.0	1.87	59	-0.1	1.0	2012	29
27	375.1	ds	2.8	1.68	76	0.2	0.9	2204	29
28	381.7	ds	2.9	1.72	32	0.2	1.0	1760	26
29	369.0	ds	3.2	1.73	117	-0.5	1.1	2495	34
30	354.9	ds	3.8	1.68	114	-0.5	0.7	2801	31
	381.0		**4.7**	**1.78**	**50**	**0.0**	**0.8**	**1550**	**27**

BREWER OBSERVATIONS MAY 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	346.4	ds	2.5	1.70	82	-0.5	0.6	2867	28
2	347.6	ds	7.2	1.53	24	0.3	1.5	2309	26
3	354.6	ds	2.9	1.93	14	-0.1	0.5	1687	25
4	362.8	ds	3.2	1.57	45	-0.4	0.4	2459	26
5	362.1	ds	2.9	2.00	24	-0.7	1.3	1641	26
6	376.8	ds	6.4	1.61	36	-0.5	1.0	2543	27
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	386.4	ds	2.6	1.45	16	-0.5	0.4	97	8
11	380.7	ds	3.3	1.56	10	-0.5	0.3	161	8
12	387.7	zs	4.7	2.04	2	-	-	127	5
13	-	-	-	-	-	-	-	-	-
14	370.6	ds	2.9	2.04	17	-0.5	0.7	473	11
15	385.6	ds	2.7	1.53	8	0.2	0.4	1038	27
16	397.6	ds	3.9	1.90	12	-0.2	0.7	2332	27
17	388.1	ds	8.1	1.58	6	-0.5	0.4	1993	26
18	371.1	ds	3.2	1.79	23	-0.6	1.3	2080	28
19	337.0	ds	1.7	1.28	12	-0.1	0.5	2745	23
20	339.6	ds	4.3	2.40	17	-0.6	0.9	2433	32
21	349.2	ds	3.9	1.31	4	-0.1	0.4	920	21
22	370.5	ds	8.3	1.88	24	-0.2	0.7	2311	32
23	402.6	ds	10.9	1.54	19	-0.1	0.6	1550	32
24	397.4	ds	4.5	1.56	34	-0.5	1.5	2301	32
25	379.5	ds	6.6	2.46	12	-1.8	2.2	1575	32
26	374.1	ds	2.2	1.29	7	-0.2	0.7	2238	33
27	396.9	ds	5.4	2.11	36	-1.0	2.0	1856	33
28	407.3	ds	3.3	1.87	49	-0.9	2.1	2556	33
29	396.9	ds	4.1	1.68	46	-0.4	1.6	2701	33
30	367.8	ds	6.1	1.73	69	-0.7	1.1	3124	33
31	353.2	ds	3.7	1.58	82	-0.4	0.8	3636	33
	373.7		**4.5**	**1.74**	**27**	**-0.4**	**0.9**	**1917**	**26**

BREWER OBSERVATIONS JUNE 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	354.7	ds	5.3	1.64	87	-0.8	0.8	3582	33
2	362.7	ds	4.3	1.68	80	-0.7	1.1	3174	33
3	365.9	ds	4.5	1.61	67	-0.6	1.0	3347	33
4	370.3	ds	5.3	1.78	56	-0.3	1.8	3148	33
5	359.2	ds	3.0	1.69	15	0.4	0.9	2104	33
6	360.2	ds	7.2	1.35	31	0.4	1.3	2978	33
7	330.9	ds	5.4	2.02	27	-0.3	0.7	2799	33
8	337.1	ds	1.9	1.74	40	-0.3	0.7	2606	33
9	346.0	ds	4.6	1.64	78	-0.6	0.6	3493	33
10	327.3	ds	1.5	1.92	17	0.4	0.4	1775	34
11	345.2	ds	4.5	1.63	61	-0.8	0.8	3609	34
12	380.7	ds	9.1	1.93	19	-0.1	1.5	1805	34
13	397.3	ds	8.6	1.80	35	-0.3	0.6	2100	34
14	349.6	ds	8.3	1.52	60	-0.6	0.9	2828	34
15	319.0	ds	5.4	2.58	9	-0.8	0.4	2308	34
16	391.8	ds	2.1	2.02	15	-1.4	2.2	1722	34
17	360.8	ds	1.8	1.55	24	0.3	0.5	3214	34
18	363.3	ds	17.9	1.33	5	1.3	2.9	1942	34
19	363.1	ds	3.4	1.45	25	-0.2	0.8	3109	34
20	350.7	ds	0.8	1.34	4	0.7	0.3	1543	34
21	359.9	ds	3.7	1.74	3	0.3	0.2	1134	34
22	352.5	ds	3.4	1.91	57	-0.4	1.1	3161	34
23	352.0	ds	2.9	1.51	50	-0.3	1.0	3181	34
24	344.2	ds	6.3	1.49	25	-0.6	0.8	2502	34
25	345.7	ds	5.1	1.87	53	-0.5	1.0	2481	34
26	365.1	ds	7.7	2.17	19	-0.6	1.0	1973	34
27	336.1	ds	2.0	1.48	28	0.1	0.8	3724	34
28	344.8	ds	7.0	1.46	33	-0.1	0.4	3017	34
29	364.3	ds	4.3	1.50	21	-0.4	0.8	2758	34
30	349.0	ds	6.3	2.33	10	-0.6	1.3	2039	34
	355.0		**5.1**	**1.72**	**35**	**-0.2**	**1.0**	**2639**	**34**

BREWER OBSERVATIONS JULY 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	326.7	ds	12.0	1.71	66	-0.2	0.8	3071	34
2	374.8	ds	3.3	1.80	21	-0.4	0.9	2022	34
3	362.,	ds	4.0	1.81	36	-0.1	0.8	2657	34
4	360,2	ds	2.5	1.81	52	-0.3	0.9	3353	34
5	331.6	ds	1.3	2.02	16	-0.6	0.3	2451	29
6	319.3	ds	8.0	1.78	52	-0.3	0.6	3256	33
7	-	-	-	-	-	-	-	-	-
8	328.4	ds	2.6	1.68	26	-1.1	0.4	1400	13
9	324.1	ds	9.1	1.57	51	-0.4	0.7	3248	29
10	347.4	ds	10.5	1.63	46	-0.4	0.8	3216	27
11	359.0	ds	2.7	1.84	35	-0.4	0.7	3044	28
12	367.7	ds	6.9	1.32	6	-0.2	0.5	1584	28
13	350.4	ds	4.6	1.40	3	0.2	0.6	1866	28
14	345.5	ds	0.0	1.22	1	-0.5	0.0	1993	27
15	345.0	ds	1.7	1.85	8	0.2	0.5	2034	27
16	327.1	ds	3.6	2.92	7	-1.0	1.1	1219	28
17	319.2	ds	1.9	1.58	30	-0.6	0.4	3375	27
18	322.9	ds	5.8	1.70	86	-0.5	0.6	3816	31
19	317.7	ds	2.1	1.56	53	0.2	0.6	2285	31
20	312.6	ds	2.8	1.72	33	-0.7	0.6	3807	21
21	309.7	ds	3.3	1.77	39	0.1	0.6	2380	29
22	310.9	ds	4.7	1.61	62	-0.4	0.5	3736	27
23	314.3	ds	3.0	1.59	26	-0.8	0.5	3023	28
24	302.0	ds	4.5	1.65	91	-0.7	0.6	4011	31
25	319.1	ds	4.7	1.87	17	-0.6	0.5	2309	27
26	318.9	ds	6.4	1.72	59	-0.5	0.4	3150	29
27	375.2	zs	13.9	1.33	12	-	-	637	27
28	341.5	zs	6.5	1.50	28	-	-	1247	27
29	336.2	ds	2.6	1.62	50	-0.4	0.6	3278	27
30	326.6	ds	4.6	1.65	112	-0.7	0.5	3627	31
31	316.8	ds	3.2	1.81	43	-0.7	0.6	3348	27
	333.8		**4.8**	**1.70**	**39**	**-0.4**	**0.6**	**2681**	**28**

BREWER OBSERVATIONS AUGUST 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	313.7	ds	4.4	1.73	44	-0.5	0.6	2809	27
2	333.6	zs	10.6	1.56	29	-	-	1175	26
3	322.5	ds	0.8	1.33	2	-1.1	0.1	1670	26
4	320.3	ds	3.2	1.92	30	-0.6	0.5	2716	27
5	327.4	ds	2.7	1.86	66	-0.3	0.6	2870	31
6	334.2	ds	5.1	1.74	73	-0.1	0.8	2746	31
7	336.3	ds	2.2	1.62	36	-0.1	0.7	2422	26
8	333.9	ds	3.9	1.71	42	-0.5	0.7	2515	26
9	326.1	ds	4.5	1.56	11	-0.0	1.6	1652	26
10	322.2	ds	6.1	1.68	24	-0.5	0.6	2890	30
11	311.9	ds	8.6	1.72	104	-0.7	0.5	3334	31
12	301.5	ds	3.2	1.70	53	-0.5	0.4	3118	26
13	317.1	zs	16.9	1.63	9	-	-	684	26
14	316.8	ds	2.6	2.43	4	-0.2	0.4	1175	26
15	315.3	ds	2.2	1.78	83	-0.5	0.6	3241	28
16	318.7	ds	4.3	1.76	48	-0.1	0.5	2788	27
17	323.0	ds	5.3	1.74	49	0.1	0.5	2559	26
18	320.8	ds	3.7	1.68	93	-0.1	0.6	2658	31
19	309.7	ds	3.3	1.69	105	-0.1	0.5	2775	30
20	304.6	ds	4.7	1.57	68	-0.2	0.5	2567	31
21	315.7	ds	1.3	1.58	10	-0.3	0.3	1581	25
22	324.6	ds	0.8	1.35	3	-0.2	0.2	1096	25
23	321.0	ds	4.3	1.72	92	-0.4	0.9	2805	31
24	313.9	ds	2.5	1.66	72	0.0	0.6	2416	28
25	318.9	ds	3.8	1.90	14	-0.1	0.6	2316	26
26	318.6	ds	5.6	1.61	26	-0.3	0.9	2170	26
27	318.6	ds	4.9	1.67	23	0.0	0.3	1819	26
28	296.1	ds	2.6	1.49	3	0.3	0.2	1231	24
29	304.7	ds	3.0	1.53	42	-0.4	0.4	2278	24
30	309.5	ds	3.2	1.68	50	0.0	0.6	2170	26
31	315.4	zs	10.0	1.69	22	-	-	598	24
	318.3		**4.5**	**1.67**	**43**	**-0.3**	**0.6**	**2221**	**27**

BREWER OBSERVATIONS SEPTEMBER 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	328.8	ds	7.0	1.96	52	0.1	0.7	1824	23
2	310.2	ds	2.6	2.01	59	0.2	0.7	2123	26
3	303.6	ds	1.8	1.94	56	0.2	0.5	2229	26
4	290.1	ds	0.8	1.98	3	0.5	0.3	1151	23
5	282.2	ds	1.9	2.10	31	-0.3	0.4	1979	24
6	273.7	ds	3.0	1.95	39	-0.3	0.4	2144	26
7	286.7	ds	4.6	1.81	40	0.2	0.5	1990	25
8	321.8	ds	3.0	1.85	53	0.2	0.4	1606	20
9	302.6	ds	6.0	2.07	13	0.7	1.3	1562	24
10	296.3	ds	1.1	1.85	98	0.1	0.4	2181	29
11	291.9	ds	2.4	1.84	68	0.4	0.5	2108	26
12	292.2	ds	2.3	1.81	30	0.0	0.3	1738	24
13	295.3	ds	6.4	2.02	62	0.4	0.6	1723	25
14	-	-	-	-	-	-	-	-	-
15	278.8	ds	0.0	3.09	1	-0.2	0.0	685	21
16	306.8	ds	4.2	1.95	44	0.4	0.6	1633	23
17	292.3	ds	2.7	2.15	71	0.2	0.3	1673	26
18	285.1	ds	1.8	2.04	67	0.2	0.4	1870	24
19	290.7	ds	4.0	2.03	70	0.7	0.3	1698	24
20	293.3	ds	6.4	2.14	24	0.5	0.7	1212	22
21	339.8	ds	0.0	3.79	1	-2.8	0.0	672	21
22	331.8	ds	0.0	1.61	1	0.2	0.0	822	20
23	339.1	ds	3.1	1.83	8	0.4	0.6	868	20
24	342.1	ds	2.9	2.53	11	-0.1	1.1	816	19
25	325.9	ds	1.7	1.97	19	0.1	0.6	1003	20
26	319.1	ds	4.6	2.44	15	-0.0	0.3	931	19
27	294.9	ds	4.7	2.16	17	0.4	0.8	1186	20
28	282.2	ds	2.8	1.99	15	0.4	0.5	1101	20
29	281.8	ds	0.0	3.07	1	-0.8	0.0	619	20
30	291.2	zs	3.6	2.00	24	-	-	535	19
	302.4		**2.9**	**2.14**	**34**	**0.1**	**0.5**	**1437**	**23**

BREWER OBSERVATIONS OCTOBER 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	289.1	zs	2.1	1.95	28	-	-	663	20
2	276.8	zs	4.0	2.08	24	-	-	661	20
3	252.2	ds	3.3	2.39	12	1.0	1.1	998	19
4	250.1	ds	1.8	2.14	79	0.9	0.7	1339	25
5	246.6	ds	2.7	2.21	71	0.3	0.2	1328	23
6	252.0	ds	2.3	2.26	91	0.4	0.2	1204	24
7	249.9	zs	6.9	2.10	21	-	-	400	17
8	264.2	ds	1.1	1.91	8	0.2	0.1	801	16
9	298.9	zs	7.5	2.31	25	-	-	471	17
10	306.9	ds	1.1	3.08	3	-0.0	0.4	493	16
11	307.8	ds	0.0	2.16	1	0.5	0.0	544	16
12	294.2	ds	1.4	2.37	64	1.0	1.2	896	18
13	288.0	ds	0.9	2.38	40	0.1	0.3	882	14
14	302.2	ds	4.6	2.35	30	0.3	0.4	754	15
15	300.0	ds	3.8	2.46	28	0.2	0.4	751	15
16	307.6	ds	1.7	2.13	8	0.6	0.4	525	16
17	300.0	ds	6.8	2.72	14	0.1	0.9	604	16
18	324.7	zs	3.5	2.43	23	-	-	353	16
19	313.4	ds	0.6	2.75	3	-0.2	0.5	435	15
20	296.5	ds	5.7	2.55	15	-0.1	0.6	483	11
21	268.7	zs	6.0	2.45	15	-	-	206	15
22	284.6	ds	1.6	2.60	36	0.5	0.6	660	15
23	281.9	ds	1.4	2.47	21	0.5	0.9	574	15
24	270.8	ds	1.3	2.58	34	0.3	0.2	657	15
25	266.9	ds	2.6	2.67	35	0.7	0.5	589	15
26	268.5	ds	1.6	2.69	36	0.9	0.5	594	14
27	276.6	zs	2.8	2.44	12	-	-	266	14
28	284.3	zs	1.5	2.54	10	-	-	187	14
29	284.8	ds	3.0	2.74	32	0.7	0.3	495	14
30	265.4	ds	1.9	2.55	8	0.8	0.4	348	13
31	256.8	zs	2.7	2.66	16	-	-	246	14
	281.6		**2.8**	**2.42**	**27**	**0.4**	**0.5**	**626**	**16**

BREWER OBSERVATIONS NOVEMBER 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	258.3	zs	7.3	2.71	15	-	-	237	13
2	251.3	ds	1.0	2.65	3	0.4	0.2	339	14
3	251.9	ds	2.9	2.93	16	0.3	0.7	451	14
4	243.6	ds	1.0	2.90	30	0.9	0.2	446	12
5	237.7	zs	6.0	2.84	8	-	-	95	13
6	277.5	zs	2.8	2.82	9	-	-	224	13
7	298.8	zs	6.2	2.97	10	-	-	193	13
8	313.9	zs	2.2	2.92	6	-	-	75	13
9	293.0	zs	4.8	2.96	9	-	-	126	13
10	297.5	ds	1.1	3.06	15	1.1	0.8	288	13
11	304.3	zs	1.9	2.95	8	-	-	103	13
12	293.0	zs	2.3	2.99	8	-	-	120	13
13	299.7	zs	2.1	3.11	3	-	-	60	13
14	321.4	ds	1.9	3.13	17	0.0	0.6	250	12
15	272.0	ds	1.1	3.61	3	-0.4	0.5	258	12
16	304.1	ds	3.9	3.19	11	-0.1	0.3	232	11
17	313.3	zs	1.8	3.15	5	-	-	142	11
18	318.7	ds	2.4	3.15	4	-0.4	0.2	148	11
19	-	-	-	-	-	-	-	34	11
20	328.6	ds	4.1	3.31	4	-0.7	1.2	244	12
21	326.4	ds	0.8	3.53	4	-0.7	0.6	209	12
22	294.4	ds	3.1	3.37	2	0.7	1.5	216	11
23	313.0	ds	2.3	3.44	10	-0.4	0.3	195	12
24	335.9	zs	0.9	3.28	6	-	-	118	11
25	253.0	zs	5.6	3.34	10	-	-	172	11
26	249.9	ds	0.9	3.50	5	0.3	0.1	234	11
27	270.1	zs	2.8	3.37	2	-	-	93	12
28	274.5	zs	4.1	3.55	2	-	-	97	11
29	315.7	zs	7.1	3.53	4	-	-	55	11
30	280.2	zs	0.0	3.50	1	-	-	64	11
	289.4		**2.9**	**3.16**	**8**	**0.1**	**0.6**	**184**	**12**

BREWER OBSERVATIONS DECEMBER 2004									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	270.7	ds	0.6	3.60	9	-0.0	0.2	182	10
2	299.9	ds	1.2	3.73	2	-0.6	0.4	86	11
3	305.3	zs	1.7	3.55	2	-	-	96	11
4	337.0	zs	0.7	3.61	4	-	-	77	11
5	305.2	ds	1.2	3.70	15	-0.6	0.4	147	10
6	282.8	zs	0.0	3.85	1	-	-	87	10
7	267.9	zs	0.0	3.72	1	-	-	72	10
8	324.9	zs	2.3	3.75	3	-	-	50	11
9	322.5	ds	0.2	3.88	2	-1.7	0.4	113	10
10	-	-	-	-	-	-	-	56	10
11	302.5	ds	0.6	3.79	12	-0.6	0.3	136	10
12	-	-	-	-	-	-	-	64	9
13	308.8	zs	0.0	3.75	1	-	-	50	9
14	-	-	-	-	-	-	-	31	10
15	298.6	zs	10.6	3.89	2	-	-	78	10
16	273.0	ds	2.1	3.83	24	-0.2	0.2	167	17
17	271.0	ds	0.9	3.79	7	0.2	0.2	132	9
18	309.9	zs	0.0	3.75	1	-	-	55	9
19	-	-	-	-	-	-	-	57	9
20	356.3	zs	0.0	3.92	1	-	-	49	9
21	320.7	zs	3.3	3.86	3	-	-	52	9
22	-	-	-	-	-	-	-	54	9
23	-	-	-	-	-	-	-	49	9
24	-	-	-	-	-	-	-	47	10
25	271.8	ds	2.5	3.76	3	-0.4	0.6	125	10
26	-	-	-	-	-	-	-	88	10
27	302.0	zs	0.0	3.83	1	-	-	48	9
28	361.1	zs	9.3	3.82	2	-	-	39	9
29	364.2	zs	4.4	3.72	2	-	-	56	9
30	-	-	-	-	-	-	-	58	9
31	252.3	zs	0.0	3.72	1	-	-	48	10
	304.9		**1.9**	**3.76**	**5**	**-0.5**	**0.3**	**79**	**10**

BREWER OBSERVATIONS JANUARY 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	274.8	zs	0.0	3.66	1	-	-	33	11
2	263.7	zs	0.0	3.64	1	-	-	77	10
3	350.4	ds	1.7	3.65	4	-1.7	0.1	73	9
4	261.7	zs	10.6	3.74	3	-	-	57	10
5	322.5	ds	4.2	3.84	3	-1.5	0.1	97	11
6	309.9	zs	2.1	3.59	2	-	-	74	10
7	266.1	zs	0.0	3.54	1	-	-	81	10
8	271.1	ds	1.1	3.69	15	0.1	0.1	193	9
9	316.5	ds	6.2	3.64	16	-0.9	0.1	161	10
10	237.9	zs	0.0	3.5	1	-	-	134	11
11	280.3	ds	2.2	3.45	8	0.1	0.1	113	10
12	306.5	ds	1.0	3.57	36	-0.2	0.1	179	15
13	303.8	ds	0.0	3.38	1	-1.5	0.0	124	11
14	341.8	zs	4.4	3.63	4	-	-	59	11
15	311.6	ds	0.0	3.47	1	-0.6	0.0	146	11
16	303.4	zs	0.6	3.34	2	-	-	132	11
17	333.1	ds	5.5	3.46	43	-0.4	0.1	189	14
18	322.3	ds	0.8	3.45	28	-0.6	0.1	205	11
19	419.0	zs	0.0	3.19	1	-	-	55	11
20	-	-	-	-	-	-	-	43	13
21	455.4	zs	2.5	3.14	3	-	-	80	11
22	-	-	-	-	-	-	-	129	12
23	402.0	zs	1.8	3.18	4	-	-	115	12
24	417.1	zs	6.1	3.08	5	-	-	111	11
25	444.2	zs	6.5	3.17	4	-	-	165	12
26	392.1	zs	7.4	3.12	13	-	-	169	12
27	350.9	zs	2.2	3.07	14	-	-	186	12
28	387.4	zs	2.8	2.99	11	-	-	176	12
29	366.9	zs	7.1	3.05	11	-	-	125	13
30	355.0	zs	4.7	3.08	11	-	-	137	13
31	281.5	zs	6.3	3.00	11	-	-	190	13
	323.2		**3.0**	**3.39**	**9**	**-0.7**	**0.1**	**123**	**11**

BREWER OBSERVATIONS FEBRUARY 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	358.5	ds	0.0	2.99	1	-3.0	0.0	169	13
2	351.0	zs	2.5	2.83	13	-	-	200	13
3	285.8	zs	12.5	2.85	10	-	-	198	14
4	326.0	zs	10.4	2.89	9	-	-	142	13
5	324.2	ds	3.1	2.96	15	0.2	0.2	342	13
6	326.8	ds	5.1	2.83	38	0.4	0.1	457	12
7	349.3	ds	4.3	2.78	46	0.2	0.1	432	14
8	340.1	ds	2.2	2.74	50	0.9	0.1	448	15
9	376.7	ds	3.2	2.71	49	0.1	0.1	413	15
10	345.5	ds	5.1	2.71	46	1.1	0.2	444	14
11	336.4	ds	0.1	2.42	2	0.8	0.7	267	13
12	326.3	zs	3.8	2.74	18	-	-	232	15
13	425.8	ds	8.3	2.73	26	-0.8	0.1	407	15
14	387.5	ds	2.3	2.63	7	0.0	0.3	317	15
15	389.4	ds	2.7	2.54	6	-0.1	0.3	316	15
16	392.8	zs	6.2	2.52	17	-	-	190	15
17	393.8	zs	2.5	2.46	13	-	-	184	15
18	373.3	zs	5.6	2.46	19	-	-	317	15
19	366.0	zs	3.6	2.49	18	-	-	257	15
20	353.0	zs	2.8	2.43	29	-	-	384	15
21	347.4	ds	2.2	2.34	4	0.7	0.9	517	16
22	369.3	zs	4.5	2.30	22	-	-	430	15
23	367.7	zs	5.1	2.30	12	-	-	205	15
24	377.9	zs	4.6	2.43	13	-	-	129	15
25	369.5	zs	5.6	2.39	31	-	-	327	15
26	353.3	ds	0.0	2.08	1	1.1	0.0	464	16
27	381.8	ds	4.3	2.40	37	0.4	0.1	832	16
28	394.5	ds	2.4	2.34	25	0.0	0.1	757	15
	360.3		**4.1**	**2.58**	**21**	**0.1**	**0,2**	**349**	**14**

BREWER OBSERVATIONS MARCH 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	334.5	ds	4.0	2.99	8	0.2	0.2	692	15
2	332.7	ds	6.3	2.29	39	1.2	0.4	926	16
3	428.6	ds	5.3	2.32	38	0.3	0.4	665	14
4	442.9	ds	3.3	2.07	28	2.2	0.6	591	16
5	430.1	ds	1.1	1.97	9	2.5	0.7	601	16
6	441.7	zs	2.3	2.07	19	-	-	454	17
7	399.1	zs	3.6	2.05	29	-	-	552	17
8	404.9	zs	2.3	2.06	27	-	-	482	17
9	425.9	ds	6.6	1.89	4	1.1	0.7	713	17
10	408.8	ds	4.2	2.19	20	0.0	0.3	903	17
11	401.0	ds	0.0	2.44	1	0.6	0.0	567	17
12	376.0	ds	0.0	2.32	1	1.0	0.0	627	17
13	371.9	ds	9.9	2.35	15	0.1	0.2	1081	17
14	365.8	ds	4.2	2.01	20	1.1	0.5	1012	17
15	363.7	ds	2.0	2.16	59	0.5	0.3	1200	21
16	330.5	ds	1.0	1.81	2	3.3	1.7	928	18
17	326.6	ds	6.9	2.28	12	0.8	0.3	832	18
18	317.5	ds	0.0	2.25	1	0.8	0.0	386	18
19	362.0	ds	5.1	2.08	12	0.6	0.1	1172	19
20	354.1	ds	5.7	2.48	13	0.2	0.1	903	18
21	331.2	ds	1.1	2.84	8	-0.2	0.1	955	19
22	317.0	ds	4.3	1.92	82	0.8	0.1	1563	22
23	296.4	ds	1.9	1.88	78	1.3	0.2	1573	23
24	316.1	ds	3.9	1.84	31	1.2	0.7	1037	21
25	319.8	ds	25	2.22	18	2.1	0.2	1008	21
26	347.6	ds	1.9	2.21	13	0.3	0.3	918	22
27	342.5	ds	1.9	2.17	4	0.6	0.2	793	22
28	351.0	ds	2.1	2.04	39	0.1	0.1	1489	21
29	368.9	ds	4.9	1.91	60	0.6	0.2	1443	22
30	390.7	ds	6.5	1.84	67	0.5	0.2	1383	22
31	386.7	ds	3.7	1.85	61	0.6	0.2	1438	19
	367.3		**3.6**	**2.15**	**26**	**0.9**	**0.4**	**932**	**19**

BREWER OBSERVATIONS APRIL 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	379.8	ds	4.2	1.78	83	1.3	0.1	1493	23
2	378.5	ds	2.9	1.88	61	0.4	0.2	1499	23
3	368.0	ds	2.6	1.86	51	0.4	0.2	1587	22
4	354.4	ds	2.5	1.77	81	0.9	0.2	1693	25
5	362.7	ds	4.1	1.74	81	0.9	0.3	1603	24
6	344.1	ds	6.4	1.76	16	0.1	0.3	1620	23
7	351.3	ds	4.1	1.75	14	1.3	0.6	1138	24
8	381.6	ds	4.8	1.58	17	1.4	0.6	1053	24
9	413.6	zs	8.5	1.79	18	-	-	391	24
10	424.1	zs	3.5	1.77	19	-	-	641	24
11	370.9	ds	6.6	1.71	28	0.6	0.3	1572	24
12	348.5	ds	3.4	1.50	22	1.1	1	1354	24
13	335.4	ds	2.2	1.73	65	0.6	0.4	2014	24
14	349.9	ds	5.5	1.64	69	1.2	0.5	1789	26
15	-	-	-	-	-	-	-	1256	25
16	379.8	ds	7.4	1.66	26	0.6	0.5	1571	26
17	384.5	ds	5.5	1.78	51	0.3	0.3	1929	23
18	381.0	ds	1.2	1.81	22	0.1	0.4	1390	25
19	393.8	ds	2.1	1.49	27	0.2	0.2	1854	26
20	401.2	ds	5.2	1.80	50	0.3	0.2	1996	23
21	438.0	ds	6.8	2.01	32	-0.8	0.2	1628	22
22	422.8	ds	8	1.85	16	0.2	0.4	1457	24
23	426.5	ds	4.3	1.78	6	0.2	0.3	1121	26
24	419.3	ds	3.5	1.67	68	0.1	0.2	2090	26
25	402.7	ds	6.3	1.63	69	0.4	0.2	2175	25
26	391.3	ds	0.0	1.27	1	0.0	0.0	1027	26
27	393.0	ds	3.7	1.75	55	-0.2	0.3	1929	28
28	415.5	zs	8.7	1.60	12	-	-	467	26
29	389.5	ds	9.2	1.87	63	0.1	0.3	1941	27
30	362.1	ds	6.8	1.84	46	0.2	0.3	2154	26
	385.0		**5.5**	**1.73**	**40**	**0.5**	**0.3**	**1514**	**25**

BREWER OBSERVATIONS MAY 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	339.2	ds	2.2	1.95	8	1.3	0.4	1476	26
2	316.9	ds	2.1	1.63	60	0.1	0.2	3254	25
3	314.7	ds	3.1	1.59	33	-0.2	0.3	2733	25
4	353.8	zs	17.2	1.37	7	-	-	489	26
5	365.6	zs	6.8	1.49	19	-	-	1122	26
6	388.8	ds	0.0	1.22	1	0.8	0.0	1199	26
7	395.1	ds	3.0	1.82	10	0.1	0.2	1858	26
8	412.4	ds	0.6	1.77	2	0.9	0.2	1291	27
9	413.8	ds	4.8	1.55	17	0.2	0.4	1706	28
10	416.7	ds	4.1	1.98	31	-0.7	0.1	1762	24
11	-	-	-	-	-	-	-	1786	27
12	-	-	-	-	-	-	-	1940	28
13	-	-	-	-	-	-	-	2111	24
14	-	-	-	-	-	-	-	3155	27
15	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	518	4
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-
24	326.8	zs	4.2	1.57	7	-	-	-	-
25	327.4	ds	3.5	1.42	47	0.1	0.2	594	13
26	319.3	ds	1.2	1.63	84	-0.4	0.2	3598	29
27	310.1	ds	1.5	1.39	97	0.5	0.1	4103	28
28	305.9	ds	1.0	2.06	28	0.4	0.6	96,2	12
29	301.6	ds	3.6	1.69	89	0.1	0.2	4318	30
30	314.8	ds	2.5	1.45	76	0.8	0.3	3886	27
31	337.9	ds	6.2	2.22	6	0.5	0.2	1792	27
	347.8		**3.8**	**1.66**	**35**	**0.3**	**0.2**	**2036**	**24**

BREWER OBSERVATIONS JUNE 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	364.1	ds	4.1	1.68	14	0.6	0.2	2243	27
2	356.9	ds	3.4	1.44	15	0.6	0.4	3010	27
3	336.7	zs	6.0	1.47	38	-	-	2523	28
4	337.1	zs	9.3	1.50	39	-	-	2975	26
5	381.8	ds	2.6	1.75	12	0.0	0.2	2488	23
6	379.8	ds	3.0	1.65	13	0.2	0.2	2232	27
7	384.4	ds	3.6	2.29	24	-0.6	0.1	2211	22
8	397.0	ds	1.3	2.24	16	-0.6	0.2	2046	26
9	354.9	ds	2.6	1.71	15	0.3	0.5	2596	27
10	340.1	ds	2.1	1.30	2	-0.1	1.2	1966	27
11	351.7	ds	3.3	2.09	13	-0.4	0.3	1832	27
12	386.3	ds	8.5	1.24	8	0.6	0.2	2397	26
13	340.8	ds	3.1	2.05	18	0.1	0.3	3666	26
14	338.7	ds	3.8	1.51	43	0.1	0.4	3287	29
15	334.6	ds	1.4	1.57	45	0.1	0.4	3060	27
16	327.1	ds	1.9	1.36	14	0.1	0.6	2632	28
17	323.8	ds	4.4	1.39	30	-0.2	0.4	3645	26
18	329.1	ds	2.3	2.76	2	-0.7	0.3	1620	27
19	332.0	ds	8.0	1.51	27	-0.1	0.2	2902	27
20	324.5	ds	1.9	2.07	51	-0.2	0.1	2431	28
21	325.1	ds	2.4	1.59	104	-0.3	0.1	4404	35
22	322.1	ds	2.6	3.01	4	-1.0	0.6	1842	27
23	334.8	ds	12.7	1.54	30	-0.3	0.1	3683	27
24	317.7	ds	1.3	1.61	69	0.0	0.2	4258	29
25	327.0	ds	3.6	1.60	50	0.1	0.2	3990	26
26	315.4	ds	1.9	1.54	35	-0.4	0.1	3803	27
27	312.7	ds	7.6	2.72	12	-0.8	0.2	7748	28
28	335.9	ds	2.0	1.50	33	0.3	0.2	3776	27
29	314.2	ds	3.6	1.68	55	-0.1	0.1	4221	28
30	322.5	ds	6.3	1.86	30	-0.3	0.1	3709	27
	341.6		**4.0**	**1.77**	**29**	**-0.1**	**0.3**	**3106**	**27**

BREWER OBSERVATIONS JULY 2005									
Day	Ozone		Dev	μ	N	SO2	Dev	UVB	NN
1	335.7	ds	5.8	1.59	34	0.1	0.3	3600	26
2	339.1	ds	6.5	1.82	56	-0.1	0.3	3191	28
3	344.9	ds	6.9	1.63	52	-0.4	0.1	3706	26
4	331.7	ds	2.8	1.51	93	0.0	0.2	4051	32
5	335.3	ds	2.2	1.41	91	1.3	0.1	4055	26
6	336.4	ds	7.8	1.76	52	0.5	0.2	3188	25
7	339.1	ds	2.9	1.55	39	0.2	0.5	2902	25
8	345.7	ds	2.3	1.72	73	0.6	0.3	3479	30
9	334.7	ds	1.7	1.69	32	0.3	0.3	2642	26
10	335.3	ds	2.9	1.64	51	-0.3	0.2	3783	27
11	336.6	ds	2.5	1.66	66	-0.2	0.2	3629	26
12	335.3	ds	1.6	1.52	84	-0.3	0.1	3894	28
13	331.9	ds	4.5	1.58	63	-0.3	0.2	3660	30
14	335.6	ds	3.3	1.60	68	-0.2	0.2	3578	29
15	326.4	ds	1.1	1.53	69	0.0	0.2	3713	26
16	344.3	ds	9.5	1.45	12	-0.7	0.4	2101	27
17	338.2	ds	5.0	1.70	28	-0.1	0.3	3062	26
18	330.3	ds	5.1	1.60	15	-0.3	0.3	2973	27
19	315.4	ds	4.9	2.85	2	0.2	0.5	1313	27
20	323.8	ds	5.1	1.84	25	-0.1	0.2	2541	26
21	347.9	ds	16.9	1.41	4	2.4	0.1	1986	27
22	351.9	ds	2.9	1.73	11	0.2	0.1	2811	27
23	345.9	ds	6.0	1.66	3	0.0	0.3	1951	26
24	351.3	ds	3.0	2.10	14	-0.8	0.1	2259	26
25	330.9	ds	1.3	2.74	9	-0.5	0.2	1769	20
26	340.8	ds	3.1	1.44	33	0.2	0.2	2807	27
27	322.2	ds	4.2	1.84	35	-0.1	0.2	3197	26
28	309.3	ds	3.3	1.54	74	0.3	0.2	3631	27
29	296.1	ds	7.7	1.49	135	0.1	0.4	6539	50
30	294.2	ds	0.0	1.20	1	-0.2	0.0	6540	50
31	306.6	ds	1.2	1.99	5	-0.4	0.4	461	9
	332.0		**4.3**	**1.70**	**43**	**0.0**	**0.2**	**3194**	**28**

BREWER OBSERVATIONS AUGUST 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	312.1	ds	2.5	1.62	53	0	0.2	3426	29
2	300.7	ds	2.9	1.69	69	-0.1	0.2	3642	28
3	313.5	ds	2.2	1.54	61	1.3	0.3	2990	26
4	319.9	zs	19.7	1.74	22	-	-	821	25
5	298.9	ds	0.7	1.64	2	0.4	1.1	1407	25
6	313.1	ds	7.2	1.46	18	0.2	0.6	2442	25
7	332.7	ds	4.3	1.91	22	-0.1	0.1	2395	25
8	330.2	ds	1.2	1.37	5	-0.1	1	1350	25
9	330.6	ds	2.0	1.58	17	0.1	0.5	2310	24
10	326.2	ds	7.7	1.74	32	0.0	0.1	2941	24
11	312.5	ds	2.0	2.91	7	-0.5	0.1	1249	25
12	315.4	ds	6.6	1.89	11	-0.3	0.2	1950	25
13	319.1	ds	5.4	1.98	23	-0.1	0.2	1921	24
14	325.2	ds	3.5	1.77	24	0.0	0.3	2304	25
15	320.1	ds	1.2	1.67	36	-0.2	0.6	2286	24
16	314.7	ds	0.0	1.77	1	0.9	1.1	1170	25
17	314.8	ds	3.1	1.69	44	0.0	0.3	2630	25
18	312.4	ds	3.9	1.69	70	-0.1	0.2	2905	23
19	313.6	ds	1.0	1.80	61	-0.1	0.2	2813	22
20	301.9	ds	2.8	1.70	69	1.4	0.1	3074	26
21	300.2	ds	2.2	1.71	79	0.5	0.2	2762	27
22	295.9	ds	3.7	1.61	100	0.4	0.2	2834	30
23	298.5	ds	2.5	1.64	29	0.6	0.7	1938	26
24	319.2	ds	2.4	1.57	13	-0.1	0.2	1918	25
25	309.0	ds	3.8	1.58	59	0.4	0.4	2264	25
26	304.2	ds	3.0	1.73	28	-0.1	0.1	2050	25
27	303.7	ds	2.1	1.82	23	0.8	0.3	2014	24
28	307.5	ds	3.4	1.72	45	0.0	0.2	2438	24
29	286.0	ds	1.1	1.65	89	-0.1	0.1	2823	29
30	287.2	ds	3.5	1.72	65	0.7	0.3	2415	23
31	294.6	ds	2.7	1.75	102	-0.2	0.1	5878	30
	310.8		**3.6**	**1.73**	**41**	**0.2**	**0.3**	**2431**	**25**

BREWER OBSERVATIONS SEPTEMBER 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	287.9	ds	1.6	1.75	102	-0.2	0.1	2718	25
2	291.2	ds	0.5	2.34	14	0.1	0.1	2489	22
3	292.5	ds	3.6	1.87	48	0.2	0.2	2251	21
4	302.3	ds	5.4	1.82	48	-0.2	0.2	2175	23
5	295.2	ds	1.1	1.82	55	-0.1	0.2	2204	21
6	298.0	ds	1.4	1.84	50	0.1	0.3	2082	20
7	297.1	ds	2.6	1.81	98	0.1	0.3	2078	26
8	278.5	ds	1.2	2.17	41	0.4	0.2	1799	16
9	284.1	ds	7.9	1.83	61	-0.1	0.3	2098	22
10	286.0	ds	2.0	1.99	23	0.5	0.3	1767	22
11	286.1	ds	2.6	1.73	24	0.4	0.5	1629	22
12	299.7	ds	2.5	1.76	18	0.8	0.3	1510	21
13	288.7	ds	2.9	2.02	15	0.1	0.3	1741	21
14	281.2	ds	3.5	2.17	31	0.7	0.3	1579	19
15	284.8	ds	4.1	2.38	6	-0.1	0.4	1047	20
16	273.9	ds	1.9	1.68	3	1.6	0.6	893	19
17	295.0	ds	0.0	1.55	1	0		1005	21
18	315.5	ds	6.7	1.92	59	0.1	0.1	1699	22
19	281.8	ds	2.0	1.86	73	0.4	0.1	1882	21
20	272.1	ds	1.4	1.98	79	0.2	0.1	-	-
21	259.2	ds	3.2	1.99	83	0.6	0.1	1886	22
22	254.9	ds	3.7	2.04	47	0.4	0.1	1900	17
23	267.2	ds	5.0	1.99	87	0.3	0.2	1674	23
24	279.1	ds	2.3	2.03	47	0.3	0.2	1456	18
25	283.6	ds	1.8	2.00	38	0.2	0.3	1320	17
26	288.1	ds	1.9	1.90	60	0.2	0.2	1339	21
27	289.2	ds	2.2	1.95	47	0.6	0.3	1238	18
28	282.7	ds	1.0	2.02	69	0.4	0.3	1291	21
29	294.8	ds	0.0	1.78	1	0.5	0.0	696	18
30	319.1	zs	4.1	1.93	27	-	-	522	17
	287.0		**2.7**	**1.93**	**45**	**0.3**	**0.2**	**1654**	**21**

BREWER OBSERVATIONS OCTOBER 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	307.1	ds	0.0	2.25	1	0.6	0.0	623	17
2	296.0	ds	1.1	2.03	32	0.0	0.4	1093	17
3	281.4	ds	0.9	2.03	26	0.1	0.5	939	17
4	284.2	ds	2.1	2.17	42	0.1	0.2	1167	17
5	278.4	ds	1.7	2.16	39	-0.1	0.3	1122	17
6	272.0	ds	1.5	2.17	54	1.2	0.1	1213	18
7	-	-	-	-	-	-	-	1105	19
8	280.6	ds	3.1	2.30	42	-0.4	0.1	1052	17
9	288.6	ds	1.9	2.31	42	-0.1	0.1	959	16
10	286.1	ds	1.5	2.28	71	0.2	0.2	912	20
11	286.0	ds	1.9	2.25	63	-0.1	0.2	859	18
12	298.9	ds	1.5	2.35	39	0.5	0.3	760	16
13	319.8	zs	2.7	2.35	18	-	-	226	16
14	310.8	ds	1.1	2.07	2	0.3	0.3	456	15
15	288.0	ds	2.0	2.64	13	0.0	0.3	450	16
16	289.1	ds	27.9	2.32	5	2.1	0.2	583	16
17	306.4	ds	1.1	3.38	4	-0.9	0.2	495	16
18	279.6	zs	6.0	2.38	19	-	-	266	16
19	280.6	ds	1.4	2.55	20	-0.5	0.1	664	15
20	262.4	ds	2.7	2.54	38	-0.3	0.3	751	15
21	256.3	ds	2.5	2.52	36	0.2	0.3	689	15
22	263.0	ds	1.3	2.50	28	-0.1	0.3	630	15
23	277.4	ds	2.2	3.29	4	-0.2	0.2	380	15
24	307.0	ds	1.8	2.44	15	-0.3	0.1	524	15
25	279.4	ds	1.7	2.30	6	0.4	0.5	430	15
26	293.4	ds	2.0	2.72	9	-0.5	0.1	469	15
27	265.9	ds	1.6	3.00	9	0.0	0.1	459	14
28	249.7	ds	3.8	2.66	62	0.9	0.1	640	18
29	238.2	ds	1.8	2.81	48	-0.2	0.1	650	16
30	239.2	ds	1.5	2.75	31	-0.1	0.1	594	14
31	244.1	ds	0.7	2.75	57	-0.2	0.1	588	17
	280.3		**2.8**	**2.48**	**29**	**0.1**	**0.2**	**701**	**16**

BREWER OBSERVATIONS NOVEMBER 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	253.6	ds	2.0	2.81	33	-0.2	0.1	529	13
2	268.1	ds	2.9	2.87	31	1.3	0.3	421	13
3	279.3	ds	1.9	2.80	21	1.3	0.4	371	13
4	270.9	ds	1.3	2.90	31	-0.1	0.3	401	13
5	258.7	ds	6.8	2.93	23	3.3	0.2	311	13
6	292.7	ds	3.4	2.89	21	-0.3	0.2	348	13
7	282.1	zs	1.4	2.86	9	-	-	111	13
8	284.0	ds	1.9	2.93	25	0.0	0.2	336	13
9	253.4	zs	4.2	2.81	8	-	-	119	13
10	238.8	zs	6.9	2.99	2	-	-	68	13
11	273.1	ds	0.0	2.82	1	-1.8	0.0	214	13
12	273.1	ds	1.6	2.86	4	-0.2	0.6	220	13
13	272.0	zs	4.2	3.14	10	-	-	124	12
14	315.1	ds	4.3	3.11	14	-0.5	0.2	221	12
15	274.7	ds	1.6	3.15	30	0.0	0.2	282	12
16	297.5	ds	12.7	3.24	3	-1.6	0.7	183	12
17	318.5	ds	0.0	3.02	1	0.0	0.1	162	12
18	325.2	zs	1.3	3.12	6	-	-	101	11
19	379.2	ds	0.0	3.59	1	-3.5	0.1	143	11
20	359.7	ds	2.0	3.36	11	-1.8	0.1	159	11
21	371.6	zs	0.0	3.14	1	-	-	68	12
22	308.9	zs	4.2	3.23	5	-	-	74	11
23	300.6	zs	0.0	3.37	1	-	-	95	11
24	320.8	zs	7.2	3.31	8	-	-	90	11
25	324.4	zs	0.0	3.24	1	-	-	68	11
26	294.6	zs	0.8	3.36	4	-	-	97	11
27	291.9	zs	2.8	3.46	3	-	-	72	11
28	318.2	ds	2.5	3.52	18	-1.0	0.2	206	11
29	308.5	ds	3.3	3.51	12	-0.7	0.2	194	11
30	331.4	ds	9.1	3.52	13	-0.8	0.2	174	10
	298.0		**3.0**	**3.13**	**12**	**-0.4**	**0.2**	**199**	**12**

BREWER OBSERVATIONS DECEMBER 2005									
Day	Ozone		dev	μ	N	SO2	Dev	UVB	NN
1	261.9	zs	6.7	3.76	3	-	-	131	11
2	286.0	zs	7.6	3.77	2	-	-	80	11
3	324.0	zs	5.3	3.59	4	-	-	81	11
4	348.0	zs	5.1	3.59	2	-	-	70	10
5	329.8	zs	0.0	3.55	1	-	-	60	10
6	-	-	-	-	-	-	-	43	10
7	-	-	-	-	-	-	-	23	10
8	302.9	zs	0.0	3.73	1	-	-	70	10
9	-	-	-	-	-	-	-	99	11
10	337.4	zs	4.9	3.68	3	-	-	101	11
11	-	-	-	-	-	-	-	67	10
12	289.9	zs	8.6	3.84	2	-	-	43	9
13	-	-	-	-	-	-	-	56	9
14	-	-	-	-	-	-	-	34	9
15	-	-	-	-	-	-	-	25	9
16	351.5	zs	0.0	3.74	1	-	-	44	9
17	370.1	ds	0.0	3.76	1	-3.7	0.3	75	9
18	349.9	ds	1.8	3.76	3	-2.6	0.2	97	10
19	343.6	ds	6.7	3.78	5	-2.2	0.1	127	10
20	-	-	-	-	-	-	-	52	8
21	294.7	zs	2.0	3.78	4	-	-	125	9
22	-	-	-	-	-	-	-	76	9
23	345.9	zs	2.6	3.82	2	-	-	88	9
24	-	-	-	-	-	-	-	32	10
25	349.8	zs	1.9	3.79	2	-	-	72	9
26	366.8	zs	0.0	3.77	1	-	-	84	10
27	-	-	-	-	-	-	-	75	9
28	-	-	-	-	-	-	-	52	9
29	309.3	ds	1.0	3.76	5	-0.5	0.2	133	9
30	-	-	-	-	-	-	-	35	9
31	307.9	zs	0.0	3.75	1	-	-	42	9
	326.1		**3.0**	**3.73**	**2**	**-2.2**	**0.2**	**71**	**10**

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Measurements of Atmospheric Trace Gases at Belsk, Poland, 2004-2005

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Tropospheric Ozone, Sulfur Dioxide, Nitrogen Dioxide and Carbon Monoxide have been measured at Belsk throughout 2004 and 2005. Measurements have been performed by automatic analysers produced by Monitor Labs Inc. (model 8810, 9850, 9830) and Advanced Pollution Instrumentation, Inc. (API 200AU). The measurement site is located beyond the direct influence of pollution sources (in the region of agriculture activity) and can be considered as rural. Air intake is situated 7 m above the ground.

The results of continuous measurements are reduced to hourly means. The units are micrograms per cubic meter ($\mu g/m^3$). The daily means, the daily maximum and minimum values and the hour (in Greenwich Mean Time) of daily maximum (h_{max}) are listed in the tables.

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JANUARY 2004, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	Min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	44.4	52	13	35	4.4	10	1	1	2.2	5	1	1	227.7	316	20	146
2	47.7	53	24	42	3.9	8	13	2	1.9	3	10	1	170.9	222	13	129
3	55.1	60	14	47	3.8	8	23	1	2.5	7	24	0	194.1	424	24	133
4	37.9	50	11	6	15.7	39	19	5	21.7	40	19	10	616.6	1112	19	402
5	32.6	45	12	8	17.2	43	16	9	15.7	32	16	7	508.5	697	21	325
6	38.1	49	15	25	14.5	27	9	9	21.8	73	9	5	375.1	453	1	267
7	37.4	50	14	22	13.5	24	3	5	15.0	27	2	4	457.0	615	2	337
8	54.1	61	15	36	6.3	15	1	1	3.5	11	5	1	325.7	459	1	258
9	48.0	58	1	35	11.7	24	24	2	16.2	27	19	4	545.4	1031	24	238
10	22.5	51	24	11	22.3	49	13	6	20.4	55	13	6	923.5	1333	13	444
11	43.9	56	13	26	11.9	22	21	5	19.9	37	20	9	609.2	1050	21	404
12	50.6	71	18	38	10.6	15	14	8	6.1	13	5	1	380.8	488	1	192
13	35.8	49	12	26	14.8	23	16	7	12.9	20	6	8	677.0	845	16	554
14	54.7	64	12	39	7.2	12	1	4	3.2	10	1	1	343.3	490	1	289
15	43.2	56	14	27	10.0	16	18	5	9.8	13	6	6	381.0	578	21	213
16	48.1	63	21	36	12.3	21	17	7	10.1	20	17	6	378.2	515	17	288
17	48.3	55	13	35	10.0	14	21	6	7.6	13	1	3	441.3	510	23	353
18	54.7	68	14	27	5.0	9	17	1	4.4	9	21	2	265.2	411	5	167
19	50.3	63	1	33	9.6	20	16	4	13.0	34	12	1	259.9	510	16	143
20	44.0	59	14	27	8.4	14	9	4	5.3	14	13	3	403.9	548	9	319
21	59.9	64	19	51	4.7	10	22	1	5.7	11	22	4	273.2	368	22	224
22	64.1	74	4	42	6.5	16	24	2	5.2	14	21	1	225.6	543	22	117
23	47.0	59	22	24	12.8	30	16	4	10.5	24	18	3	410.5	698	18	225
24	35.9	58	2	5	17.2	41	24	1	35.6	95	24	3	398.2	525	18	255
25	31.8	48	22	3	18.6	39	3	6	45.5	92	10	9	566.8	703	16	433
26	46.8	54	18	38	9.2	13	23	5	14.6	29	6	5	468.0	609	1	394
27	56.8	69	18	44	11.5	16	20	8	16.0	20	5	12	653.0	838	24	544
28	39.2	63	14	17	21.8	35	24	11	22.5	31	23	7	1025.5	1606	21	467
29	33.7	69	14	9	25.8	35	18	13	25.0	39	21	18	1106.0	1669	3	371
30	53.3	79	14	32	14.1	24	2	4	17.3	28	1	3	407.2	682	1	203
31	64.0	86	17	38	12.6	20	8	9	21.3	34	24	9	487.5	607	18	381
Mean	**38.4**				**11.5**				**14.0**				**468.0**			

FEBRUARY 2004, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	Min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	63.3	76	6	35	8.9	14	1	4	10.9	30	1	3	446.0	515	2	390
2	38.6	67	19	13	11.7	20	13	6	5.7	8	18	3	499.5	726	12	319
3	29.5	55	1	14	12.9	24	17	7	3.1	7	17	1	465.9	675	17	295
4	36.1	44	20	28	11.9	16	16	8	2.8	5	19	1	390.4	510	1	315
5	50.3	60	15	40	10.2	14	6	6	5.1	6	9	3	183.7	217	1	133
6	49.2	67	12	27	10.7	16	23	6	5.5	8	24	3	256.7	391	23	176
7	65.2	86	12	46	7.4	12	7	4	4.1	11	3	1	272.3	436	16	191
8	65.5	73	24	56	6.1	11	11	2	2.0	9	11	0	153.4	227	3	90
9	66.3	76	22	45	4.9	8	10	2	5.2	10	3	2	156.0	462	21	66
10	68.6	77	13	59	5.3	9	16	1	4.6	13	12	2	256.2	306	21	128
11	67.9	79	2	57	9.5	21	7	3	10.7	38	7	2	185.4	296	1	104
12	70.6	83	15	56	7.1	16	24	2	5.7	13	23	2	282.9	540	24	175
13	53.3	73	13	26	14.4	23	4	6	15.4	32	7	9	560.0	766	4	375
14	40.1	69	24	16	10.3	18	1	2	4.6	15	11	0	371.0	626	3	194
15	73.6	81	15	66	3.7	6	17	1	2.1	6	20	0	261.6	358	20	166
16	64.0	82	18	46	5.5	10	9	2	2.5	6	24	0	290.4	385	10	240
17	50.2	73	1	32	8.0	15	21	2	6.0	16	7	1	368.0	476	7	264
18	61.8	77	15	42	5.0	11	1	2	2.5	6	1	1	377.8	474	18	259
19	52.5	62	15	41	10.2	22	20	4	11.8	26	20	5	469.4	704	18	180
20	56.0	91	15	12	13.5	37	21	3	11.7	34	21	4	437.6	1019	24	211
21	77.4	93	13	44	8.2	17	1	3	8.5	23	3	1	417.7	1532	12	116
22	72.1	86	13	43	6.7	11	24	4	12.5	15	16	10	317.0	494	21	234
23	56.4	94	17	29	8.7	14	10	4	9.8	23	13	4	414.1	576	11	120
24	63.8	87	15	42	7.2	14	24	3	9.3	18	21	4	150.6	282	24	28
25	74.3	98	14	45	10.6	18	18	7	18.5	33	12	4	411.9	560	5	194
26	81.9	103	15	59	15.2	32	22	8	25.1	42	9	14	522.9	926	22	345
27	59.2	83	19	6	28.2	56	6	12	21.2	62	14	6	681.7	1109	6	439
28	73.6	105	14	16	14.3	40	24	9	17.9	31	24	11	530.5	1112	24	310
29	74.7	96	12	20	12.2	45	1	4	11.1	30	1	4	411.1	1087	1	225
30																
31																
Mean: 60.6					9.9				8.8				363.5			

MARCH 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	76.5	87	13	63	6.0	14	21	2	4.7	16	21	1	225.8	370	21	170
2	56.0	69	24	43	10.4	15	17	7	8.2	14	9	3	395.4	504	10	276
3	77.6	88	10	64	5.2	8	1	2	1.0	3	10	1	258.5	325	24	203
4	73.4	81	21	68	5.6	11	16	3	6.7	12	24	4	223.5	291	19	144
5	71.8	86	15	48	7.4	14	10	3	13.4	43	10	6	250.0	553	24	158
6	83.9	122	13	43	10.2	17	1	2	14.0	24	23	8	575.6	852	6	329
7	89.1	102	14	70	11.3	19	7	8	24.0	39	6	13	548.1	749	21	373
8	79.1	124	14	32	20.2	43	21	8	26.8	36	21	17	746.4	1064	23	599
9	92.4	103	5	78	10.1	24	2	3	7.4	32	1	1	365.5	820	1	234
10	88.1	101	15	70	9.5	17	22	3	16.6	39	13	2	300.7	399	16	233
11	99.7	115	14	89	9.7	14	20	6	9.6	22	9	1	373.7	434	23	329
12	88.0	101	17	75	10.3	17	14	6	16.4	34	13	6	190.2	295	22	137
13	83.2	105	14	63	10.2	17	19	4	9.8	28	1	4	400.8	588	21	275
14	63.8	83	15	52	15.2	21	21	8	11.3	15	8	6	656.3	951	20	466
15	71.5	104	15	35	13.6	19	19	8	7.5	12	20	4	505.4	691	6	312
16	54.7	86	13	37	13.2	20	1	9	3.6	8	23	1	337.3	470	1	214
17	35.3	62	14	17	13.1	23	20	6	4.4	12	19	1	248.2	494	20	100
18	60.3	113	14	19	18.2	37	23	12	10.7	24	15	2	416.9	667	23	281
19	65.3	103	13	40	18.8	32	22	11	9.3	17	11	4	509.6	855	20	292
20	70.3	91	13	51	11.3	18	19	7	4.1	10	22	2	234.3	378	18	143
21	84.3	105	7	56	7.3	11	4	4	2.6	8	5	1	178.1	245	23	78
22	79.7	99	15	62	7.9	16	20	2	1.9	5	20	1	197.0	489	19	117
23	76.9	109	14	49	9.8	25	18	4	4.7	8	18	1	287.0	530	17	141
24	46.1	79	1	15	19.2	42	20	6	11.7	25	19	3	438.6	670	19	259
25	58.1	68	22	37	8.0	16	1	3	2.2	14	1	1	239.7	421	1	134
26	61.5	69	6	51	5.5	10	13	2	3.4	7	18	2	110.6	144	18	87
27	63.2	72	16	50	5.8	11	23	2	1.7	7	23	1	165.3	314	22	115
28	76.3	102	15	54	7.0	13	23	3	5.3	19	23	1	305.2	396	23	185
29	58.1	81	17	36	10.6	15	24	5	7.2	12	8	3	428.6	609	24	344
30	59.2	96	15	19	14.2	28	20	8	5.4	14	10	2	407.5	804	20	231
31	63.3	96	11	18	21.5	42	7	10	19.9	56	14	8	447.1	748	7	201
Mean: 71.2					**11.2**				**8.9**				**353.8**			

APRIL 2004, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	77.3	108	16	31	15.5	39	7	5	9.8	29	4	1	348.8	653	7	128
2	85.8	106	16	68	7.7	14	21	2	7.6	51	8	3	215.4	365	20	116
3	88.5	110	14	67	8.1	16	19	2	4.3	10	11	1	309.3	548	18	211
4	84.1	123	15	52	12.1	25	19	7	6.3	12	11	2	474.5	732	19	302
5	66.5	95	14	43	11.2	25	19	2	4.9	9	3	2	284.0	569	19	155
6	67.4	96	15	41	11.1	18	22	7	7.2	22	11	3	366.4	584	22	250
7	62.3	80	9	27	13.6	29	6	6	3.5	10	11	1	344.2	465	21	201
8	80.8	95	10	53	7.5	17	22	3	2.8	7	23	1	166.7	279	21	105
9	66.4	99	15	44	10.3	15	22	6	2.3	6	5	1	356.9	563	23	259
10	78.0	104	15	43	9.9	16	21	6	4.1	9	7	2	492.5	734	21	394
11	64.9	88	15	49	8.4	12	7	4	6.2	20	11	2	252.8	438	1	144
12	81.0	104	15	61	5.4	9	21	2	6.9	11	22	4	257.0	348	21	197
13	68.4	98	16	30	12.5	25	19	5	6.2	14	5	2	303.0	450	19	193
14	86.5	111	15	54	9.2	23	20	2	6.1	13	6	2	276.5	512	22	94
15	95.1	126	15	55	14.1	27	21	3	6.5	10	4	4	390.3	608	22	210
16	91.2	137	15	50	15.5	36	21	7	7.0	11	4	4	722.2	1231	21	229
17	82.0	105	10	57	9.5	17	4	4	10.5	13	2	6	366.0	472	1	264
18	70.2	79	12	46	8.2	16	21	4	5.8	17	16	1	360.9	502	20	292
19	75.3	103	15	43	9.8	14	5	5	3.7	8	11	1	323.2	386	18	256
20	75.9	112	13	43	11.5	18	5	4	7.7	31	14	2	248.8	332	24	162
21	83.5	127	15	38	13.8	26	3	3	16.3	83	11	5	324.6	436	24	178
22	68.3	113	10	27	14.3	30	23	3	6.3	17	18	1	272.0	505	23	101
23	87.9	125	15	49	11.7	21	21	4	3.3	9	7	1	240.0	371	19	140
24	49.5	62	16	40	14.0	22	8	6	4.8	19	8	2	471.5	1123	19	266
25	60.4	94	18	47	9.2	14	13	2	4.0	8	3	1	315.7	427	14	213
26	84.3	122	14	38	14.2	30	23	7	7.0	14	22	4	265.0	425	23	143
27	101.9	143	14	59	17.1	30	6	8	9.2	16	20	4	321.9	538	22	82
28	92.9	127	16	51	14.1	30	6	5	9.7	20	10	3	321.4	505	24	233
29	93.5	129	15	44	15.2	44	22	3	8.0	23	6	2	353.7	748	20	158
30	94.8	126	14	46	12.1	25	1	3	6.1	16	3	2	626.2	932	20	180
31																
Mean: 78.8					11.6				6.5				345.7			

MAY 2004, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	101.7	133	14	74	7.8	20	19	2	2.6	6	20	1	228.1	326	20	92
2	82.2	110	14	49	7.0	14	6	4	2.4	8	11	0	339.6	374	11	300
3	61.2	94	13	33	6.6	10	5	3	2.1	7	14	0	245.3	295	1	206
4	73.0	108	12	17	9.4	18	2	3	1.2	4	8	0	237.1	378	1	177
5	71.6	89	11	47	7.1	11	5	2	4.8	8	22	2	265.8	312	14	227
6	75.7	107	17	33	6.4	10	6	3	2.8	12	12	0	235.6	280	23	185
7	66.7	109	16	36	6.9	14	19	3	5.0	30	18	0	272.8	335	8	164
8	57.1	82	24	35	7.9	12	5	5	6.8	17	11	4	238.9	313	21	201
9	82.6	102	15	59	4.8	10	21	2	0.7	2	1	0	217.4	240	21	202
10	66.3	107	16	49	4.6	8	1	0	1.0	2	17	0	339.7	1007	17	140
11	79.9	115	17	39	6.3	13	19	3	3.5	12	13	0	189.9	320	8	108
12	53.5	86	11	17	6.6	20	24	1	2.3	7	23	0	183.9	364	1	110
13	73.1	103	16	37	9.8	18	4	3	4.5	9	20	2	90.0	209	1	34
14	68.3	98	10	44	5.6	10	22	2	2.4	7	1	1	124.8	207	1	74
15	70.0	83	14	57	5.6	12	3	2	1.2	4	4	0	169.2	237	2	112
16	68.1	91	13	47	3.4	8	23	0	0.8	1	24	0	90.1	170	1	23
17	70.8	90	16	40	4.9	12	19	1	2.8	6	13	1	125.7	201	21	21
18	82.5	101	13	53	5.5	12	3	2	1.9	9	8	0	117.4	191	19	64
19	70.8	84	15	39	5.0	8	22	1	2.9	6	7	0	185.2	215	20	149
20	61.2	90	15	25	4.9	13	22	0	1.3	4	24	0	157.3	233	1	115
21	71.7	94	16	36	6.6	12	8	2	2.3	7	1	1	195.8	383	13	133
22	71.6	93	9	35	3.8	8	23	1	0.7	2	23	0	203.3	303	23	153
23	68.6	95	16	39	4.3	8	1	2	1.4	5	10	0	116.0	246	1	75
24	50.6	79	12	35	4.2	8	24	1	4.5	14	19	0	107.5	150	24	67
25	66.7	83	15	48	5.5	10	24	0	3.5	8	7	0	187.8	427	15	134
26	66.2	96	12	36	5.0	10	7	1	2.3	6	8	1	126.7	157	23	83
27	66.6	94	13	36	5.3	8	1	2	2.4	11	9	0	167.7	241	23	116
28	74.6	105	15	36	7.5	19	6	2	4.3	16	6	0	111.2	177	2	53
29	83.5	121	15	21	10.0	32	5	3	1.9	7	6	0	211.6	507	5	113
30	98.1	125	15	56	5.8	17	24	2	2.4	5	10	0	148.9	270	23	55
31	84.1	129	15	52	8.1	19	20	3	2.2	6	20	0	133.2	197	1	63
Mean: 72.2					6.2				2.6				185.9			

JUNE 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	77.9	109	14	47	4.4	10	1	1	2.8	13	7	0	104.1	166	20	44
2	83.4	112	17	51	3.9	8	13	2	4.2	9	9	1	151.0	210	19	111
3	71.1	96	10	39	3.8	8	23	1	3.7	12	5	2	173.0	206	20	140
4	80.1	105	15	36	15.7	39	19	5	1.1	4	5	0	205.4	311	21	123
5	66.0	95	14	27	17.2	43	16	9	2.3	8	15	0	269.1	329	23	180
6	84.1	112	13	18	14.5	27	9	9	2.8	9	23	0	183.0	276	1	108
7	57.5	79	1	13	13.5	24	3	5	2.4	5	1	1	180.1	232	17	88
8	71.8	111	12	19	6.3	15	1	1	1.3	7	12	0	177.3	265	9	102
9	74.6	92	16	53	11.7	24	24	2	1.9	4	24	1	122.6	159	7	56
10	66.3	97	11	34	22.3	49	13	6	3.7	6	10	1	193.5	291	18	93
11	71.7	104	12	29	11.9	22	21	5	3.3	9	8	1	211.4	311	23	115
12	58.6	81	15	37	10.6	15	14	8	2.3	5	16	1	176.0	274	2	111
13	69.1	103	14	40	14.8	23	16	7	3.0	5	16	1	171.3	227	20	98
14	78.1	94	14	52	7.2	12	1	4	3.6	7	12	2	197.1	241	20	136
15	63.5	77	19	50	10.0	16	18	5	5.4	8	2	3	115.1	150	20	72
16	64.2	79	14	43	12.3	21	17	7	1.8	6	6	0	206.5	300	18	113
17	63.8	89	15	39	10.0	14	21	6	2.7	5	2	1	117.6	194	23	60
18	60.5	79	16	42	5.0	9	17	1	3.3	6	3	2	184.6	282	22	59
19	71.5	109	17	30	9.6	20	16	4	6.0	10	11	3	151.0	239	20	83
20	50.7	64	11	30	8.4	14	9	4	3.9	9	11	1	215.5	246	14	190
21	54.7	89	17	19	4.7	10	22	1	0.5	1	21	0	160.9	224	5	113
22	79.1	116	15	24	6.5	16	24	2	6.1	19	15	1	94.5	143	6	50
23	84.4	124	15	29	12.8	30	16	4	5.4	10	8	3	218.9	482	10	136
24	74.4	103	12	34	17.2	41	24	1	3.9	10	7	1	279.6	530	15	152
25	82.4	111	12	40	18.6	39	3	6	6.3	20	13	3	256.2	427	1	153
26	64.9	85	14	49	9.2	13	23	5	5.5	12	6	2	254.6	490	5	170
27	76.4	98	16	39	11.5	16	20	8	1.9	7	24	0	265.0	389	23	127
28	82.0	113	12	62	21.8	35	24	11	5.7	19	21	1	196.6	233	15	141
29	68.1	86	15	53	25.8	35	18	13	5.4	13	15	2	185.0	251	3	120
30	65.1	89	15	41	14.1	24	2	4	3.3	13	13	0	196.3	296	21	128
31																
Mean: 70.5					**11.9**				**3.5**				**187.1**			

JULY 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	88.1	136	15	37	5.7	10	3	2	2.6	9	15	0	259.6	397	20	164
2	66.4	92	13	22	4.3	10	21	2	2.5	6	8	0	211.5	307	1	128
3	64.6	94	13	32	5.5	11	3	2	2.8	8	17	1	201.0	259	19	164
4	61.2	85	13	26	4.0	10	21	1	1.0	3	6	0	174.3	185	1	167
5	58.8	97	16	35	5.4	13	22	1	3.8	6	8	2	299.8	403	21	189
6	64.5	92	15	35	4.3	8	2	0	2.2	6	10	0	74.8	165	1	32
7	70.3	94	17	48	5.6	17	22	0	3.3	7	3	2	132.7	279	21	80
8	69.4	101	16	35	9.5	14	3	4	4.3	8	1	2	243.3	330	21	197
9	75.7	118	12	44	-	-	-	-	8.1	20	6	3	323.4	514	12	250
10	77.4	102	16	45	2.5	4	16	1	3.4	16	21	1	162.9	216	1	100
11	73.3	105	16	44	5.5	10	22	2	2.1	8	1	0	218.9	287	18	136
12	60.9	85	13	42	5.5	8	1	4	2.4	4	10	1	237.1	286	19	190
13	48.7	71	16	31	6.9	13	20	3	3.2	10	24	2	187.6	244	17	71
14	48.0	68	13	33	7.2	13	23	3	25.0	36	21	18	184.1	211	9	160
15	59.9	88	13	32	8.2	13	1	5	6.0	13	1	3	174.3	245	24	88
16	-	-	-	-	6.5	9	21	3	3.2	5	18	1	327.4	391	19	243
17	68.7	92	15	44	8.0	21	20	3	2.5	9	3	0	237.1	369	22	138
18	67.8	106	15	40	9.1	16	1	4	4.3	9	18	1	373.5	524	8	160
19	74.3	130	11	34	7.6	13	20	4	7.4	12	8	4	369.1	761	8	232
20	80.8	126	11	24	10.0	27	19	5	4.0	9	7	2	553.4	891	18	337
21	74.8	116	11	46	6.8	12	24	4	2.4	6	21	0	386.7	607	17	233
22	81.8	136	15	16	10.1	23	21	3	7.3	12	16	2	271.2	444	9	93
23	65.9	109	15	29	10.3	16	10	6	4.5	7	10	2	337.1	548	11	102
24	69.5	93	11	31	8.2	13	22	5	1.6	5	7	1	258.1	404	7	128
25	66.5	104	16	33	6.2	9	21	3	1.8	3	24	1	252.6	365	7	87
26	73.8	124	14	31	7.0	10	20	3	5.5	10	6	3	306.3	820	9	95
27	42.6	61	15	34	4.7	7	20	2	4.5	7	10	2	246.1	325	12	142
28	56.1	63	10	44	5.2	11	20	2	2.4	5	24	1	210.5	281	21	160
29	63.1	95	14	25	9.4	25	22	2	4.9	7	6	3	319.9	468	23	237
30	65.2	107	16	26	8.9	18	22	1	3.1	10	5	0	226.7	352	1	73
31	62.5	87	15	43	6.6	19	24	1	2.1	9	6	0	273.6	504	18	160
Mean: 66.7					6.8				4.3				259.2			

AUGUST 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	70.0	114	15	28	6.5	15	2	2	5.8	8	7	2	321.2	409	17	263
2	50.6	69	23	33	5.8	13	1	1	3.4	10	1	2	327.6	359	2	298
3	42.2	76	14	0	6.2	11	17	2	4.5	12	15	2	298.2	385	16	208
4	54.8	110	15	1	7.4	15	23	3	4.1	8	9	2	395.5	575	17	291
5	63.4	94	15	22	8.0	20	23	1	7.3	19	18	5	278.7	421	10	210
6	61.5	95	11	25	8.4	15	23	1	8.0	32	16	5	324.4	357	13	299
7	65.2	103	16	24	8.2	21	23	2	5.5	17	8	3	292.3	366	23	186
8	72.1	110	14	41	8.0	16	20	2	4.6	8	6	3	425.9	614	16	315
9	55.3	106	11	37	11.0	19	23	5	3.5	6	24	2	392.6	485	5	264
10	73.1	130	14	41	8.2	16	19	3	4.8	11	7	2	669.7	934	18	466
11	70.7	117	16	26	6.9	19	22	2	6.2	10	2	3	303.6	549	7	89
12	82.1	132	15	28	9.8	23	21	1	10.0	16	9	3	643.2	1293	20	90
13	54.0	79	9	28	9.5	29	4	3	3.8	8	1	2	761.9	1254	10	108
14	53.9	78	15	43	4.9	9	15	2	3.0	4	6	2	265.0	336	12	150
15	55.1	80	16	38	5.0	11	23	1	4.0	21	22	0	120.8	173	21	30
16	83.1	117	15	35	5.5	11	21	1	7.1	10	24	3	308.2	456	15	153
17	92.9	137	15	56	8.3	14	3	3	13.0	22	20	5	268.4	389	17	206
18	92.2	137	15	50	7.6	13	5	3	7.9	19	8	3	336.4	680	18	184
19	96.4	145	13	52	8.8	17	20	3	10.3	15	18	3	402.3	582	9	244
20	94.7	168	14	57	8.3	13	10	2	9.1	14	4	3	182.3	257	7	85
21	61.8	84	15	32	6.9	12	21	2	2.4	12	3	0	232.7	322	12	155
22	56.0	77	13	35	5.9	13	24	2	3.3	8	24	1	160.3	241	8	73
23	62.3	91	13	42	6.2	13	23	1	4.7	7	8	3	76.5	130	16	30
24	73.7	113	16	29	7.0	17	5	1	5.2	8	16	3	463.1	1022	13	122
25	66.5	89	14	47	6.1	12	20	2	4.5	9	15	2	249.7	336	2	153
26	64.7	104	15	35	7.3	11	6	1	5.9	16	4	1	236.5	304	7	183
27	64.5	99	13	40	6.5	13	1	2	4.6	9	22	0	213.6	277	24	121
28	44.4	85	12	19	7.8	11	16	4	3.2	8	10	0	281.1	398	23	182
29	69.0	121	16	14	6.5	12	20	3	5.3	10	16	0	293.6	437	19	183
30	80.3	124	15	25	6.2	14	5	2	7.2	23	20	2	304.0	486	18	117
31	33.0	53	1	21	7.0	10	19	4	4.9	8	23	1	197.1	265	24	132
Mean: 66.4					**7.3**				**5.7**				**323.4**			

SEPTEMBER 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	47.6	88	16	11	7.4	14	24	2	1.7	7	9	0	151.5	254	1	60
2	74.1	113	15	23	6.1	20	24	2	2.9	12	9	0	166.5	329	24	62
3	79.6	114	16	50	5.8	16	1	2	3.3	12	8	0	271.4	369	24	118
4	51.7	72	10	22	3.5	7	1	0	0.8	3	24	0	288.6	376	24	128
5	49.8	88	14	13	5.2	10	3	1	0.5	2	1	0	281.6	370	1	174
6	67.4	104	14	12	5.4	11	3	1	6.5	16	9	2	236.9	293	3	194
7	77.3	118	13	29	5.6	15	24	1	3.3	9	1	0	257.5	333	21	184
8	57.1	77	16	30	4.1	15	2	0	1.3	6	2	0	168.3	282	1	118
9	52.8	71	14	37	3.2	8	21	1	0.7	2	24	0	142.0	204	22	101
10	56.1	89	14	11	5.4	13	21	1	2.4	20	24	0	269.3	458	21	157
11	77.8	116	15	31	8.5	22	5	3	14.4	54	5	4	269.3	376	19	165
12	79.4	124	14	42	4.0	5	1	2	4.5	13	11	1	233.0	313	18	177
13	54.1	85	16	20	5.9	12	19	1	2.7	8	14	0	191.1	344	24	49
14	59.9	89	19	40	8.8	12	2	6	10.3	19	2	4	261.1	364	21	184
15	44.1	59	1	34	8.7	11	5	5	2.2	10	1	0	317.4	528	11	121
16	58.1	77	14	36	5.4	11	24	2	4.4	12	4	0	229.2	463	1	123
17	52.8	85	15	21	8.7	32	20	2	4.3	29	21	0	479.5	705	20	124
18	55.5	88	15	25	11.6	23	2	4	4.4	11	2	1	170.8	306	1	92
19	65.4	110	15	14	7.7	15	3	3	6.9	15	8	1	153.9	233	8	85
20	63.3	99	15	39	7.7	12	6	5	10.8	19	18	7	488.3	639	24	338
21	55.5	70	13	48	4.4	6	2	3	4.2	21	1	0	369.4	531	1	280
22	56.2	69	13	44	3.6	7	21	2	0.9	2	2	0	174.3	268	21	83
23	45.5	65	14	26	4.9	6	24	3	0.3	0	1	0	184.1	308	20	136
24	34.7	57	16	15	6.1	11	20	3	1.3	3	11	0	114.0	216	1	44
25	30.4	68	14	15	6.7	11	19	3	3.9	20	11	0	215.5	390	21	65
26	31.2	59	12	8	6.7	10	21	2	6.1	19	13	2	202.4	340	21	115
27	35.5	67	15	14	8.0	20	19	3	4.2	24	19	0	404.1	490	20	299
28	42.5	75	13	15	7.1	12	19	2	3.0	4	3	2	269.5	363	6	142
29	19.9	27	15	12	10.1	15	18	6	2.1	9	24	0	254.1	377	22	158
30	32.3	51	13	19	5.9	10	1	3	0.8	5	1	0	209.7	356	1	119
31																
Mean: 53.6					6.4				3.8				247.5			

OCTOBER 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	25.7	44	13	11	6.1	8	22	4	4.3	11	24	1	282.7	413	11	232
2	10.4	35	16	0	7.1	18	3	4	2.1	12	1	0	140.5	272	3	34
3	26.1	73	13	1	8.3	15	5	6	10.4	23	12	2	408.0	537	15	251
4	38.1	80	14	3	11.2	25	19	4	8.5	69	11	0	249.9	343	19	164
5	55.1	96	14	17	8.6	12	23	5	7.6	18	23	3	397.2	497	2	298
6	60.8	102	15	21	10.7	18	5	6	16.8	36	4	6	367.0	619	4	173
7	41.2	57	2	20	9.1	15	13	5	7.1	14	21	3	598.3	728	15	476
8	36.7	73	20	10	5.9	11	7	1	4.1	15	7	0	215.1	441	13	133
9	34.8	54	1	23	6.2	8	9	3	6.9	14	21	3	506.1	592	18	404
10	25.2	42	12	10	6.1	11	14	3	5.6	11	15	3	610.8	667	4	540
11	37.5	46	8	22	6.8	18	18	1	1.5	7	15	0	203.9	344	1	30
12	30.8	54	11	5	10.0	20	6	3	12.5	87	13	1	308.7	431	7	188
13	37.5	56	13	22	8.6	17	13	5	4.7	7	11	3	431.0	1277	15	153
14	41.2	59	13	29	7.6	14	9	4	6.4	9	23	4	862.7	1160	9	205
15	42.7	61	11	24	6.4	11	1	2	2.5	8	19	0	359.8	531	19	235
16	40.5	70	14	15	6.0	11	6	3	3.5	8	13	0	368.7	448	21	235
17	41.0	59	13	23	5.1	9	21	2	9.6	21	10	3	318.4	487	21	108
18	38.5	51	15	24	6.6	9	21	5	11.7	25	13	5	216.5	280	1	170
19	46.2	57	14	39	5.8	11	20	4	5.0	10	22	3	169.7	345	20	53
20	30.0	46	13	10	9.7	28	20	3	6.3	10	1	4	250.3	733	20	106
21	21.4	31	9	9	12.3	22	16	8	6.7	9	20	5	613.3	842	21	464
22	36.7	63	13	22	8.8	15	20	4	4.5	18	15	1	288.6	526	22	177
23	33.2	61	14	4	10.6	21	5	5	7.0	18	13	3	562.7	759	5	399
24	46.9	73	14	31	4.9	7	1	2	4.2	6	7	3	269.0	394	1	181
25	34.1	49	14	22	9.3	18	18	4	9.0	18	14	2	475.0	664	18	319
26	30.4	64	14	6	12.7	29	18	6	5.1	13	12	1	343.9	592	23	193
27	19.3	48	19	0	16.1	31	3	7	5.0	20	13	2	459.1	802	3	175
28	31.2	44	6	20	8.7	13	16	4	7.7	28	10	3	380.3	638	24	83
29	43.1	77	14	14	13.4	35	21	5	8.5	14	13	5	471.5	772	21	289
30	33.9	62	14	2	11.0	24	2	7	5.6	12	15	2	465.8	657	1	369
31	32.4	55	11	19	7.4	14	19	3	5.3	7	23	4	371.0	476	20	261
Mean:	35.6				8.6				6.6				386.0			

NOVEMBER 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	22.2	46	12	11	9.4	21	18	3	6.4	8	11	5	315.8	485	17	208
2	25.0	50	14	1	15.8	36	19	6	5.8	10	21	3	330.0	601	20	172
3	29.9	43	13	3	8.5	19	1	6	6.6	32	7	1	376.5	514	21	211
4	19.3	41	14	7	13.5	33	16	6	8.7	22	14	3	513.5	903	16	260
5	23.9	35	24	10	10.1	13	20	7	3.3	7	12	0	401.4	560	2	209
6	39.4	54	13	25	5.7	8	16	4	2.8	4	1	2	266.0	418	22	170
7	21.6	53	12	0	9.3	19	21	4	4.4	7	24	3	459.2	838	22	219
8	26.7	40	10	5	9.2	27	12	4	5.2	9	13	3	435.0	755	13	167
9	38.2	51	13	30	4.4	8	16	3	3.5	12	16	1	328.8	415	16	212
10	19.1	33	13	4	10.2	17	7	5	11.1	43	14	5	508.7	609	18	364
11	19.7	37	23	6	6.0	11	16	4	4.7	8	9	2	237.1	333	18	145
12	28.0	35	2	14	6.9	12	20	4	4.4	10	20	3	411.0	596	23	265
13	24.9	42	23	12	9.7	13	7	6	8.1	13	2	4	493.0	659	7	306
14	33.3	40	1	27	5.3	8	20	4	7.1	14	9	3	257.2	296	18	222
15	37.3	45	13	30	5.8	10	16	2	6.0	14	10	3	297.4	404	17	219
16	43.4	63	14	27	5.4	9	19	2	7.8	21	19	3	254.0	341	19	173
17	43.9	55	12	18	4.4	9	21	2	9.3	15	14	5	246.8	402	22	197
18	50.2	74	14	18	5.8	9	3	0	3.8	6	23	2	143.8	224	1	40
19	53.2	66	22	36	4.4	8	6	2	3.4	9	18	2	177.8	243	11	105
20	58.9	64	9	46	6.7	10	10	4	5.3	12	19	2	231.8	359	20	144
21	61.6	68	6	54	4.2	12	18	1	4.6	11	11	2	140.5	240	23	84
22	44.9	54	18	26	7.7	15	14	2	11.5	25	13	5	311.8	429	13	175
23	57.5	72	13	29	3.3	10	1	1	1.7	5	9	0	270.3	399	1	143
24	58.2	63	16	54	2.5	5	22	1	4.5	7	23	3	223.3	281	12	174
25	44.6	56	13	36	9.0	13	20	4	12.2	43	12	5	345.4	417	7	244
26	26.1	45	15	0	22.1	38	23	14	19.9	29	4	11	546.4	742	18	366
27	16.1	53	24	1	19.9	35	1	5	8.6	15	7	3	432.0	551	17	241
28	31.8	54	1	0	9.6	21	19	3	4.9	8	22	3	489.6	940	19	265
29	5.0	12	11	0	16.1	23	23	12	5.1	16	23	1	919.3	1165	23	563
30	16.0	37	20	0	14.8	22	10	7	10.1	19	16	6	776.2	1129	2	446
31																
Mean: 34.0					8.9				6.7				371.3			

DECEMBER 2004,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	25.3	37	13	16	11.3	20	16	6	9.1	11	2	7	635.7	900	16	457
2	20.9	41	2	2	11.8	22	24	5	10.0	15	13	6	465.2	784	19	255
3	18.6	31	17	5	15.6	24	14	11	10.4	21	1	5	381.5	526	10	202
4	29.1	39	20	17	9.1	15	18	7	4.5	7	1	1	335.8	518	18	276
5	30.3	41	13	19	10.9	16	15	7	11.7	42	14	3	461.8	564	14	383
6	49.0	66	15	30	5.8	9	2	4	4.7	8	2	2	307.2	409	2	253
7	28.2	48	1	18	10.2	16	14	5	9.0	17	14	5	430.5	566	15	273
8	38.8	51	17	24	7.6	10	2	6	8.8	12	18	7	357.7	393	9	328
9	50.9	58	19	44	4.0	5	23	3	7.1	9	23	5	218.6	258	9	57
10	34.3	45	3	7	8.5	23	24	3	12.4	36	12	2	332.3	577	24	210
11	5.7	16	12	0	23.8	33	15	12	20.8	28	7	12	962.2	1240	14	588
12	6.0	14	24	0	20.4	26	1	14	8.6	12	19	5	482.3	614	1	350
13	18.2	37	5	2	10.8	14	24	6	9.2	14	1	6	510.6	760	24	324
14	23.9	40	19	3	10.4	16	8	6	6.1	10	24	4	511.9	726	2	391
15	12.3	25	13	1	17.5	27	6	10	24.4	62	11	7	693.8	856	6	542
16	9.6	21	12	0	19.1	25	19	12	19.7	30	1	10	627.5	897	19	453
17	13.4	24	12	3	16.7	24	22	11	24.9	32	22	11	811.2	918	22	711
18	22.5	60	23	2	11.5	21	2	4	12.3	19	1	5	579.5	916	2	217
19	43.2	50	1	35	5.7	7	10	4	7.9	13	24	4	468.5	543	10	364
20	50.3	55	18	41	6.0	9	21	3	8.3	19	7	4	289.9	394	21	208
21	19.1	52	2	0	16.0	29	23	5	15.6	31	23	6	596.1	880	23	324
22	32.2	54	8	2	13.7	28	22	5	17.7	30	20	5	542.1	944	21	252
23	27.7	32	24	21	11.5	17	1	9	11.7	21	14	2	306.1	444	1	191
24	47.3	63	18	35	5.2	7	1	4	3.0	6	2	2	308.6	366	11	246
25	42.5	51	1	33	6.2	8	18	4	8.1	14	24	3	586.8	777	18	321
26	30.3	33	15	25	7.8	10	8	6	9.6	13	1	7	670.0	747	9	615
27	20.0	38	4	0	11.3	20	14	7	9.5	17	24	7	595.0	969	21	320
28	31.2	50	14	3	6.7	16	24	3	3.7	14	1	0	405.9	736	24	256
29	8.4	21	13	0	12.4	19	22	8	6.5	14	4	0	603.6	821	8	432
30	20.3	35	16	0	9.7	20	1	6	10.1	28	14	3	428.9	819	1	282
31	23.5	28	11	17	10.1	17	4	7	9.7	18	4	6	618.5	732	4	533
Mean: 26.9					**11.2**				**10.8**				**500.8**			

JANUARY 2005, BELSK																
	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
Day	mean	max	h_{max}	Min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	27.9	53	22	18	13.4	20	1	7	5.5	12	20	2	520.5	623	1	426
2	47.2	68	17	30	8.3	15	12	5	8.0	13	13	2	404.3	570	12	312
3	60.6	65	14	55	5.7	8	1	4	6.8	10	1	4	237.0	332	20	147
4	49.8	56	1	39	6.9	10	3	5	6.4	15	3	4	303.4	404	22	196
5	50.9	63	18	40	8.1	16	24	5	8.7	23	22	5	353.8	555	24	260
6	32.1	57	23	17	13.1	18	11	4	8.0	23	3	2	419.9	643	3	216
7	42.3	56	1	36	10.5	13	18	6	7.6	12	2	5	159.3	358	3	61
8	45.3	56	20	37	10.8	17	16	7	12.9	34	16	7	174.6	283	14	89
9	64.4	70	6	58	4.9	8	1	2	8.2	10	9	6	208.4	272	13	121
10	48.1	59	1	36	10.5	20	21	5	10.3	16	15	6	313.3	418	24	201
11	33.8	40	8	21	17.7	30	22	10	11.3	17	22	7	360.5	456	23	289
12	26.9	43	16	16	23.6	33	20	19	13.6	26	16	6	507.1	664	20	414
13	32.2	56	16	17	18.3	24	1	12	8.9	13	8	5	443.6	580	22	333
14	46.6	52	15	39	8.7	15	3	6	6.9	10	20	5	354.0	418	19	271
15	45.1	53	17	40	9.0	12	2	6	9.4	12	8	5	265.2	414	2	171
16	33.3	50	17	15	11.2	19	11	6	11.1	15	15	9	334.6	482	11	196
17	33.4	45	16	27	21.8	40	19	9	21.4	35	17	10	647.3	1373	21	299
18	34.6	52	17	25	26.9	41	19	17	25.5	35	20	14	818.4	1240	1	674
19	30.9	44	5	14	21.3	30	20	14	20.5	28	16	14	651.4	820	20	540
20	35.0	54	23	20	19.4	29	1	10	15.2	29	12	8	488.7	673	1	340
21	56.8	65	9	48	7.2	12	4	4	6.3	11	23	3	446.4	572	13	307
22	55.5	61	6	49	5.0	8	3	3	7.7	13	13	5	477.8	631	19	340
23	49.3	60	18	44	5.9	12	21	4	9.5	19	14	6	315.9	504	3	155
24	37.8	47	2	24	18.6	30	12	8	18.5	26	12	7	542.2	740	19	254
25	42.2	56	18	30	18.1	29	10	11	15.1	28	10	10	742.8	849	14	509
26	52.5	58	9	49	9.1	13	1	6	9.2	16	1	6	519.6	667	2	361
27	48.1	53	3	39	10.5	20	12	6	10.8	19	7	6	427.3	565	1	283
28	42.5	55	18	28	17.4	23	6	11	19.9	44	15	11	498.3	696	5	214
29	34.3	50	22	25	18.9	28	4	8	20.4	44	12	4	489.3	812	4	247
30	45.2	55	18	31	12.4	19	6	7	17.3	31	2	9	545.6	648	24	352
31	45.5	65	23	34	16.2	23	10	7	15.6	25	10	5	578.9	719	12	395
Mean	**42.9**				**13.2**				**12.1**				**437.1**			

FEBRUARY 2005, BELSK																
	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
Day	mean	max	h_{max}	Min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	54.7	61	10	46	7.2	11	1	4	9.9	13	2	6	419.5	603	21	55
2	39.3	46	1	30	9.2	17	24	6	10.4	15	16	7	396.1	605	24	212
3	25.5	43	24	11	20.8	37	20	13	15.3	67	18	8	502.9	636	22	243
4	52.3	57	17	45	8.6	14	21	6	7.1	18	13	3	266.0	453	1	110
5	47.9	58	16	24	16.6	51	20	6	26.5	88	20	4	463.6	808	21	285
6	62.5	81	17	46	17.2	27	19	9	27.7	66	19	15	604.5	724	4	449
7	67.1	83	17	54	17.7	29	20	9	24.3	43	21	12	583.1	757	21	381
8	62.1	85	17	44	25.9	41	23	18	29.7	38	3	22	862.4	1313	24	691
9	68.2	89	18	53	44.6	90	24	21	34.7	43	24	25	825.6	1247	2	520
10	68.1	92	18	36	67.3	103	8	23	45.0	55	24	33	998.5	1531	23	552
11	48.1	61	1	35	14.9	30	1	6	17.6	55	1	7	588.2	1266	1	248
12	46.8	84	19	27	14.2	20	3	8	15.2	28	23	8	604.0	769	24	267
13	57.6	69	1	47	6.6	13	3	3	13.1	22	1	8	418.1	936	3	147
14	51.5	57	17	46	6.9	10	5	4	10.8	15	5	7	326.2	489	24	131
15	43.7	58	21	13	12.4	29	10	7	10.4	16	12	7	400.1	536	1	276
16	43.0	64	3	4	15.1	43	24	6	6.4	10	23	5	443.7	706	24	297
17	38.7	45	12	20	8.8	20	1	5	6.2	10	1	5	491.9	636	23	369
18	46.6	65	24	33	7.9	12	20	5	8.2	19	20	5	535.4	646	10	338
19	54.3	66	4	32	12.2	25	24	7	15.8	24	24	9	616.4	1030	24	458
20	42.1	59	18	30	18.3	32	24	13	25.3	30	19	21	803.5	1198	24	609
21	41.4	76	17	3	30.9	60	4	14	22.7	38	10	15	975.7	1614	4	557
22	56.1	70	15	45	15.5	34	1	9	19.4	38	23	9	632.8	817	1	488
23	47.4	56	4	37	12.5	24	17	6	20.6	52	18	4	366.7	639	2	138
24	43.9	50	7	38	9.3	14	23	7	8.6	17	23	4	525.3	615	23	391
25	45.9	53	17	35	14.6	30	21	7	13.8	18	21	10	496.3	731	22	221
26	54.0	81	23	17	18.4	40	9	7	14.8	26	9	9	629.3	1028	9	367
27	67.4	77	16	57	8.2	15	2	4	10.5	22	13	4	224.7	508	3	82
28	62.5	109	2	52	8.7	17	1	5	9.2	16	2	5	355.5	493	5	162
29																
30																
31																
Mean: 51.4					**16.8**				**17.1**				**548.4**			

MARCH 2005, BELSK																
	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
Day	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	59.3	75	16	47	6.6	11	24	4	23.6	24	1	23	448.3	691	23	207
2	73.9	92	16	52	6.8	11	1	4	23.6	24	4	23	396.6	827	24	121
3	82.7	112	15	42	18.0	29	18	9	23.8	30	13	18	776.6	900	6	619
4	85.5	132	14	24	31.2	75	22	18	31.6	48	3	25	697.0	1208	6	322
5	84.6	109	13	60	21.4	37	1	14	18.2	28	7	10	825.3	1119	3	562
6	84.0	93	15	69	8.6	22	1	6	12.5	40	1	6	377.8	585	1	232
7	89.1	97	12	74	7.4	11	19	5	9.6	16	17	7	466.7	612	18	335
8	75.7	89	16	67	7.9	13	13	5	9.0	17	13	4	275.7	349	13	176
9	82.2	91	14	74	6.1	8	7	4	6.1	11	2	3	281.3	378	4	170
10	81.7	99	14	63	7.8	12	6	3	10.0	15	20	5	274.4	492	24	40
11	71.0	79	11	51	14.5	18	14	11	16.6	27	14	10	426.5	559	18	302
12	76.8	90	12	61	7.7	11	1	5	8.8	12	11	5	249.6	325	19	112
13	84	98	16	68	6.0	13	23	4	10.6	19	21	7	237.7	316	5	109
14	75.6	94	14	61	11.0	19	22	7	14.0	23	11	8	465.7	609	6	343
15	73.4	100	14	48	15.6	26	23	9	14.2	20	19	10	547.1	752	24	269
16	86.5	102	13	58	16.3	21	1	13	12.2	19	1	9	383.5	633	1	216
17	82.3	104	13	60	9.4	30	13	1	8.4	11	8	6	441.8	649	21	156
18	68.1	84	24	54	3.2	5	14	1	6.3	11	9	4	386.9	649	20	198
19	84.0	89	17	71	1.2	2	24	1	5.1	6	11	4	378.8	617	21	118
20	77.4	86	13	63	1.7	2	2	1	8.3	14	2	5	499.6	703	19	218
21	84.4	93	13	69	1.6	4	6	1	5.2	6	15	4	473.8	791	24	215
22	87.0	102	14	69	2.8	6	23	2	10.9	16	22	7	519.1	940	23	201
23	92.7	126	14	75	8.0	18	19	3	20.4	30	19	12	990.0	1615	24	261
24	64.6	94	13	25	10.6	13	21	8	18.7	26	16	10	659.1	886	3	291
25	56.0	94	15	3	8.7	37	23	3	9,0	18	24	5	505.1	1222	20	92
26	48.4	97	15	5	9.4	27	1	5	9.7	24	19	4	577.3	1065	1	319
27	56.3	78	16	27	4.1	10	2	2	5.4	13	1	0	480.9	670	1	262
28	66.6	91	15	42	3.7	9	24	1	8.5	15	20	5	375.6	634	20	143
29	72.7	104	13	40	6.7	13	6	1	11.0	20	21	4	389.4	698	19	155
30	74.7	105	12	51	6.1	10	6	2	9.5	18	5	4	243.7	459	1	101
31	68.8	103	13	40	9.4	23	20	1	13.0	31	22	0	520.1	1005	20	139
Mean: 75.8					**9.0**				**12.7**				**470.0**			

APRIL 2005, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	76.6	101	17	58	16.0	24	22	9	16.8	28	13	5	251.4	573	1	6
2	107.6	131	15	76	7.6	14	1	3	8.3	17	24	4	322.4	591	23	3
3	114.0	128	16	83	7.2	14	20	3	8.0	21	22	3	255.8	496	21	54
4	109.8	141	15	84	10.7	28	18	6	8.1	14	5	4	278.6	544	19	76
5	102.6	143	14	51	12.3	25	19	6	10.5	18	7	4	408.9	775	19	225
6	70.6	94	14	39	8.2	19	19	4	1.9	7	24	0	300.7	608	24	44
7	95.7	143	14	36	11.9	17	18	8	6.3	9	12	4	478.9	689	19	213
8	101.9	132	13	70	8.0	13	20	4	9.0	11	15	7	375.4	487	1	307
9	59.6	73	15	44	6.5	10	3	3	3.9	8	3	0	331.3	442	1	247
10	69.6	77	9	59	3.4	6	19	2	2.8	5	24	1	167.1	235	24	101
11	61.4	83	12	38	7.2	15	20	3	7.5	13	3	4	263.4	557	20	108
12	50.6	73	11	28	15.7	26	22	8	12.5	46	14	2	412.7	720	22	227
13	74.1	114	16	25	12.4	25	5	6	9.1	14	8	7	311.3	464	24	132
14	88.9	127	15	62	15.5	27	1	11	11.9	22	5	5	283.0	447	1	144
15	73.8	108	11	32	13.2	29	6	4	4.3	8	22	2	299.4	457	18	193
16	70.3	115	13	22	11.6	19	7	5	6.2	18	10	2	427.8	517	20	289
17	89.8	128	15	50	7.3	18	6	4	4.3	27	10	0	387.2	566	4	241
18	67.6	102	14	38	7.4	14	19	4	4.5	8	14	2	283.4	326	13	187
19	63.1	93	14	39	5.8	10	23	3	5.2	10	23	2	260.3	440	1	163
20	65.3	86	15	46	7.4	13	8	3	8.1	25	8	2	392.1	603	20	126
21	69.0	86	15	46	3.2	10	1	0	5.9	15	7	2	569.5	853	20	181
22	71.8	96	13	49	6.2	13	24	1	4.4	10	5	1	372.6	559	24	161
23	65.0	95	15	32	7.6	19	2	0	5.7	14	8	1	304.9	497	3	80
24	78.0	105	16	45	4.8	17	21	0	7.7	13	21	5	297.7	523	24	98
25	77.7	108	15	38	7.0	14	5	2	7.7	18	4	4	651.4	848	4	380
26	55.3	75	13	30	8.7	18	21	5	3.0	19	11	0	252.4	375	21	166
27	69.3	105	14	25	10.8	38	20	2	5.5	14	6	2	298.2	503	4	96
28	56.5	69	1	46	4.6	9	19	2	3.7	8	23	2	416.3	541	21	262
29	77.9	106	15	37	5.2	11	20	3	5.8	15	8	2	406.5	514	20	154
30	93.5	120	17	44	6.4	13	5	3	5.6	11	7	2	275.6	505	23	112
31																
Mean: 77.6					**8.7**				**6.5**				**344.5**			

MAY 2005, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	87.9	109	16	72	12.2	17	8	9	9.6	26	15	4	359.7	466	12	276
2	80.0	109	15	42	15.8	36	19	4	7.6	20	3	4	351.7	476	2	228
3	82.2	121	14	50	7.6	11	3	1	2.3	7	18	0	394.2	472	12	284
4	51.0	77	17	13	14.9	54	15	2	5.1	8	15	3	410.5	629	14	316
5	57.1	69	10	41	4.2	7	22	1	3.3	6	2	1	156.1	224	1	98
6	61.1	83	11	42	7.2	13	19	3	5.7	9	12	3	245.6	327	22	181
7	53.5	76	14	32	6.7	17	20	2	6.5	9	5	5	259.4	379	21	199
8	50.6	72	8	13	8.9	33	3	3	2.0	4	3	0	238.9	402	3	136
9	69.6	84	16	49	3.7	10	19	1	3.4	9	9	1	215.3	700	11	56
10	62.1	86	15	39	6.3	19	23	0	4.8	10	9	1	253.9	367	23	162
11	60.9	82	13	31	4.8	21	19	0	2.7	5	8	1	282.9	464	8	145
12	66.2	95	15	35	6.1	13	2	1	7.3	19	8	5	359.8	969	11	218
13	67.2	82	16	45	4.0	11	22	0	6.2	15	18	2	306.8	540	9	151
14	81.0	102	14	38	3.9	11	18	0	6.5	14	18	2	194.6	354	22	28
15	75.5	108	12	47	6.6	11	14	1	6.1	18	14	2	239.4	316	13	155
16	73.1	98	17	43	9.1	35	21	3	6.5	12	9	5	340.4	468	21	228
17	56.1	76	15	41	9.7	24	1	3	2.5	14	8	0	250.3	330	14	185
18	60.2	78	7	45	9.5	23	20	4	3.8	10	21	1	316.5	457	20	238
19	57.1	88	12	28	10.2	38	24	1	3.7	9	24	1	266.6	446	23	157
20	60.3	89	15	24	12.1	38	1	1	8.1	11	23	5	506.0	669	22	168
21	66.4	91	14	32	9.2	25	3	1	5.5	13	21	3	254.9	435	20	68
22	55.6	79	11	33	7.1	14	18	0	4.0	19	18	0	163.6	237	20	50
23	43.3	78	14	19	11.4	36	10	3	12.0	65	10	3	344.5	955	14	171
24	59.4	82	10	33	6.5	9	4	3	4.3	6	15	1	269.1	369	11	188
25	93.0	122	16	51	-	-	-	-	3.6	6	13	1	179.1	311	10	95
26	93.8	111	10	76	-	-	-	-	4.0	7	2	3	218.1	291	24	115
27	106.9	147	16	51	-	-	-	-	10.9	25	13	5	225.4	419	9	58
28	130.9	161	11	80	-	-	-	-	7.7	11	4	5	368.3	586	13	149
29	110.8	150	13	75	-	-	-	-	7.5	21	11	3	409.7	638	18	277
30	102.4	152	13	61	-	-	-	-	7.4	28	8	3	352.2	525	19	177
31	69.0	85	18	47	-	-	-	-	4.8	11	17	2	278.6	641	22	54
Mean: 72.4					**8.2**				**5.7**				**290.7**			

JUNE 2005, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	58.5	84	10	36	-	-	-	-	4.2	8	17	1	585.9	1597	6	65
2	66.5	99	14	41	-	-	-	-	3.2	9	5	1	266.9	675	19	28
3	72.9	105	11	39	-	-	-	-	9.2	19	8	6	178.9	365	9	73
4	93.6	148	13	44	-	-	-	-	3.9	12	7	0	257.0	346	7	183
5	66.0	87	15	42	-	-	-	-	2.2	7	9	0	214.2	284	20	132
6	53.9	78	15	32	-	-	-	-	3.7	5	17	2	241.6	347	21	145
7	57.1	77	14	35	6.8	8	20	6	3.6	6	22	2	178.3	398	10	84
8	57.0	82	11	37	4.9	7	2	3	2.7	5	3	1	143.6	358	11	21
9	55.4	79	11	39	6.9	12	18	4	3.2	7	16	1	205.0	287	22	108
10	60.9	90	14	40	7.8	13	18	5	2.8	4	11	1	206.6	258	18	131
11	70.4	96	17	45	5.3	9	1	3	4.8	8	17	3	203.0	249	10	100
12	70.1	101	13	42	5.1	7	22	2	4.4	6	11	3	194.7	264	18	135
13	89.9	119	15	50	6.8	14	20	4	2.6	4	15	1	212.9	355	23	51
14	85.7	147	12	23	10.8	35	23	5	5.7	13	11	3	293.8	462	23	133
15	86.7	151	13	19	8.9	15	7	5	2.3	4	11	0	271.9	1023	18	82
16	92.7	134	14	58	6.4	9	7	5	3.9	8	22	1	168.7	277	18	56
17	90.6	125	15	52	5.5	8	7	2	3.1	13	17	1	249.9	368	2	116
18	67.1	77	14	51	3.6	6	1	2	1.4	5	18	0	279.4	357	19	138
19	76.1	100	10	56	3.9	6	23	2	1.9	4	3	0	158.7	189	20	109
20	61.6	88	16	45	5.7	13	23	3	2.9	4	24	2	180.3	249	8	140
21	73.7	105	16	36	7.1	16	24	3	5.5	20	6	2	312.6	403	10	264
22	71.9	106	15	46	7.9	15	1	4	2.4	6	14	0	262.9	365	14	201
23	73.8	93	11	56	5.4	9	24	3	6.3	12	6	5	253.9	336	24	99
24	80.7	114	13	30	7.0	11	5	3	3.1	6	22	0	243.9	386	23	134
25	100.8	149	15	55	7.5	12	21	4	6.7	18	4	3	227.1	389	20	54
26	74.1	105	1	48	3.9	8	1	2	1.6	4	24	0	249.7	437	1	110
27	71.0	108	16	24	5.7	13	3	3	3.1	7	17	1	265.6	955	10	26
28	80.3	116	14	50	4.9	10	24	3	3.2	9	7	0	229.3	550	18	60
29	69.1	93	12	46	5.0	8	24	2	5.0	22	12	2	352.1	526	9	167
30	58.6	79	14	43	4.4	8	22	2	0.4	2	12	0	299.3	1016	8	74
31																
Mean: 72.9					**6.1**				**3.6**				**246.3**			

JULY 2005, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	68.4	106	15	24	6.7	11	20	3	3.9	8	8	1	184.2	342	24	92
2	70.5	106	14	32	8.4	22	2	3	6.6	8	12	5	423.0	628	2	129
3	69.3	97	12	41	6.3	12	24	2	3.2	7	24	0	433.8	551	17	325
4	71.1	111	15	21	9.2	20	5	3	4.6	16	21	2	382.3	536	18	288
5	70.8	107	15	33	9.7	16	20	4	13.8	54	11	4	327.5	516	18	221
6	68.5	96	16	33	8.8	12	5	5	9.2	37	8	3	328.6	488	18	68
7	64.0	108	12	24	8.3	13	21	5	4.1	8	3	1	351.4	788	23	88
8	77.6	127	16	13	10.9	23	24	4	7.3	22	16	2	420.1	1402	6	88
9	62.6	94	10	21	11.5	25	5	4	2.9	5	8	2	230.5	339	18	109
10	62.1	88	13	26	7.6	14	1	2	4.3	6	24	3	393.3	517	6	255
11	66.8	94	15	40	9.7	24	21	3	3.0	6	20	1	346.6	698	14	106
12	60.3	85	17	24	8.5	25	24	2	4.5	9	24	1	529.8	664	17	437
13	73.3	101	10	34	7.3	18	1	3	5.0	8	8	0	609.1	715	10	501
14	90.2	134	15	45	7.9	19	22	2	6.2	11	16	2	434.1	565	16	264
15	77.0	112	14	29	7.6	16	6	3	6.2	15	11	0	418.4	564	17	266
16	79.2	147	12	34	8.5	11	9	5	4.3	19	3	1	188.4	283	18	33
17	58.1	81	12	28	5.3	11	2	2	3.9	5	4	3	219.4	369	16	83
18	56.6	101	14	17	10.7	36	22	3	-	-	-	-	544.6	708	21	343
19	61.4	101	15	37	10.6	21	12	5	-	-	-	-	522.2	738	11	398
20	60.4	89	15	39	6.2	13	20	3	-	-	-	-	278.0	402	18	129
21	51.3	63	14	33	6.6	11	4	3	-	-	-	-	359.6	617	22	88
22	58.1	79	17	38	5.9	8	23	3	-	-	-	-	327.8	581	21	211
23	48.2	72	12	27	6.2	8	19	4	-	-	-	-	215.7	334	3	125
24	45.9	71	14	26	5.9	11	23	3	-	-	-	-	257.9	386	6	189
25	61.4	99	11	33	7.5	12	19	5	-	-	-	-	338.2	453	7	168
26	43.2	98	13	18	6.6	11	21	3	-	-	-	-	390.8	723	9	194
27	72.1	112	13	22	7.8	17	21	4	-	-	-	-	184.7	329	9	89
28	77.0	130	16	11	10.2	22	24	3	-	-	-	-	240.1	442	16	84
29	81	149	13	24	10.0	19	1	3	-	-	-	-	458.5	1112	15	233
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	3.5	6	19	0	-	-	-	-	-	-	-	-
Mean: 65.7					**8.0**				**5.5**				**356.5**			

AUGUST 2005,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	88.7	114	15	61	4.4	8	21	2	-	-	-	-	192.4	256	10	131
2	71.6	107	15	50	5.8	12	22	2	-	-	-	-	241.1	346	21	132
3	77.3	119	12	42	13.1	20	18	10	-	-	-	-	222.6	359	24	91
4	49.3	75	14	28	6.3	9	5	3	-	-	-	-	248.2	340	5	132
5	35.2	56	13	13	5.5	9	20	2	-	-	-	-	179.8	314	18	73
6	44.6	71	12	12	5.3	8	17	4	-	-	-	-	308.1	465	15	95
7	47.5	70	14	20	4.3	10	23	1	-	-	-	-	225.5	345	21	156
8	50.7	70	14	30	5.5	10	1	3	-	-	-	-	81.6	143	1	31
9	55.6	75	14	29	3.8	7	3	2	-	-	-	-	115.5	186	19	53
10	71.4	100	15	49	4.2	9	21	1	-	-	-	-	383.7	927	21	30
11	43.1	51	12	33	5.3	7	18	3	-	-	-	-	516.9	576	16	459
12	39.9	60	16	28	6.0	10	22	1	-	-	-	-	396.8	481	21	300
13	47.4	70	9	24	5.2	9	13	3	-	-	-	-	177.6	291	13	84
14	38.2	68	16	21	4.6	9	21	1	-	-	-	-	172.7	270	6	63
15	47.3	81	13	10	5.7	10	4	2	-	-	-	-	181.4	225	4	106
16	39.9	74	14	23	11.1	22	21	4	-	-	-	-	284.6	403	20	179
17	61.0	99	14	20	9.9	23	23	2	-	-	-	-	193.4	334	7	118
18	54.4	88	15	31	8.5	21	21	2	1.0	3	22	0	404.5	517	10	208
19	53.5	86	15	28	7.8	14	19	2	1.7	4	3	0	294.7	367	20	238
20	52.9	81	16	18	8.7	14	4	4	19.9	77	11	0	263.4	350	10	133
21	80.2	130	14	28	7.5	16	6	3	9.4	28	12	1	410.4	571	18	158
22	70.6	107	13	36	8.7	18	23	3	3.9	23	9	1	326.8	448	7	230
23	56.4	100	13	28	12.4	24	21	4	3.4	13	9	1	309.3	484	22	189
24	53.4	106	14	15	8.3	16	4	2	0.9	3	16	0	317.1	410	15	152
25	60.5	115	14	8	6.2	11	24	2	2.9	18	24	1	263.7	537	23	146
26	61.2	92	13	32	4.8	8	4	1	2.5	13	1	0	396.6	602	21	350
27	64.6	97	15	44	6.2	12	22	3	4.4	11	16	1	193.4	317	11	104
28	77.2	111	12	37	5.9	12	7	1	4.1	12	6	1	247.8	352	5	177
29	85.5	111	15	36	5.1	11	24	1	4.6	12	4	1	175.5	255	10	89
30	98.9	146	14	32	7.5	19	24	3	8.1	20	10	3	365.9	497	13	242
31	61.2	115	15	25	12.6	26	21	4	3.4	7	1	1	215.2	605	6	35
Mean: 59.3					**7.0**				**5.0**				**267.9**			

SEPTEMBER 2005, BELSK

Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	51.6	87	14	19	11.0	31	21	2	2.6	8	6	0	260.9	448	14	96
2	49.8	76	15	27	8.0	22	7	1	1.5	6	6	0	272.9	424	7	164
3	61.8	96	14	36	4.7	9	6	2	2.1	20	9	0	257.3	374	1	156
4	85.2	118	15	39	2.5	5	1	1	1.7	9	1	0	261.8	372	9	169
5	85.9	121	14	58	4.4	9	20	2	2.2	4	14	1	207.6	411	7	120
6	100.0	138	16	66	8.5	21	19	3	6.6	15	22	3	325.3	865	11	214
7	94.3	125	15	49	7.6	22	6	3	5.8	17	1	3	287.5	520	6	187
8	95.6	133	15	68	10.8	15	21	7	7.9	12	6	4	415.5	659	13	224
9	96.0	128	15	73	12.0	21	19	6	4.3	10	7	2	368.0	495	7	276
10	76.9	114	12	47	13.0	30	3	1	5.3	11	19	3	396.6	499	23	283
11	79.3	113	15	53	6.9	15	7	2	4.9	15	13	1	446.0	524	7	380
12	69.1	104	12	48	6.0	9	21	2	3.7	13	10	1	324.9	461	7	226
13	69.4	88	12	48	3.8	12	24	0	2.2	3	24	1	326.9	455	24	241
14	73.8	107	15	40	7.5	14	4	2	9.0	46	11	1	211.8	456	8	114
15	71.0	115	14	57	5.2	10	20	1	7.2	33	17	1	253.9	501	12	138
16	53.7	64	11	42	6.9	16	7	2	3.2	8	10	1	228.2	364	9	161
17	53.5	70	13	42	6.3	14	23	1	1.6	5	22	0	115.4	185	15	66
18	61.4	88	14	33	6.7	21	2	1	2.3	5	24	1	224.0	379	2	102
19	67.2	90	15	43	4.7	14	19	1	2.3	11	10	0	126.7	233	7	52
20	70.9	93	12	53	7.6	11	12	4	3.3	8	9	1	257.1	784	12	69
21	56.7	95	14	17	10.4	21	19	3	2.3	5	6	1	215.3	375	19	139
22	36.0	78	14	5	10.2	21	5	2	2.7	9	9	1	257.9	489	11	139
23	51.2	109	13	4	12.2	21	18	6	7.8	32	15	2	473.2	1426	16	162
24	62.4	106	14	31	10.9	21	18	5	7.5	40	11	1	308.2	523	4	95
25	67.9	109	15	32	9.2	15	6	5	4.4	12	17	2	504.1	681	5	367
26	69.7	117	14	30	10.8	23	19	5	3.7	9	8	1	265.5	446	22	63
27	59.3	109	13	26	9.6	16	20	4	4.9	15	8	0	323.8	560	4	144
28	61.7	106	13	27	9.4	14	20	4	4.0	7	10	2	274.7	646	14	58
29	41.8	58	4	25	8.9	13	2	4	4.7	12	21	2	153.5	274	20	49
30	34.1	54	14	16	7.5	12	24	4	1.2	4	9	0	128.9	299	14	46
31																
Mean: 66.9					**8.1**				**4.1**				**282.4**			

OCTOBER 2005,BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	27.6	47	12	13	11.6	20	18	6	2.8	6	18	0	248.0	335	20	152
2	33.5	74	14	8	9.8	18	19	5	1.7	3	10	1	379.7	492	24	301
3	23.4	62	15	2	29.1	51	24	16	7.1	27	12	3	721.1	1351	17	365
4	38.9	78	13	4	17.9	49	1	7	3.0	5	1	2	256.4	440	1	114
5	31.5	73	14	8	16.1	31	20	7	1.7	4	17	0	163.2	276	20	94
6	30.4	59	13	4	17.2	24	14	7	11.5	63	11	1	310.1	666	7	123
7	42.8	77	14	7	16.6	38	17	6	7.1	42	16	1	251.4	333	17	156
8	52.6	84	14	23	13.2	22	19	7	3.3	10	18	1	261.6	334	23	162
9	57.7	94	14	25	11.2	17	22	6	4.0	8	18	1	351.6	583	19	193
10	67.8	104	14	21	12.8	23	8	6	5.7	26	11	2	408.4	677	7	258
11	52.7	91	14	15	15.9	24	18	6	4.2	17	10	1	416.1	525	23	300
12	54.7	99	14	30	20.7	39	19	11	15.5	67	14	1	482.8	710	19	351
13	24.3	54	1	2	22.6	33	14	14	4.2	20	13	1	543.3	816	19	297
14	25.1	51	13	8	14.1	24	20	9	4.5	12	8	0	558.2	782	22	320
15	46.9	82	11	19	11.7	19	3	5	3.0	9	12	0	350.2	532	8	102
16	49.9	64	12	40	6.2	9	18	4	0.8	2	19	0	446.3	661	19	188
17	41.9	57	14	33	8.6	15	18	5	1.4	4	11	0	310.2	406	19	168
18	44.4	58	14	35	8.0	15	23	5	1.6	5	22	0	305.6	492	22	176
19	40.8	70	13	22	12.2	23	21	6	3.8	17	18	0	373.1	683	19	170
20	32.4	64	14	3	21.9	33	17	13	9.3	17	11	3	593.0	906	4	301
21	45.9	82	14	23	16.8	25	18	9	9.8	14	3	4	440.6	1105	3	134
22	46.0	64	14	29	13.4	21	17	10	7.4	15	13	3	348.0	505	1	201
23	46.0	64	14	35	10.2	12	13	7	6.2	13	14	2	360.1	610	12	83
24	46.1	72	14	9	9.9	24	22	3	3.7	14	15	1	360.4	818	20	146
25	34.6	46	22	15	16.2	21	1	11	7.4	12	24	2	343.9	502	10	226
26	58.0	69	12	40	8.4	16	2	5	3.0	14	1	1	159.2	243	1	69
27	46.7	65	15	19	11.3	28	24	6	4.0	7	3	0	359.3	670	20	136
28	31.1	56	14	8	16.0	29	6	5	12.6	107	11	1	430.5	845	17	156
29	43.3	62	13	32	7.6	10	20	6	1.7	3	12	1	300.1	429	20	227
30	38.8	63	14	27	9.6	18	17	6	4.4	8	23	2	320.7	456	20	155
31	45.4	65	14	27	12.0	29	23	0	12.8	12	23	2	409.1	629	21	10
Mean:	**42.0**				**13.8**				**5.5**				**373.0**			

NOVEMBER 2005, BELSK																
	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
Day	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	52.9	76	13	37	13.2	23	19	6	5.1	10	19	1	445.7	753	19	265
2	44.0	74	12	16	23.9	50	24	11	17.2	79	14	6	631.5	1154	24	386
3	30.1	49	13	14	32.4	50	21	18	10.1	17	13	7	800.0	1063	1	476
4	40.6	71	13	7	21.8	30	6	13	7.3	14	11	5	648.1	882	1	452
5	47.3	58	3	28	17.3	27	18	8	7.0	15	18	3	493.9	764	20	273
6	38.1	63	14	7	11.6	35	23	5	3.7	7	2	2	329.6	917	23	44
7	9.6	22	2	2	19.7	26	20	12	1.9	4	24	1	656.8	903	21	364
8	13.4	38	13	2	20.5	34	20	12	6.2	17	24	1	654.8	1036	23	356
9	7.6	17	21	2	20.5	28	1	14	5.5	11	15	2	812.1	1288	14	530
10	17.1	33	11	7	18.1	37	17	11	5.0	9	12	2	655.0	1193	18	240
11	18.1	30	14	2	18.9	32	2	14	4.8	11	2	3	542.6	722	1	388
12	11.5	25	12	2	20.6	30	17	14	5.3	8	14	4	602.5	977	18	91
13	18.2	34	23	3	16.2	23	2	10	5.8	12	24	2	810.9	1035	6	554
14	34.7	45	19	16	15.8	30	16	10	12.5	33	24	1	379.3	570	3	230
15	38.8	66	13	18	11.5	19	5	4	10.3	16	20	4	-	-	-	-
16	18.1	37	11	3	14.8	26	22	8	3.7	7	21	2	-	-	-	-
17	42.9	62	11	20	5.2	15	1	1	5.9	10	10	2	-	-	-	-
18	37.3	48	2	26	5.2	10	23	2	6.9	16	13	4	-	-	-	-
19	33.1	42	13	15	5.4	9	21	2	4.8	10	22	2	-	-	-	-
20	34.9	56	14	9	4.3	15	2	0	4.6	8	2	2	-	-	-	-
21	24.8	42	14	2	9.2	22	11	0	4.4	12	11	1	-	-	-	-
22	16.7	35	1	2	9.9	18	21	1	5.2	14	9	2	-	-	-	-
23	3.2	8	12	2	10.4	16	24	5	4.9	7	11	3	-	-	-	-
24	29.8	42	9	3	7.7	19	1	2	6.2	12	13	2	-	-	-	-
25	29.7	37	17	19	10.2	25	21	4	12.1	23	21	5	-	-	-	-
26	22.6	32	11	12	17.6	31	15	8	12.4	29	5	3	-	-	-	-
27	23.9	31	5	4	11.5	21	23	6	4.6	7	12	2	-	-	-	-
28	27.2	45	13	2	17.2	35	18	3	14.7	23	19	7	-	-	-	-
29	25.7	41	13	16	18.5	27	19	10	11.5	22	1	7	-	-	-	-
30	22.4	51	13	9	20.7	40	17	11	10.3	17	11	7	-	-	-	-
31																
Mean: 27.1					**15.0**				**7.3**				**604.5**			

DECEMBER 2005, BELSK																
Day	Ozone				Nitrogen Dioxide				Sulfur Dioxide				Carbon monoxide			
	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min	mean	max	h_{max}	min
1	17.1	43	24	5	20.6	49	20	6	12.8	66	20	4	-	-	-	-
2	41.8	50	3	29	7.5	12	10	3	10.3	32	10	3	-	-	-	-
3	24.1	32	2	17	11.1	22	15	5	17.8	51	12	1	-	-	-	-
4	15.3	29	2	4	15.6	30	18	6	8.2	13	23	5	-	-	-	-
5	28.2	33	19	16	10.4	14	20	7	6.2	10	20	4	-	-	-	-
6	22.5	35	1	10	7.7	22	14	3	4.1	13	12	1	-	-	-	-
7	10.3	22	3	4	10.6	24	2	2	3.7	6	20	2	-	-	-	-
8	16.1	20	7	11	5.2	9	15	3	3.0	6	1	2	-	-	-	-
9	27.5	56	20	8	3.5	9	7	0	1.8	4	24	1	-	-	-	-
10	39.3	54	22	23	6.1	15	15	0	8.0	18	24	5	-	-	-	-
11	42.8	51	14	27	3.1	9	21	0	5.7	12	1	2	-	-	-	-
12	20.3	31	24	11	9.3	19	16	6	5.4	6	24	4	-	-	-	-
13	49.3	57	17	39	1.5	4	24	0	5.3	17	22	2	-	-	-	-
14	35.7	46	2	27	5.6	10	13	3	3.4	6	14	2	-	-	-	-
15	53.8	68	22	43	3.4	9	15	0	2.2	6	24	1	-	-	-	-
16	50.1	64	1	22	5.7	18	20	0	2.2	5	1	1	-	-	-	-
17	59.2	64	8	52	1.0	3	18	0	4.9	7	2	2	-	-	-	-
18	50.5	56	23	43	1.1	3	7	0	6.0	14	7	1	-	-	-	-
19	47.1	56	15	35	2.9	13	24	0	6.8	14	24	3	-	-	-	-
20	16.2	31	1	6	23.8	35	18	13	17.0	31	3	9	-	-	-	-
21	37.5	46	13	28	9.9	23	20	4	13.6	38	21	4	-	-	-	-
22	25.3	58	23	4	18.3	35	18	5	10.8	18	4	3	-	-	-	-
23	34.8	53	1	13	12.1	29	20	6	5.3	9	21	3	-	-	-	-
24	40.3	62	24	15	9.8	21	8	2	3.8	5	7	2	-	-	-	-
25	59.4	71	7	43	1.7	6	23	0	5.2	10	23	2	-	-	-	-
26	40.6	47	6	28	6.5	13	21	2	7.0	15	14	1	-	-	-	-
27	41.7	55	12	29	6.8	14	8	3	5.2	15	8	1	-	-	-	-
28	33.9	41	10	25	6.8	12	15	4	4.2	10	24	2	-	-	-	-
29	24.3	32	12	19	15.7	26	17	8	19.1	31	16	5	-	-	-	-
30	16.4	31	24	8	27.3	42	10	13	29.7	73	10	13	-	-	-	-
31	39.2	54	18	22	13.3	17	6	9	16.6	29	24	10	-	-	-	-
Mean:34.2					**9.2**				**8.2**				**-**			

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Solar Radiation
Belsk 2004-2005

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Geographical coordinates: $\varphi = 51^o50'$ N, $\lambda = 20^o47'$ E

Altitude: 188 m a.s.l. (ultraviolet meter and pyranometer).

Instrumentation and symbols used in the tables

UV-B – Ultraviolet radiation [MED/day] (MED – Minimum Erythema Dose): sun and sky radiation on a horizontal surface; UV – Biometer model 501 A: Detector S/N: 2011 (Solar Light Co., Philadelphia, U.S.A.).

G – Global (sun and sky) radiation on a horizontal surface in the whole spectral range [MJm^{-2}/day] in the WRR scale; Kipp & Zonen CM11-913891 pyranometer.

G/G_0 – Relative global radiation (in percent); G_0 is the astronomical global radiation.

V – Visibility at 12^h LMT according to the meteorological WMO code:

0	V < 50 m	**5**	2 km ≤ V < 4 km
1	50 m ≤ V < 0.2 km	**6**	4 km ≤ V < 10 km
2	0.2 km ≤ V < 0.5 km	**7**	10 km ≤ V < 20 km
3	0.5 km ≤ V < 1 km	**8**	20 km ≤ V < 50 km
4	1 km ≤ V < 2 km	**9**	50 km ≤ V

SC – Snow cover at 12^h LMT – part of the ground (in percent) covered with snow according to the scale:

1	5% < SC ≤ 25%
2	25% < SC ≤ 75%
3	75% < SC ≤ 100%

Received March 15, 2006
Accepted December 11, 2006

SOLAR RADIATION BELSK 2004

	January					February				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	0,2	0,96	13	6	3	0,9	2,37	23	7	3
2	0,4	1,58	21	6	3	0,4	1,52	14	2	2
3	0,6	2,48	34	7	3	0,5	1,82	17	2	1
4	0,9	3,07	43	6	3	0,6	1,61	15	6	
5	0,6	2,64	37	6	3	1,1	2,86	25	8	
6	0,6	2,42	35	3	3	1,2	4,34	38	6	
7	1,0	3,15	45	5	3	0,8	3,04	26	8	
8	0,6	1,95	28	5	3	1,0	4,78	40	8	
9	1,1	3,72	55	6	3	0,9	3,38	28	7	2
10	0,3	1,23	18	3	3	1,6	7,19	58	8	2
11	0,4	1,48	22	5	3	1,6	8,12	64	9	3
12	0,2	0,89	13	3	3	1,6	7,96	62	8	3
13	0,5	1,87	28	6	3	1,1	3,76	29	6	3
14	0,4	1,38	21	7	3	0,6	1,78	13	5	3
15	0,5	2,20	34	7	3	1,2	3,35	25	7	3
16	0,6	2,75	42	7	3	1,4	3,75	27	7	3
17	0,5	1,89	29	7	3	1,1	2,59	18	7	3
18	0,6	3,64	57	7	3	0,9	2,62	18	6	3
19	0,5	2,92	46	6	3	0,8	2,75	19	6	3
20	0,3	1,90	30	5	3	2,7	10,31	69	7	3
21	0,9	5,08	79	8	3	3,0	10,80	71	9	1
22	0,4	2,63	41	7	3	1,1	3,71	24	7	1
23	0,6	3,15	49	6	3	1,2	2,93	19	6	1
24	0,6	2,49	39	7	3	1,8	5,90	37	6	3
25	1,0	3,18	50	6	3	2,9	10,87	67	7	3
26	0,9	2,39	37	6	3	2,4	8,07	49	7	3
27	1,3	4,56	71	6	3	1,7	5,35	32	4	3
28	0,9	3,41	53	5	3	1,7	6,33	37	6	3
29	1,0	4,53	70	5	3	1,2	3,94	23	6	3
30	0,5	3,06	47	3	3					
31	1,5	5,68	86	7	3					
Total	20,4	84,28				39,0	137,80			
Mean	0,66	2,72	41			1,34	4,75	34		
[illegible]	[illegible]	[illegible]				[illegible]	[illegible]			

SOLAR RADIATION BELSK 2004

Day	March UV - B	March G	March G/Go	March V	March SC	April UV - B	April G	April G/Go	April V	April SC
1	2,5	8,03	46	7	3	8,4	18,70	70	8	
2	1,2	3,19	18	6	3	8,4	20,92	77	8	
3	2,5	9,88	55	8	3	8,6	20,62	75	8	
4	1,5	5,32	29	7	3	5,6	15,14	55	7	
5	4,0	13,73	74	8	3	4,6	10,54	38	7	
6	5,1	14,23	76	7	3	6,0	15,64	55	7	
7	2,9	8,33	44	6	3	2,7	6,97	24	7	
8	3,0	9,57	49	6	3	1,7	3,75	13	7	
9	2,2	5,82	30	7	3	4,3	10,48	36	7	
10	3,6	11,09	55	7	3	4,4	11,32	38	7	
11	4,7	14,46	71	7	3	3,9	9,20	31	7	
12	4,4	13,16	64	7	3	9,8	21,76	72	8	
13	4,8	11,22	54	7	3	6,2	12,34	41	7	
14	2,6	5,22	25	6	2	9,6	23,14	76	9	
15	5,0	12,90	60	6	2	10,3	23,04	75	8	
16	3,9	7,95	36	7		8,5	18,55	59	7	
17	3,2	5,46	25	7		4,0	8,70	28	8	
18	5,1	12,85	57	6		3,4	6,69	21	7	
19	4,0	11,86	52	6		8,2	17,15	54	7	
20	2,8	7,42	32	8		9,6	18,68	58	4	
21	3,8	7,01	30	8		9,7	21,83	67	8	
22	4,3	10,56	45	8		6,5	14,19	43	7	
23	5,7	14,38	60	7		11,0	22,38	68	7	
24	2,9	6,78	28	6		2,2	3,74	11	6	
25	0,9	1,81	7	3		3,6	6,38	19	7	
26	1,0	2,07	8	6	2	9,8	20,49	60	7	
27	1,5	3,35	13	7		10,1	23,29	68	7	
28	3,3	9,43	37	7		7,6	16,45	48	7	
29	3,3	7,95	31	6		11,6	25,02	72	8	
30	3,8	8,32	32	7		13,0	26,09	75	8	
31	6,2	12,69	48	7						
Total	105,7	276,04				213,3	473,19			
Mean	3,41	8,90	42			7,11	15,77	51		
Min	0,9	1,81				1,7	3,74			

SOLAR RADIATION BELSK 2004

	May					June				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	13,3	25,54	73	8		17,2	29,53	73	9	
2	10,7	18,64	53	8		15,3	27,13	67	9	
3	7,7	14,10	40	7		16,3	27,88	68	9	
4	11,1	20,68	58	8		14,2	25,71	63	9	
5	7,4	13,97	39	7		8,7	13,31	32	7	
6	11,3	20,89	58	8		12,3	19,47	47	7	
7	9,8	17,30	47	7		14,6	22,44	54	8	
8	5,2	9,36	25	8		14,2	22,12	54	7	
9	8,9	18,23	49	8		15,4	25,30	61	9	
10	5,3	8,66	23	7		10,4	15,00	36	8	
11	10,8	21,04	56	7		15,9	24,94	60	8	
12	11,9	21,15	56	8		8,3	14,15	34	7	
13	7,0	12,01	32	8		12,2	22,95	55	7	
14	12,2	24,60	65	8		14,4	22,64	54	9	
15	5,6	10,81	28	6		12,1	14,65	35	8	
16	8,2	14,43	38	8		10,0	17,28	41	9	
17	9,4	16,66	43	9		14,1	22,25	53	9	
18	8,9	16,22	42	8		9,4	14,24	34	8	
19	14,0	20,69	53	8		13,1	22,53	54	8	
20	13,8	23,00	59	9		5,7	8,34	20	7	
21	12,7	18,65	48	9		6,0	8,95	21	8	
22	10,2	16,57	42	9		17,1	28,22	68	8	
23	8,7	17,25	44	9		14,2	22,28	53	8	
24	11,6	21,77	55	9		13,0	19,56	47	8	
25	6,7	12,05	30	8		10,9	17,74	43	8	
26	11,0	17,11	43	8		10,9	19,34	46	8	
27	10,3	21,03	53	9		17,0	25,85	62	8	
28	10,9	21,75	54	8		11,9	17,86	43	8	
29	11,2	23,14	57	8		15,4	25,36	61	8	
30	12,2	23,43	58	8		12,1	19,08	46	8	
31	16,9	29,44	73	9						
Total	314,9	570,17				382,3	616,10			
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]		

SOLAR RADIATION BELSK 2004

Day	July UV - B	July G	July G/Go	July V	July SC	August UV - B	August G	August G/Go	August V	August SC
1	15,7	23,56	57	7		12,5	22,01	59	7	
2	11,2	17,96	43	7		5,0	6,86	18	7	
3	13,7	22,28	54	8		7,1	9,18	25	7	
4	14,6	24,97	60	8		11,3	18,30	50	8	
5	11,3	15,63	38	7		12,7	22,27	61	8	
6	14,3	20,22	49	8		11,8	22,45	62	8	
7	17,4	28,63	70	9		11,4	20,20	56	8	
8	18,6	27,92	68	8		11,6	21,34	59	8	
9	14,6	22,93	56	7		7,1	12,32	35	7	
10	15,5	26,15	64	9		12,8	22,21	63	8	
11	15,0	26,27	65	8		14,9	24,68	70	9	
12	7,9	12,11	30	8		13,8	22,81	65	8	
13	9,0	13,57	34	8		2,9	5,03	14	6	
14	8,5	12,21	30	8		5,0	7,78	23	7	
15	8,7	13,90	35	7		14,7	24,95	73	9	
16	6,0	8,79	22	7		12,7	22,47	66	8	
17	15,2	21,70	54	8		11,4	20,35	60	8	
18	17,3	26,86	67	7		11,8	21,00	63	8	
19	10,2	16,53	42	7		12,3	22,05	66	7	
20	16,3	25,83	65	7		11,3	19,14	58	8	
21	10,2	18,16	46	7		6,6	10,53	32	8	
22	16,1	25,56	65	7		4,8	7,43	23	8	
23	13,7	20,80	53	7		12,7	23,12	72	9	
24	17,9	26,76	69	8		11,1	20,11	63	8	
25	10,1	14,80	38	7		9,6	16,02	51	9	
26	14,6	23,46	61	8		9,8	16,19	52	8	
27	2,7	3,77	10	6		8,4	14,62	47	8	
28	5,5	7,46	20	8		5,2	7,54	24	8	
29	15,0	25,62	67	7		10,3	17,63	58	8	
30	16,4	27,84	74	8		9,8	18,50	61	8	
31	14,9	24,49	65	8		2,7	3,63	12	7	
[illegible]	[illegible]	[illegible]				[illegible]	[illegible]			

SOLAR RADIATION BELSK 2004

September / October

Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	8,3	17,04	57	8		2,9	4,95	24	7	
2	9,3	18,04	61	7		2,7	4,58	22	6	
3	9,9	19,11	66	8		4,5	7,71	38	7	
4	5,3	8,34	29	7		6,0	12,21	61	7	
5	9,3	15,00	52	8		6,0	11,44	58	7	
6	9,7	15,92	56	7		5,5	11,72	61	7	
7	8,7	15,92	57	7		1,8	3,22	17	7	
8	7,7	15,87	57	9		3,7	6,30	34	7	
9	7,4	13,07	48	9		2,2	4,17	23	7	
10	10,0	18,90	70	9		1,9	4,45	24	6	
11	9,7	18,68	70	9		2,2	4,94	28	8	
12	7,9	13,69	52	9		4,2	12,17	69	9	
13	8,0	15,73	60	8		4,2	11,92	69	9	
14	9,4	17,45	67	8		3,6	9,82	57	9	
15	3,0	4,51	18	6		3,2	8,95	53	8	
16	7,6	15,82	62	9		2,4	5,38	33	7	
17	8,0	16,10	64	9		2,7	7,23	44	8	
18	8,6	17,09	69	9		1,5	3,90	24	8	
19	7,7	16,27	67	7		1,8	4,65	30	8	
20	5,6	12,21	51	7		2,3	6,40	41	8	
21	2,7	4,89	21	8		1,0	1,81	12	6	
22	3,6	6,90	29	7		3,0	8,60	58	8	
23	3,8	8,27	36	7		2,6	6,92	47	8	
24	3,6	8,55	37	7		3,0	7,81	54	8	
25	4,7	10,35	46	7		2,7	7,60	54	7	
26	4,1	9,19	41	7		2,7	7,70	55	7	
27	5,6	12,79	58	8		1,3	2,98	22	6	
28	4,8	9,04	42	7		0,9	1,95	15	6	
29	2,8	4,36	20	7		2,2	6,57	50	7	
30	2,5	3,92	19	8		1,5	3,20	25	7	
31						1,2	2,33	18	7	

SOLAR RADIATION BELSK 2004

	November					December				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	1,1	2,17	17	7		0,8	2,97	40	6	
2	1,6	3,46	28	7		0,4	1,73	23	6	
3	2,0	4,57	38	6		0,4	1,55	21	6	
4	2,0	5,49	46	6		0,3	1,43	20	6	
5	0,5	1,11	10	6		0,6	3,28	46	6	
6	1,1	3,02	27	7		0,4	1,69	24	7	
7	0,9	2,31	21	7		0,3	1,12	16	6	
8	0,4	1,04	9	7		0,2	0,87	13	6	
9	0,5	1,40	13	6		0,5	2,53	37	7	
10	1,3	4,83	46	6		0,2	0,87	13	5	
11	0,4	1,26	12	6		0,6	3,26	49	4	
12	0,5	1,32	13	5		0,2	0,99	15	4	
13	0,3	0,73	7	6		0,2	0,79	12	4	
14	1,1	4,54	46	7		0,1	0,50	8	6	
15	1,2	2,87	30	6		0,3	1,38	21	6	
16	1,1	4,01	42	7		0,8	3,62	56	7	
17	0,6	2,08	22	7		0,6	2,54	39	7	
18	0,5	2,56	28	7		0,2	1,06	17	6	
19	0,2	0,81	9	3	2	0,2	1,07	17	5	
20	1,1	4,46	50	8	3	0,3	1,46	23	5	
21	1,0	3,39	39	8	3	0,2	0,91	14	2	2
22	1,0	3,16	37	6	3	0,2	0,90	14	5	2
23	0,9	3,47	41	7	2	0,2	0,81	13	6	2
24	0,5	2,09	25	7	2	0,2	0,80	12	7	
25	0,8	2,36	29	6	2	0,5	2,57	40	7	
26	1,1	3,27	41	7	2	0,4	1,54	24	6	
27	0,4	1,24	16	4	1	0,2	0,78	12	7	
28	0,4	1,28	16	7		0,2	0,66	10	6	
29	0,2	0,96	13	4		0,2	1,21	19	5	
30	0,3	0,95	13	6		0,2	0,93	14	5	
31						0,2	0,79	12	6	

SOLAR RADIATION BELSK 2005

	January					February				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	0,1	0,50	8	4		0,8	2,89	28	7	2
2	0,3	1,19	18	7		0,9	3,19	30	6	2
3	0,3	1,77	26	8		0,9	2,37	22	6	2
4	0,2	0,78	11	6		0,6	1,66	15	4	2
5	0,4	1,96	28	8		1,5	4,99	44	5	2
6	0,3	1,12	16	6		1,9	7,83	68	6	2
7	0,4	1,19	17	7		1,8	7,94	68	7	2
8	0,9	3,72	52	7		1,9	7,98	67	6	2
9	0,8	4,17	58	9		1,7	8,35	69	6	2
10	0,8	2,36	32	7		1,9	7,63	62	5	2
11	0,8	3,24	44	7		1,2	3,48	28	5	2
12	0,8	4,17	56	7		1,1	3,21	25	4	2
13	0,5	2,15	28	7		1,7	7,66	58	8	2
14	0,2	1,11	14	7		1,3	4,98	37	8	2
15	0,6	2,97	38	7		1,4	5,12	38	6	2
16	0,5	2,30	29	4		0,8	2,31	17	4	3
17	0,9	4,84	60	6		1,0	2,84	20	4	3
18	0,9	4,47	55	6		1,4	3,63	25	4	3
19	0,2	1,45	17	6		1,1	3,22	22	5	3
20	0,2	1,02	12	4	2	1,6	4,58	31	5	3
21	0,3	1,56	18	7	1	2,2	6,31	42	5	3
22	0,5	3,16	36	7	1	1,8	4,60	30	5	3
23	0,4	2,08	23	7	1	0,9	2,15	14	6	3
24	0,4	2,06	23	6	1	0,5	1,48	9	5	3
25	0,6	3,37	37	6	2	1,4	3,64	22	5	3
26	0,8	2,65	28	7	2	2,0	5,50	33	5	3
27	0,9	2,95	31	4	2	3,7	12,54	75	8	3
28	0,8	3,08	32	6	2	3,2	10,84	63	6	3
29	0,5	1,97	20	4	2					
30	0,6	2,08	21	6	2					
31	0,9	2,19	21	4	3					
Total	16,8	73,63				42,2	142,92			
Mean	0,54	2,38	29			1,51	5,10	38		
Mi[illegible]	0,1	0,50				0,5	1,48			

SOLAR RADIATION BELSK 2005

	March					April				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	3,0	7,92	46	4	3	6,9	19,32	72	7	
2	4,1	10,95	62	7	3	6,8	19,20	71	7	
3	2,8	10,78	60	6	3	7,1	18,14	66	7	
4	2,5	9,80	54	6	3	7,6	19,10	69	7	
5	2,5	9,28	50	6	3	7,2	18,76	67	7	
6	2,0	6,24	33	6	3	7,2	13,68	48	7	
7	2,3	5,57	29	4	3	5,1	11,18	39	7	
8	2,2	5,58	29	6	3	4,7	11,42	40	7	
9	3,0	8,81	45	6	3	1,7	3,50	12	6	
10	4,0	11,91	60	8	3	2,9	6,01	20	8	
11	2,6	6,71	33	6	3	7,0	15,60	52	8	
12	2,8	6,57	32	5	3	5,8	11,57	39	7	
13	4,7	12,24	58	8	3	8,9	19,07	63	7	
14	4,6	11,61	55	7	3	8,2	18,34	60	7	
15	5,3	13,28	62	7	3	5,9	11,85	38	6	
16	4,1	7,79	36	7	3	7,2	17,52	56	7	
17	4,1	9,12	41	6	2	8,9	21,29	68	6	
18	1,6	3,07	14	5	1	6,0	13,09	41	6	
19	5,0	13,51	59	8	1	8,5	17,34	54	7	
20	3,9	10,10	44	8		9,0	22,92	71	9	
21	4,1	9,57	41	8	1	6,9	19,85	61	8	
22	7,2	17,16	72	8	1	6,6	16,71	51	7	
23	7,2	16,19	67	7		5,0	11,44	35	8	
24	4,6	10,92	45	6		9,7	24,30	73	9	
25	4,5	9,27	38	6		10,0	23,89	71	7	
26	4,2	8,94	36	3		4,6	8,38	25	6	
27	3,6	7,37	29	6		8,7	20,47	60	7	
28	7,0	17,57	69	7		2,2	3,54	10	7	
29	6,6	17,45	68	8		8,9	20,21	58	7	
30	6,3	18,28	70	8		10,4	21,45	62	7	
31	6,6	18,93	71	7						
Total	129,0	332,49				205,6	479,14			
Mean	4,16	10,73	49			6,85	15,97	52		
Min	1,6	3,07				1,7	3,50			

SOLAR RADIATION BELSK 2005

Day	May UV - B	May G	May G/Go	May V	May SC	June UV - B	June G	June G/Go	June V	June SC
1	6,9	11,79	34	7		9,8	17,81	44	9	
2	15,0	23,95	68	8		12,6	20,17	49	9	
3	12,5	19,47	55	8		10,8	16,17	40	8	
4	2,3	2,95	8	5		12,9	20,89	51	8	
5	4,8	7,13	20	8		11,7	22,43	55	8	
6	5,7	9,44	26	8		10,3	17,66	43	8	
7	7,7	14,39	39	8		9,9	18,75	45	8	
8	6,0	11,75	32	8		8,6	16,38	40	8	
9	7,9	16,17	44	9		10,8	17,21	42	9	
10	8,3	19,26	52	8		8,8	13,14	32	9	
11	8,6	18,48	49	9		7,6	13,47	32	9	
12	8,8	19,07	51	9		10,5	18,29	44	8	
13	9,0	19,57	52	9		16,4	28,26	68	8	
14	14,2	25,94	68	9		14,3	24,67	59	7	
15	10,1	18,08	47	8		13,3	22,99	55	7	
16	14,2	26,28	69	9		10,9	16,88	41	7	
17	6,6	10,75	28	7		15,7	23,07	55	8	
18	4,8	7,45	19	7		7,0	10,57	25	8	
19	13,8	24,27	62	9		13,8	21,89	52	8	
20	16,4	29,70	76	9		10,9	19,21	46	7	
21	17,5	29,09	74	9		19,3	30,65	73	9	
22	17,5	28,36	72	9		7,2	11,43	27	8	
23	17,8	28,42	72	6		15,6	24,19	58	9	
24	6,5	9,65	24	7		17,9	28,18	68	9	
25	16,4	26,35	66	8		17,0	28,08	67	8	
26	18,4	28,74	72	8		18,1	25,26	61	9	
27	18,9	28,90	72	9		15,7	25,89	62	9	
28	18,3	28,43	71	9		16,5	27,24	65	9	
29	18,6	28,47	71	9		18,0	26,17	63	9	
30	16,6	27,32	68	7		16,6	26,29	63	9	
31	7,5	11,57	29	8						
Total	357,6	611,19				388,5	633,29			
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]		

SOLAR RADIATION BELSK 2005

	July					August				
Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	15,5	25,37	61	8		14,7	24,20	65	8	
2	14,0	23,73	57	8		15,5	23,85	64	9	
3	16,7	29,30	71	9		13,3	22,23	60	8	
4	17,7	29,11	71	9		3,3	4,51	12	6	
5	17,7	30,17	73	9		5,9	7,66	21	8	
6	14,1	25,32	62	9		10,8	15,15	42	8	
7	12,2	20,46	50	7		11,0	18,81	52	9	
8	15,0	27,15	66	8		6,0	9,19	26	8	
9	11,4	19,15	47	8		9,7	15,56	44	8	
10	16,5	28,05	69	9		13,2	23,11	65	9	
11	16,0	27,83	68	8		5,2	8,18	23	8	
12	17,3	29,71	73	9		8,8	13,87	40	8	
13	15,3	26,26	65	8		7,5	13,54	39	7	
14	14,9	26,81	66	9		10,3	17,02	49	8	
15	16,0	25,86	64	8		10,0	16,53	48	7	
16	8,7	14,72	37	8		5,1	8,33	24	7	
17	13,9	23,68	59	7		11,5	19,66	58	7	
18	12,8	18,58	47	8		12,9	22,61	67	7	
19	5,7	8,81	22	8		12,6	22,26	67	8	
20	11,3	17,61	45	8		13,7	23,92	73	9	
21	8,7	13,31	34	8		12,2	22,49	69	8	
22	11,8	19,38	49	8		12,7	21,58	66	8	
23	8,7	13,53	35	8		8,5	14,42	45	7	
24	10,1	16,69	43	8		7,9	13,28	42	7	
25	9,6	14,95	39	7		9,9	18,27	58	7	
26	12,9	21,69	56	8		9,1	15,12	48	8	
27	13,7	21,75	57	8		8,7	15,04	48	8	
28	15,8	25,21	66	8		10,4	18,97	61	8	
29	12,2	18,62	49	7		12,4	20,89	68	8	
30	13,5	22,34	59	6		10,5	19,88	66	8	
31	9,1	12,59	34	9		11,7	21,50	72	9	
[illegible]	[illegible]	[illegible]				[illegible]	[illegible]			

SOLAR RADIATION BELSK 2005

September | October

Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	12,3	21,42	72	9		2,7	4,61	22	7	
2	11,2	19,88	67	9		4,8	10,83	53	7	
3	9,8	17,32	59	9		4,1	8,40	41	7	
4	9,5	18,01	62	8		5,2	12,22	61	7	
5	9,6	17,95	63	8		5,1	11,73	60	7	
6	9,1	18,67	66	7		5,5	12,93	67	7	
7	9,1	18,65	67	7		5,2	12,69	67	7	
8	10,4	18,49	67	7		5,0	12,64	67	8	
9	9,3	17,78	65	7		4,5	12,17	66	7	
10	7,3	13,14	48	7		4,3	11,67	64	7	
11	7,1	13,68	51	7		4,1	11,37	63	7	
12	6,3	11,39	43	7		3,4	10,29	58	7	
13	7,7	13,83	53	8		1,1	2,42	14	6	
14	7,4	13,79	53	7		2,0	5,27	31	6	
15	5,0	8,87	35	8		2,3	6,43	38	6	
16	3,9	5,21	21	7		2,7	7,00	42	8	
17	4,3	7,28	29	9		2,4	5,84	36	9	
18	7,6	17,37	70	9		1,2	2,43	15	8	
19	8,5	17,35	71	9		3,0	7,75	49	9	
20	8,4	16,70	69	9		3,6	9,41	61	6	
21	8,5	16,21	68	8		3,2	8,04	53	6	
22	8,6	15,83	67	9		2,9	7,19	48	7	
23	7,5	15,40	66	8		1,7	4,25	29	7	
24	6,6	14,53	63	7		2,5	7,30	51	8	
25	5,9	12,79	57	7		1,8	4,19	30	8	
26	5,9	13,51	61	7		2,0	6,21	45	9	
27	5,5	12,64	57	7		2,4	6,37	47	8	
28	5,8	12,54	58	7		3,0	8,82	66	9	
29	2,9	4,97	23	7		3,1	8,95	68	9	
30	2,4	4,53	21	8		2,8	7,84	61	7	
31						2,8	8,73	69	7	

SOLAR RADIATION BELSK 2005

November / December

Day	UV - B	G	G/Go	V	SC	UV - B	G	G/Go	V	SC
1	2,5	7,88	63	8		0,6	1,86	25	6	2
2	1,9	6,67	54	7		0,3	1,24	17	6	2
3	1,7	5,76	48	6		0,3	1,41	19	5	2
4	1,8	6,16	52	6		0,3	1,52	21	5	1
5	1,4	4,10	35	6		0,3	1,22	17	6	
6	1,5	5,27	46	7		0,2	0,81	12	5	
7	0,5	1,22	11	4		0,1	0,49	7	4	
8	1,5	5,02	46	5		0,3	1,18	17	6	1
9	0,5	1,16	11	4		0,1	0,60	9	7	1
10	0,3	0,74	7	4		0,4	1,95	29	6	1
11	1,0	2,52	24	6		0,3	1,08	16	6	1
12	1,0	2,53	25	6		0,2	0,71	11	5	
13	0,5	1,48	15	5		0,3	1,08	16	7	
14	1,0	3,80	39	6		0,2	0,66	10	5	
15	1,3	5,22	54	6		0,1	0,43	7	7	
16	0,8	2,72	29	6		0,2	0,93	14	7	
17	0,6	2,45	26	7		0,5	2,84	44	7	3
18	0,4	1,45	16	7		0,4	1,85	29	7	3
19	0,6	3,30	37	7		0,5	2,55	40	7	3
20	0,8	3,92	44	7		0,2	1,01	16	5	3
21	0,3	1,44	17	5		0,5	1,86	29	6	3
22	0,3	1,02	12	6	1	0,3	1,48	23	4	3
23	0,4	1,31	16	5	1	0,4	1,67	26	2	1
24	0,4	1,41	17	5	1	0,2	0,60	9	5	
25	0,3	1,12	14	6	1	0,3	1,55	24	8	
26	0,4	1,58	20	5	2	0,4	2,08	32	7	
27	0,3	0,94	12	5		0,3	1,94	30	7	
28	1,0	4,47	57	6	2	0,2	0,96	15	7	2
29	0,9	3,71	48	6	2	0,6	3,22	50	7	3
30	0,8	3,67	49	6	2	0,2	0,88	13	2	3
31						0,3	1,41	21	4	3

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Quality Control of Belsk's Dobson Spectrophotometer: Comparison with the European Sub-Standard Dobson Spectrophotometer and Satellite (OMI) Overpasses

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A b s t r a c t

The total ozone measurements by Belsk's Dobson spectrophotometer have been compared with the satellite total ozone taken during the OMI (on board of Aura spacecraft) overpasses for the period August 2004 – July 2006. The agreement between both data sets is much better if the results of the recent (June 2005) calibration campaign of Belsk's Dobson at Hohenpeissenberg are incorporated to the standard total ozone calculation software. The bias and standard deviation of the normalized differences between the satellite and Dobson total ozone are less than 1% and 2-3% (lower range of standard deviation is for the most reliable ADQP observations), respectively, for that period. These estimates correspond to those found for the satellite–Dobson comparisons carried out for Hradec Kralove and Hohenpeissenberg.

1. Introduction

Recent analyses of the total ozone measurements from the European ground-based network suggest a beginning of the ozone layer recovery there since the mid 1990s (Krzyścin et al. 2005). Various statistical and chemical-climate models support the notion that both anthropogenic (reduced emission of man-made ozone depleting substances being the result of the Montreal Protocol, 1987) and "natural" processes (internal changes in the atmospheric dynamics and cleaning of the atmosphere after the Mt. Pinatubo volcanic eruption in 1991) contributed to the restoration of the ozone layer (e.g. Chipperfield 2003, Krzyścin 2006).

The quality control of the ground-based spectrophotometers is an important problem when searching for the ozone recovery (e.g., Fioletov et al. 2002, Harris et al.

2003, Stahelin et al. 2003). The European Dobsons frequently participated in the intercomparison campaigns (e.g., Belsk 1974, Potsdam 1979, Arosa 1986 and 1990) with the World Standard Instrument, Dobson No. 83 (e.g., WMO 1994). The regional Dobson calibration center has been established at Meteorological Observatory Hohenpeissenberg (Germany) in 2000 in close cooperation with the Solar and Ozone Observatory Hradec Kralove (Czech Republic), and World Dobson Calibration Center at NOAA, Boulder, Colorado (USA). Many intercomparisons of national instruments with the European sub-standard (the Dobson spectrophotometer No. 64) took place there since then. Belsk's Dobson visited the Calibration Center in 2001 and 2005. To have better agreement between the readings of the sub-standard and Belsk's Dobson spectrophotometer, the new R-N tables have been constructed as a result of the calibration of the instrument wedges during the last intercomparison.

It seems that the total ozone measurements by the spectrophotometer (Ozone Monitoring Instrument – OMI) on board of the Aura satellite spacecraft provide reliable data covering the whole globe since August 2004 (Kroon et al. 2006). Thus, a comparison of the ground-based and satellite spectrophotometer ozone data is another option to examine Belsk's Dobson performance in periods between the intercomparisons with the European sub-standard. A need of next calibration in the Center will be clearly manifested in case of the bias appearing between the satellite and ground-based data.

Recent comparison of total ozone ground-based network (including the Brewer and Dobson spectrophotometers) and the satellite (total ozone mapping spectrophotometer – TOMS on board of the Earth Probe satellite) data showed the small bias in the mean values for the period 1996-2004 (Krzyścin et al. 2005). However, the daily differences between these instruments were not trendless, suggesting that the long-term drift of Dobson spectrophotometer might be of the order of 1-2% for that period. This estimate was close to the statistical error of trend derived from the European ground-based network (Krzyścin et al. 2005). Thus, to establish changes in the total ozone long-term pattern over Europe and therefore discuss more precisely the ozone recovery problem we need more efforts to limit the uncertainty level of ozone data and respond almost immediately to the instrument aging.

2. Comparison of the ground-based and satellite data

Figure 1 shows the differences between total ozone taken during the satellite overpasses and that measured by the Dobson spectrophotometer. Total ozone has been measured every day (sometimes twice a day) by OMI on board of the Aura spacecraft since August 2004. Here, the OMI total ozone column data retrieved with the TOMS Version 8 algorithm are examined. The satellite data are freely available on web page http://avdc.gsfc.nasa.gov/phpgdv2/avdc_tablefile.php?id=28. For comparison we select the results of the Dobson ozone measurements being as close as possible to the overpass time. Only the measurements taken in ±1-hour interval relative to the overpass time are used for Fig. 1.

The Dobson total ozone used in Fig. 1 is calculated by means of the calibration constants obtained during the 2001 intercomparison held at Hohenpeissenberg observatory. The data are divided into classes according to the observation type (on zenith or sun, abbreviation ZC for cloudy zenith, ZB for blue zenith, and QP for direct sun observation are used, see the figure legend) and the wavelength pair applied (AD or CD), for more details of the Dobson measurements see Dziewulska-Łosiowa, 1991. It is not surprising that the largest differences (up to 10-15%) are found for CDZC observations known to be the most unreliable.

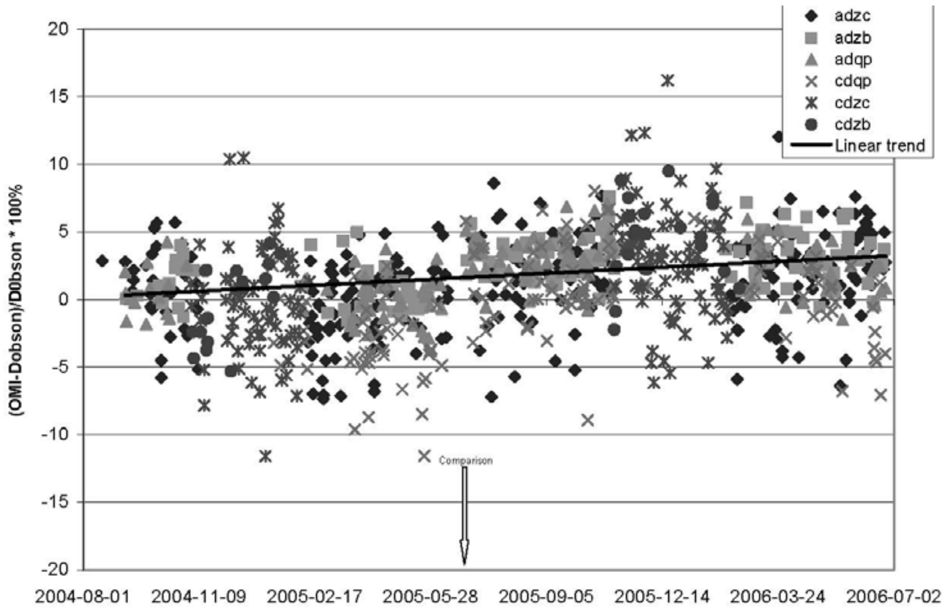

Fig. 1. The differences between OMI TOMS total ozone taken during the satellite overpasses and Belsk's Dobson total ozone in percent of OMI TOMS values for the period August 2004 – July 2006. Ground-based total ozone is calculated using the calibration constants obtained during the 2001 comparison at the Regional Calibration Center Hohenpeissenberg, Germany. The data are divided into classes according to the observation type (QP, ZB, and ZC) and the wavelength pair applied (AD or CD). Solid line represents the linear regression fit to the differences for ADQP observations.

The straight line in Fig. 1 represents the linear regression fit to the satellite-ADQP Dobson differences. ADQP observations by the Dobson spectrophotometer provide the most reliable results. It is seen that there is a drift in the differences, i.e., the Dobson ozone based on the 2001 calibration is too low in the second half of the record. A step change in the differences appeared in summer 2005. The calibration of the instrument wedges during the intercomparison seems to be a possible source of this step change. Figure 2 illustrates that the drift disappears (and also the step change) when the total ozone is calculated with use of the new (2005) calibration constants for the observations taken after the intercomparison.

The results of the satellite–Dobson intercomparison are summarized in Table 1 for all classes of the Dobson observations. The agreement between satellite and ground-based data sets is better after application of the newest calibration constants.

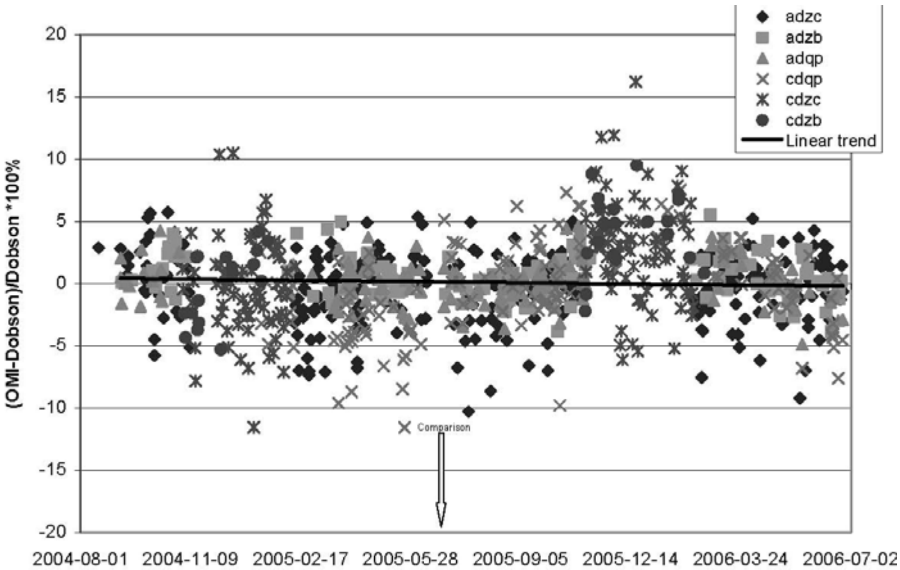

Fig. 2. The same as Fig.1 but the Dobson total ozone since June 2005 is calculated using the calibration constants obtained during the 2005 comparison at the Regional Calibration Center.

Since the last intercomparison, the previous (2001) calibration constants cannot be further used. The 2005 calibration affected mostly AD observations keeping CD observations almost unchanged. The overall bias between the OMI and ground-based observations is lower than 1% with the standard deviation of about 3%.

Table 1

The mean differences between OMI TOMS overpasses and Belsk's Dobson total ozone in percent of the ground-based data for the period August 2004 – July 2006 separately for the Dobson ozone calculated with the 2001 calibration constants and the 2005 calibration constants applied for the Belsk's observations after the 2005 intercomparison. The pertaining standard deviations are in parentheses

Type of observations	(OMI – Dobson)/Dobson •100%	
	2001 calibration	2005 calibration
ADQP	1.86(2.14)	0.07(1.77)
ADZB	2.55(1.96)	0.65(1.77)
ADZC	1.13(3.32)	–0.38(2.96)
CDQP	–0.25(3.78)	–0.64(3.63)
CDZB	2.35(3.72)	2.29(3.66)
CDZC	1.43(4.26)	1.28(4.20)
All data	1.36(3.38)	0.23(3.18)

It is worthwhile to find the differences between the satellite and Dobson total ozone for other European stations. The daily means of total ozone from the Dobson measurements at Hradec Kralove and Hohenpeissenberg are taken from World Ozone Data Center, Toronto, Canada. These values and also the Belsk's daily means are used for comparison with the daily means of the total ozone from the OMI observations over these sites for the period August 2004 – June 2006. The results are shown in Table 2. The smallest bias is found for the Belsk's total ozone data set that includes 2005 calibration. Thus, the Belsk's Dobson is almost equivalent to the OMI data. The highest standard deviations found for the Belsk overpasses are due to less reliable **zc** observations carried out in late autumn and early winter seasons, being usually very cloudy in Poland. Other stations use mostly ADQP observations and do not measure total ozone during not perfect weather conditions. However, the standard deviation would be the smallest for the Belsk's ozone set if only the most accurate ADQP observations were included in the comparison.

Table 2

The mean differences (in percent of the Dobson ozone) between daily means of the OMI TOMS and ground-based total ozone data for Hohenpeissenberg, Hradec Kralove, and Belsk (separately for all types of the observations jointly, and ADQP subset with 2001 and 2005 calibration constants). The pertaining standard deviations are in parentheses

Station	Data	(OMI – Dobson)/Dobson •100%
Hradec Kralove	all	1.19(2.12)
Hohenpeissenberg	all	1.59((2.21)
Belsk	all (2005 cal.)	0.26(2.94)
Belsk	ADQP(2005 cal.)	0.31(1.94)
Belsk	all (2001 cal.)	1.30(3.10)
Belsk	ADQP(2001 cal.)	1.90(2.17)

3. Conclusions

The total ozone measurements by Belsk's Dobson spectrophotometer utilizing results of the recent (2001 and 2005) calibrations campaigns at Hohenpeissenberg observatory correspond to the satellite total ozone measured by OMI on board of the Aura spacecraft. The calibration campaign appeared very fruitful for keeping high quality and homogeneity of the total ozone time series and continuation of the frequent intercomparisons with the European Sub-standard is evidently needed.

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OCENA JAKOŚCI POMIARÓW OZONU SPEKTROFOTOMETREM DOBSONA W BELSKU: PORÓWNANIE Z EUROPEJSKIM WZORCEM SPEKTROFOTOMETRU DOBSONA ORAZ SATELITĄ (OMI)

Streszczenie

Wyniki pomiarów całkowitej zawartości ozonu spektrofotometrem Dobsona w Belsku porównano z całkowitą zawartością ozonu zmierzoną spektrofotometrem OMI (zainstalowanym na satelicie Aura) podczas przelotów nad stacją w okresie od sierpnia 2004 do lipca 2006. Zgodność między naziemnymi i satelitarnymi pomiarami jest lepsza wówczas, gdy dane z Belska zostały przeliczone z wykorzystaniem stałych

kalibracyjnych spektrofotometru Dobsona uzyskanych podczas ostatniego porównania przyrządu w centrum kalibracyjnym w Hohenpeissenberg w czerwcu 2005 r. Stwierdzono, że średnia różnica między satelitarnym i naziemnym ozonem (wyrażona jako procent całkowitej zawartości ozonu zmierzonej przez spektrofotometr Dobsona) jest mniejsza od 1% z odchyleniem standardowym między 2-3%, przy czym wartość 2% otrzymano dla najbardziej wiarygodnych naziemnych pomiarów ozonu o typie ADQP. Powyższe oszacowanie potwierdzono porównując średnie dzienne całkowitej zawartości ozonu zmierzone przez satelitę i naziemne spektrofotometry Dobsona zainstalowane na innych europejskich stacjach Hohenpeissenberg (Niemcy) i Hradec Kralove (Republika Czeska).

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UV Measurements at the Polish Polar Station, Hornsund, Calibration and Data for the Period 2005-2006

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Abstract

Measurements of various radiative quantities have been resumed at the Polish Polar station, Hornsund, in spring 2005. The UV-B, UV-A, total solar irradiances and the sunshine duration with 1-min resolution are available there, together with the aerosols characteristics (single scattering albedo, aerosols optical depth). The quality of the UV data is assured by comparison of the instruments' readings with the output of Institute of Geophysics, Polish Academy of Sciences, traveling UV calibration system. The daily and seasonal variations of UV-B, UV-A, and total solar irradiance are discussed for the period March 2005 – September 2006. The daily doses of UV-B, UV-A, daily sum of the total solar irradiance, and the UV index are shown in the table. The maximum value of UV daily dose and UV index found in late spring were ~3000 J_{eryt}/m^2 and ~4, respectively. These values are larger than our previous estimates obtained from the biometer measurements (5-min resolution) over the period 1996-1997 (Krzyścin and Sobolewski, 2001). Importance of the ground albedo variations on the UV-B irradiance is demonstrated and a need of setting off such observations at Hornsund is suggested.

1. Introduction

Measurements of the UV-B radiation reaching ground-level at the Polish Polar Station, Hornsund (Svalbard, 77ºN, 15º30′E) have been initiated in February 1996. The erythemally weighted irradiances averaged over 5-min intervals were measured by an instrument constructed in the Institute of Geophysics, Polish Academy of Sciences (IGF PAS), in the late 1980s. It was an improved version of the Robertson-Berger meter (RBM) that had a temperature stabilization. The RBM was under operation in many countries, including Poland, where such instrument was installed in Central Geophysical Observatory of IGF PAS at Belsk in 1974 (Krzyścin 1996). The RBM was designed to measure erythemal solar irradiance by approximating the spectral response of human skin to ultra violet (UV) irradiance. The IGF PAS instrument was an ancestor of the new-generation of RBMs commercially produced by the Solar Light Company (SLC), the UV Biometer 501A.

The 1996-1997 results of the UV observation at Hornsund were discussed by Krzyścin and Sobolewski (2001) focusing on the factors responsible for the daily variations of the UV doses (daily integral of the 5-min irradiances measured by the instrument) and UV-index (daily maximum of the irradiance). The quality of the UV measurements was assured by comparison of the instrument readings with those calculated from a radiative transfer model under clear-sky conditions. The UV measurements were carried out at Hornsund up to summer 2001 but the 1998-2001 data wait for a re-evaluation because of the instrument deterioration, which was first noticed in 1997 (Krzyścin and Sobolewski 2001).

As the interest in the UV radiation changes over the Arctic has been increasing in recent years (e.g. Johnson et al. 2002, Lud et al. 2002, Rinnan et al. 2005) we decided to resume the UV observations at Hornsund using more reliable instruments and calibration procedure.

2. Instrument setup

In spring 2004 the Kipp&Zonen dual band (UV-A, UV-B) biometer, UV-S-AE-T, was fixed at a platform mounted close to the roof of the Hornsund observatory (Fig. 1). The instrument measures the irradiance in two spectral bands (erythemally weighted UV-B and UV-A integrated over the 320-400 nm band) with 2 sensors placed in one thermally stabilized housing yielding separate outputs for each band. To have more comprehensive information of the solar radiation reaching the ground level at Hornsund, we also installed a pyranometer (Kipp&Zonen CM-11 for the total solar irradiance over whole spectrum, ~300-3000 nm) and sunshine duration meter (Kipp&Zonen CSD1 for identification of the cloudless conditions, it is equivalent to the classic Campbell-Stockes sunshine recorder used since mid-19 century). Fortunately, it was possible to measure the atmospheric aerosols properties (since March 2004) at the same place by means of a CIMEL CE-318-2 sunphotometer working under framework of AERONET program sponsored by NASA. All the Hornsund radiation equipment together with the calibration system is shown in Fig. 1.

3. Calibration

It is well recognized that UV broad-band instrument needs frequent (at least every year) calibration with a reference spectrophotometer because of sometimes very abrupt deterioration of its spectral properties. Transportation of such a spectrophotometer (e.g. the Brewer spectrophotometer involved in routine UV spectra and ozone measurements at Belsk) to the Arctic station appears beyond our ability. It should be mentioned that the station is located in rather isolated place in Svalbard, out of regular connection with neighboring city Longyearbyen (in ~150 km distance). Frequently the station is only accessible by a helicopter or snowmobile. Thus, we decided to calibrate the Hornsund biometer using a secondary standard consisting of well calibrated biometers that have compact size enabling transportation in severe weather conditions. UVB-1 and UVA-1 biometer, being product of the Yankee Environmental System

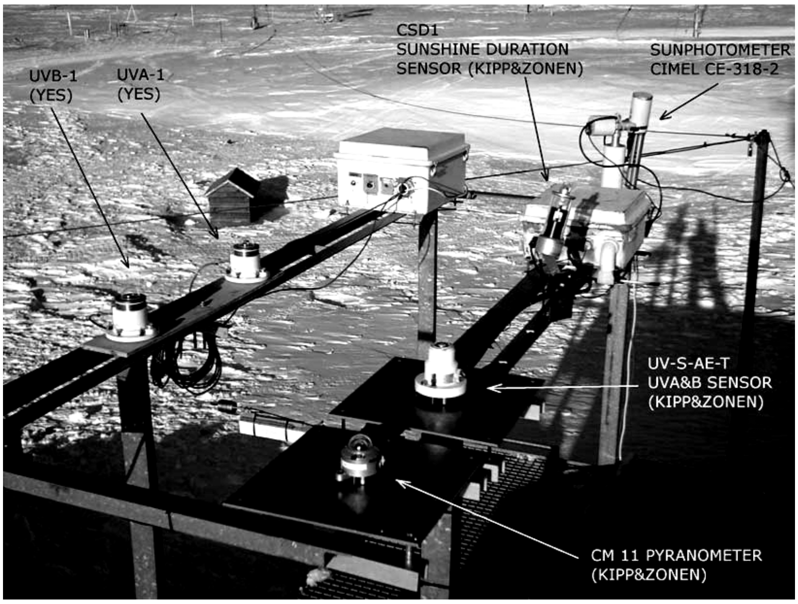

Fig. 1. Calibration of the UV instruments at the Polish Polar Station, Hornsund (Svalbard, 77ºN, 15º30'E) in March 2006.

Fig. 2. Comparison of the IGF PAS traveling UV calibration system with the Bentham spectrophotometer DM 150 in Innsbruck in May 2006.

company, constitutes our traveling UV calibration system. The comparison of the readings of the YES and Kipp&Zonen biometers took place in Hornsund during the period March 30 – April 7, 2006 (see Fig. 1). Afterward, the calibration system returned back to Poland and in May 2006 it participated in the calibration campaign in Innsbruck (Fig. 2). The calibration, i.e., conversion from the biometer output (in volts) to the absolute unit W/m^2 (for UV-A meter) and the erythemally weighted W/m^2 (for UV-B meter) was done by the company Calibration Measurement Softwaresolutions (CMS) – Ing. Dr. Schreder GmbH. Having the YES biometers calibrated we could express the readings of our Hornsund biometers in the absolute units. Figs. 3a, b show that the ratio between YES and Kipp&Zonen biometer outputs is almost constant, i.e., independent of the solar zenith angle (SZA) and ozone. Thus, the value of the slope of the straight line fitted to the scattered data represents our calibration constants used for conversion of all readings of the Kipp&Zonen biometers. It appears (Dr Julian Grebner PMO/WRC Davos – private communication) that the conversion constants for the Kipp&Zonen biometers is almost independent of SZA and total ozone. This justifies using our empirically determined constants for all SZAs. Our calibration constants were obtained during rather short inter-comparison at Hornsund and not the whole range of possible SZA over Hornsund was examined.

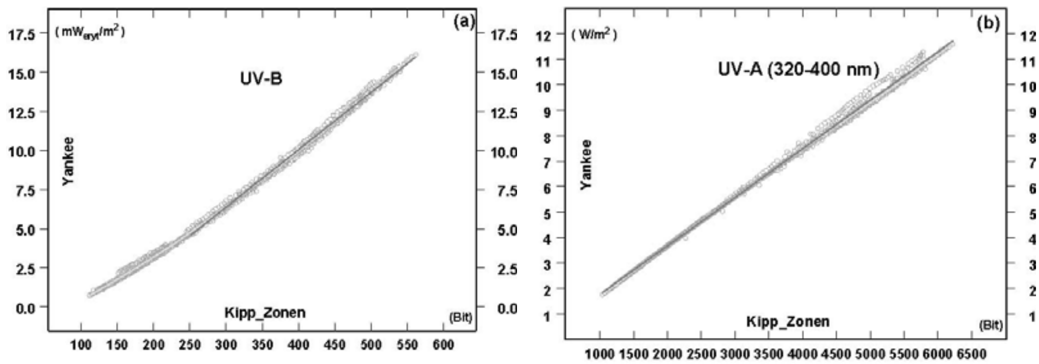

Fig. 3. Irradiance measured by the IGF PAS traveling UV calibration system versus the output of the Kipp&Zonen biometer during cloudless conditions in the period March 30 – April 7, 2006; erythemally weighted irradiance (a), integrated irradiance over the range 320-400 nm (b). Red curve represents standard linear regression fit to the data with UV-B and UV-A irradiance exceeding 5mW$_{eryt}$/m^2 and 2W/m^2, respectively. Green curve is given from locally weighted least squares regression (LOWESS) fit to the all data.

Alternative way of the biometer calibration is a comparison of instrument's readings with hypothetical clear-sky irradiances derived from a radiative transfer model. Thus, the measurements in cloudless conditions need to be extracted from whole data sample and the ratio (depending on SZA and total ozone) between the model irradiance and the instrument voltage is obtained from a standard multi-regression procedure. Such a procedure was used in our previous paper (Krzyścin and Sobolewski 2001). However, the quality of such a calibration depends on the reliability of model input parameters (total ozone, ozone vertical profile, aerosols characteristics, and the ground-albedo).

Daily total ozone values over Hornsund are available almost every day (excluding polar night season) from the site overpasses by the Ozone Monitoring Instrument (OMI) on board of the Aura satellite. The aerosols characteristics, i.e., aerosol optical depth and single scattering albedo, are obtained from the routine measurements by the CIMEL sunphotometer (Fig. 1). The ozone vertical profiles (normalized by the actual total ozone value) are selected as the McClatchey sub-Arctic winter and summer profile (McClatchey et al. 1972). The most serious problem is to parameterize yearly course of the ground albedo. The measurements of such quantity were not available. In early spring whole area is covered by snow but in late spring/early summer snow disappears near the station, over the fiord and sea but there is still plenty of old snow in the surrounding mountains and glaciers. Snow falls sporadically during summer but since the late autumn the station is fully covered by fresh snow. The radiative transfer model used here is the Tropospheric Ultraviolet and Visible (TUV) (frequently used by many authors) freely available from the web page:
http://cprm.acd.ucar.edu/Models/TUV/.

Figure 4 shows the scatter plot of the measured and modeled UV-B irradiance during clear-sky conditions in two periods: March 12 – June 15, 2006 (high albedo) and July 1 – September 18, 2006 (low albedo). In model calculations it was assumed that the ground albedo changes linearly from 0.8 (early spring) to 0.3 (beginning of summer) and back to 0.8 (beginning of winter). It can be inferred from Figs. 4a, b (see blue lines) that the measured values are higher than the modeled ones in the first period but the opposite relation is found in the second period (see also the figure legend for the mean value and standard deviation of the differences between the measured and modeled irradiance expressed in percent of the modeled value). It is worth mentioning much larger cloudless measurements in first half of 2006. Usually summers are much more cloudy than any other seasons at Hornsund.

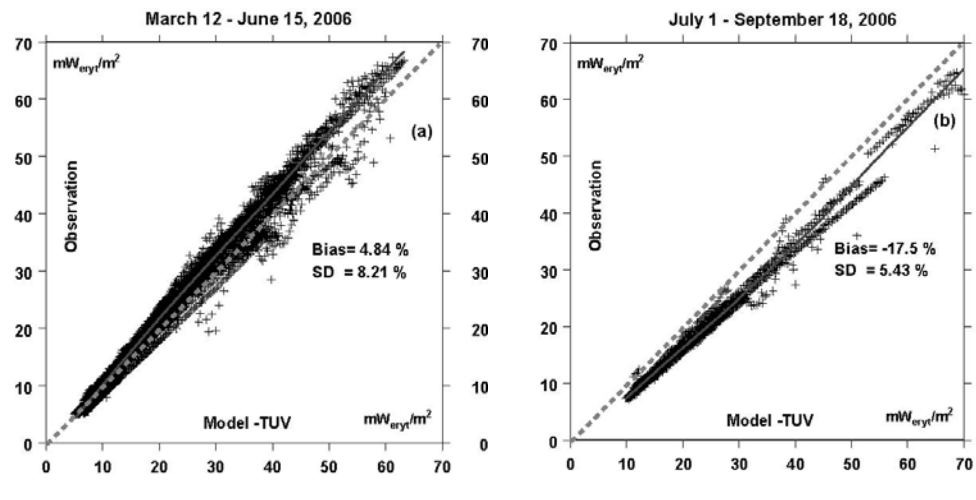

Fig. 4. Measured versus modeled erythemaly weighted UV irradiance for the period; March 12 – June 15, 2006 (high ground albedo period) and July 1 – September 18, 2006 (low ground albedo period).

The albedo pattern is evidently different from the assumed one. Probably there is a strong asymmetry in the albedo seasonal pattern with higher values in the first half of the year and much lower albedo in the second half. Thus, to make measurement/model calibration of the UV data for any Arctic station located in a plateau close to the sea border it is necessary to have more detailed information of the yearly course of ground-albedo and terrain configuration. Because of the importance of albedo also for the radiative balance and changes of the Arctic climate (e.g. melting of the Arctic ice being signal of the global warming) we decide to start in near future measurements of the ground albedo at Hornsund.

4. Results of Sun radiation measurements

The daily patterns of UV-B and total (over whole spectral range, 300-3000 nm) solar irradiance for selected days are shown in Fig. 5. Results of 1-min observations are presented. Cases when the Sun circle was observed (even if it was obscured by thin clouds) are marked by red points. The blue points are for cases with thick clouds covering the Sun circle. The data grouping into these two classes is done by the sunshine duration measurements with CSD1 instrument (Fig. 1). The output of this instrument is 1 when the normal direct solar radiation exceeds 120 W/m^2 and 0 otherwise. Thus, cases with transparent clouds over the Sun circle are classified as the clear sky conditions (red points in Fig. 5). Existence of such thin clouds can be identified also from the daily pattern of total irradiance being much more rough comparing to that for the cloudless case.

Figures for May 30, 2005, and June 5, 2005, illustrate the enhancement of the solar radiation by clouds. The clear sky values of total solar radiation reaching the ground level are about 600 W/m^2 at noon in late spring/early summer, whereas the measured total solar irradiance was as high as 1000 W/m^2 and the erythemally weighted UV-B irradiance could reach 100 mW_{eryt}/m^2 (UV Index = 4) in those days. The daily pattern of the radiation for such conditions is very rough suggesting that the radiation reflectance from clouds being outside the solar circle is a possible explanation of this phenomenon. Strong enhancements appear during thick scattered clouds passing on the Sun circle. This is illustrated by the blue and red points mixtures in Fig. 5 in such periods. It seems that 3-D structure of the cloud field is important to explain a rate of the enhancement. For example, clouds passing on the Sun circle on June 13, 2005, caused only small increase of the irradiance.

A comparison of the irradiance pattern for June 13, 2005 (almost sunny day) and June 13, 2006 (fully cloudy day) demonstrates the importance of albedo and local terrain configuration effect on the solar irradiance in the Arctic. It is worth mentioning almost the same total ozone value measured by the satellite in those days. The total irradiance at noon time on June 13, 2006, was also approximately the same as that on June 13, 2005, in spite of the presence of thick clouds (see that only blue points appeared on the radiance pattern for June 13, 2006). The erythemal irradiance in the cloudy day was only slightly lower than that in the sunny day. Thus, any reasonable explanation of this phenomenon is multiple reflectance between the cloud layer and the ground (including the mountain edges surrounding the station to the North) that is able to convey radiation from sunny regions located far from the station. The patterns shown in Fig. 5 suggest that a lot of efforts (including 3-D modeling of the radiative transfer) is needed to explain complexity of the radiation field in the Arctic.

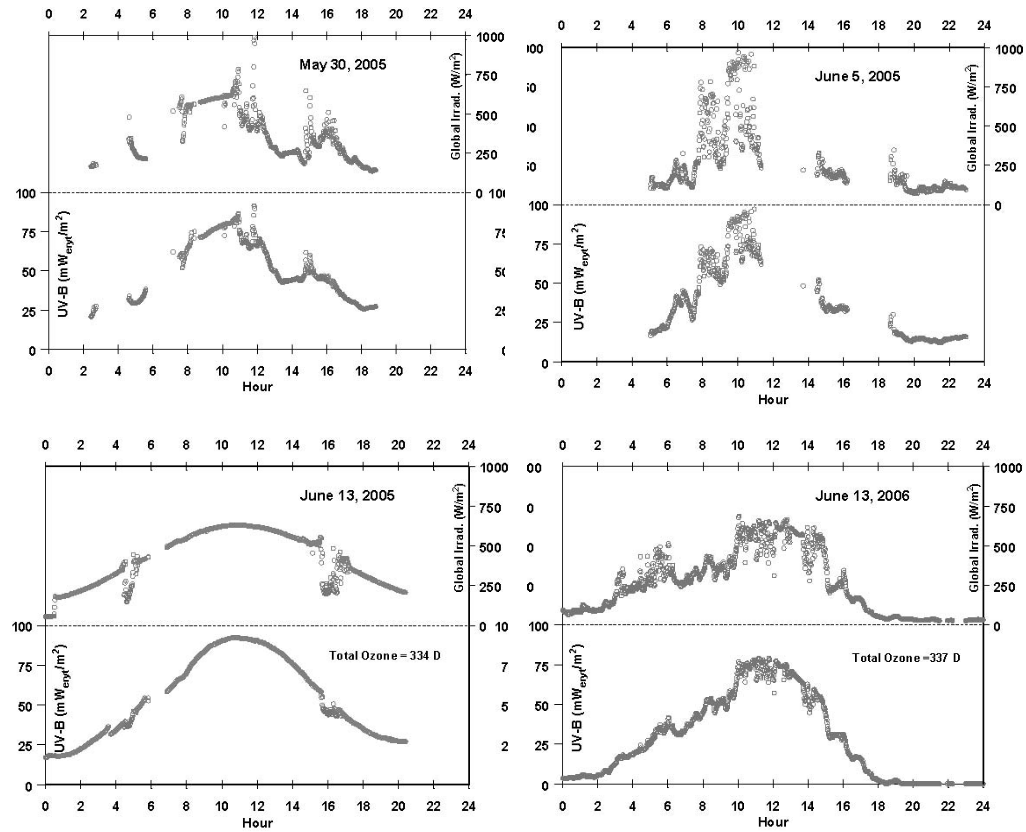

Fig. 5. Examples of the daily course of total solar radiation and the erythemally weighted UV irradiance at Hornsund. Red points are for the Sun-shining conditions (including cases if the Sun circle is obscured by transparent clouds). Blue points are for conditions of the Sun circle being covered by non transparent heavy clouds.

The daily integrals of the radiative quantities and the UV index (maximum value of the erythemally weighted irradiance) measured at Hornsund are in Table 1 at the end of this paper. The last column gives % of all possible measurements (with SZA less than 90°) used for the calculation of daily integral. Sometimes not all 1-min measurements are available because of the lost of electricity supply (especially in 2005) or the presence of heavy clouds at time of high SZA, i.e., the measurements were unreliable resembling the polar night noise of the instrument. When % of the data used for the integration is less than 80, the integral is not shown in Table 1 (and -1 appears instead).

The yearly pattern of UV-B and UV-A daily doses is illustrated in Fig. 6. Maxima of UV-A doses are almost the same in 2005 and 2006, whereas the highest

UV-B doses in 2005 (~3000 J_{eryt}/m^2) exceeded those in 2006 (~2600 J_{eryt}/m^2) due to lower daily total ozone values ~300 DU in 2005 comparing to ~340 DU in 2006. The maximum UV-B doses and index measured at Hornsund in 1996 and 1997 were 2200 J_{eryt}/m^2 and 2.5, respectively. However, our earlier data should be treated with caution because the instrument calibration was done by the radiative model assuming too high optical depth of aerosols in the UV-range and the surface albedo yearly course was set rather arbitrarily.

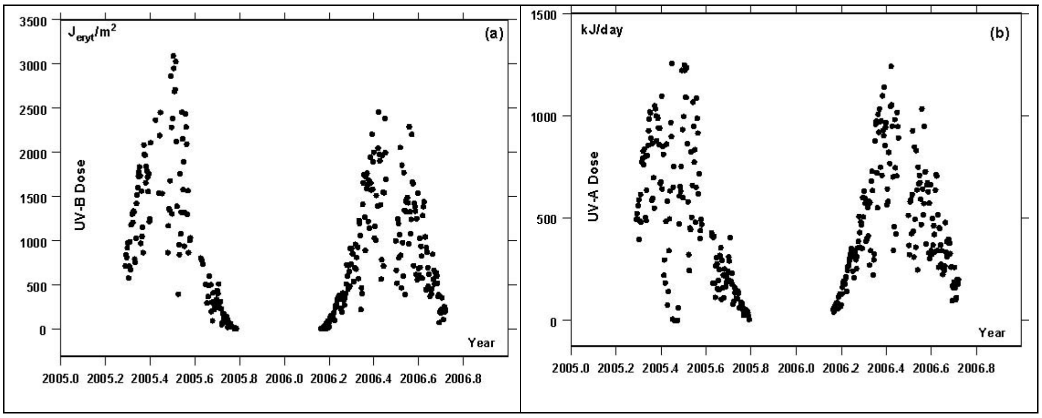

Fig. 6. Time series (March 2005-September 2006) of the UV daily doses measured at Hornsund; erythemally weighted daily doses (a), the integrated over the range 320-400 nm daily doses (b).

5. Conclusion

The upcoming International Polar Year 2007-2008 is scheduled to officially begin in March 2007. One of objectives is creating of multidisciplinary polar observing networks that will provide a long-term perspective. The quality-controlled radiative measurements at the Polish Polar station Hornsund embrace many parameters necessary to extend our knowledge of the specific variability of the UV radiation over the Arctic region, being the most vulnerable to the expected climatic changes. The northern Scandinavia and Arctic islands that are affected by Gulf Stream are under particular interest because of the richness of the biological life in sea and land. The measurements and calibrations of the UV-B, UV-A, total solar radiation, sunshine duration, and atmospheric aerosol properties will be continued in next years. It is scheduled to start in spring 2007 measurements of the ground albedo at least for the whole solar spectrum and, if possible, additionally for the UV-B and UV-A range.

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POMIARY PROMIENIOWANIA ULTRAFIOLETOWEGO SŁOŃCA NA POLSKIEJ STACJI POLARNEJ HORNSUND. KALIBRACJA ORAZ DANE ZA LATA 2005-2006

Streszczenie

Wiosną 2005, w Polskiej Stacji Polarnej na Hornsundzie, wznowiono pomiary wybranych parametrów promieniowania słonecznego takich jak: promieniowanie ultrafioletowe Słońca w zakresach UV-A i UV-B, promieniowanie całkowite i usłonecznienie, rejestrowanych z 1-minutową rozdzielczością. Równolegle prowadzone były pomiary parametrów aerozolu atmosferycznego (albedo pojedynczego rozpraszania, grubości optyczne aerozolu). Jakość danych UV oceniono przez porównanie wskazań instrumentów pracujących na stacji z synchronizowanymi pomiarami wykonanymi przez mobilny zestaw kalibracyjny wykonany w Instytucie Geofizyki Polskiej Akademii Nauk.

Artykuł omawia dzienną i sezonową zmienność słonecznego promieniowania ultrafioletowego oraz całkowitego w okresie od marca 2005 do września 2006. Zamieszczone tabele zawierają dzienne dawki promieniowania UV-B i UV-A oraz sumy promieniowania całkowitego Słońca oraz indeks UV. Maksymalne wartości dziennych

dawek promieniowania UV, a także indeksu UV wystąpiły późną wiosną i wyniosły odpowiednio ~3000 J_{eryt}/m^2 i ~4. Wartości te są większe niż otrzymane z naszych wcześniejszych pomiarów, prowadzonych w latach 1996-1997 z rozdzielczością 5-minutową (Krzyścin i Sobolewski 2001). Stwierdzono znaczny wpływ sezonowej zmienności albedo gruntu na przebiegi roczne natężenie promieniowania UV-B, a więc istnieje potrzeba uzupełniania zestawu gromadzonych danych o wyniki pomiarów albedo gruntu.

Table 1

Results of the sun radiation measurements at Polish Polar Station, Hornsund

Date			UVB erythemal dose	UVB index	UVA dose	Global Radiation daily sum	% of useful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
16	04	2005	714	1.3	493	11.97	96.4
17	04	2005	842	1.5	521	9.58	95.5
18	04	2005	809	1.6	496	9.61	92.9
19	04	2005	920	1.5	559	11.38	92.7
20	04	2005	976	1.5	588	13.46	91.1
21	04	2005	576	1.2	396	7.07	90.6
22	04	2005	710	1.0	484	8.67	93.9
23	04	2005	989	1.6	614	12.37	87.1
24	04	2005	672	1.6	480	9.86	94.4
25	04	2005	1180	1.5	774	19.68	100.0
26	04	2005	1190	1.5	791	18.89	100.0
27	04	2005	1302	1.6	827	20.59	100.0
28	04	2005	1209	1.7	762	18.71	98.2
29	04	2005	1334	1.7	837	20.18	100.0
30	04	2005	1324	1.8	799	18.55	97.2
01	05	2005	793	1.2	504	9.30	91.1
02	05	2005	754	1.4	488	8.98	96.3
03	05	2005	1029	1.6	636	11.99	100.0
04	05	2005	1423	2.0	806	16.42	100.0
05	05	2005	1515	2.2	855	19.87	100.0
06	05	2005	1599	1.9	926	23.26	100.0
07	05	2005	1728	2.0	984	23.99	100.0
08	05	2005	1777	2.1	1018	25.03	100.0
09	05	2005	1835	2.3	1012	24.01	100.0
10	05	2005	1731	2.4	891	18.32	100.0
11	05	2005	969	1.2	587	10.13	100.0
12	05	2005	1563	2.0	864	17.38	100.0
13	05	2005	1048	2.5	596	11.38	99.9

Date			UVB erythemal dose	UVB index	UVA dose	Global Radiation daily sum	% of useful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
14	05	2005	1152	2.1	697	13.72	100.0
15	05	2005	865	1.3	548	9.69	100.0
16	05	2005	2084	2.6	1048	23.19	100.0
17	05	2005	1977	2.7	1034	21.64	100.0
18	05	2005	1969	2.7	999	21.30	100.0
19	05	2005	1656	2.1	878	16.45	100.0
20	05	2005	1840	2.4	995	20.89	100.0
21	05	2005	1787	2.5	986	20.49	100.0
22	05	2005	1720	2.5	940	19.95	100.0
23	05	2005	1556	2.6	860	15.69	100.0
24	05	2005	1757	3.2	939	20.55	100.0
25	05	2005	1215	1.3	669	11.58	100.0
26	05	2005	1246	2.0	676	11.06	100.0
27	05	2005	2107	2.9	1095	21.44	100.0
28	05	2005	-1	3.1	642	-1.00	49.7
29	05	2005	-1	3.4	851	-1.00	55.0
30	05	2005	-1	3.7	811	-1.00	50.4
31	05	2005	-1	3.0	220	-1.00	13.6
01	06	2005	-1	2.6	295	-1.00	29.5
02	06	2005	-1	2.0	183	-1.00	18.6
03	06	2005	-1	3.0	483	-1.00	31.3
04	06	2005	2364	3.3	861	16.19	84.7
05	06	2005	-1	3.9	582	-1.00	50.5
06	06	2005	-1	2.0	75	-1.00	7.5
07	06	2005	-1	1.3	140	-1.00	25.7
08	06	2005	-1	2.5	340	-1.00	36.0
09	06	2005	-1	3.0	496	-1.00	44.3
10	06	2005	1538	1.9	633	11.00	99.4
11	06	2005	2190	3.0	966	19.89	89.0
12	06	2005	2450	3.6	898	17.65	86.9
13	06	2005	-1	3.7	1255	-1.00	79.5
14	06	2005	-1	0.1	6	-1.00	4.2

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
15	06.	2005	1534	1.9	651	12.03	99.3
16	06	2005	-1	2.7	752	-1.00	74.0
17	06	2005	-1	0.0	0	-1.00	0.0
18	06	2005	-1	0.0	0	-1.00	0.0
19	06	2005	-1	0.0	0	-1.00	0.0
20	06	2005	-1	0.0	0	-1.00	0.0
21	06	2005	-1	0.0	0	-1.00	1.0
22	06	2005	-1	0.0	0	-1.00	0.0
23	06	2005	-1	0.2	61	-1.00	28.4
24	06	2005	864	1.2	471	8.56	100.0
25	06	2005	1169	2.1	608	11.36	100.0
26	06	2005	1360	2.2	654	12.21	100.0
27	06	2005	1345	2.1	632	11.76	100.0
28	06	2005	1678	2.3	751	14.51	100.0
29	06	2005	2862	3.4	1221	26.31	100.0
30	06	2005	2283	3.2	932	19.68	100.0
01	07	2005	1303	2.3	599	11.27	99.9
02	07	2005	2384	3.7	995	20.95	99.9
03	07	2005	3091	3.4	1247	28.61	100.0
04	07	2005	2950	3.3	1221	27.92	100.0
05	07	2005	2689	3.7	1092	24.36	100.0
06	07	2005	2708	3.4	1089	23.24	100.0
07	07	2005	3026	3.3	1234	28.51	100.0
08	07	2005	2121	3.4	864	18.11	100.0
09	07	2005	1388	2.6	580	11.78	93.0
10	07	2005	-1	2.0	322	-1.00	74.8
11	07	2005	396	1.4	243	5.14	99.7
12	07	2005	956	3.1	451	9.29	96.2
13	07	2005	842	1.4	444	8.52	99.7
14	07	2005	1758	3.2	822	18.95	100.0
15	07	2005	1077	3.1	504	10.36	99.0
16	07	2005	1322	2.2	660	13.67	100.0
17	07	2005	2453	3.2	1066	24.39	100.0

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
18	07	1005	2151	2.8	948	22.17	100.0
19	07	2005	1577	2.9	773	16.49	100.0
20	07	2005	1891	2.7	834	18.93	94.6
21	07	2005	938	1.4	479	9.79	98.3
22	07	2005	1319	2.1	650	13.28	100.0
23	07	2005	2434	2.7	1086	26.66	100.0
24	07	2005	2286	2.6	986	22.41	99.9
25	07	2005	2092	2.7	915	20.10	100.0
26	07	2005	1295	2.1	618	12.61	99.9
27	07	2005	1565	2.1	716	15.46	99.9
28	07	2005	865	1.2	400	7.93	87.0
29	07	2005	-1	2.6	439	-1.00	68.8
30	07	2005	1003	1.5	495	10.73	99.7
31	07	2005	1032	2.3	469	9.55	100.0
16	08	2005	-1	1.9	428	-1.00	75.5
17	08	2005	803	1.2	412	9.00	81.7
18	08	2005	-1	0.6	182	-1.00	76.2
19	08	2005	777	1.4	405	8.51	89.1
20	08	2005	735	1.3	411	9.16	91.9
21	08	2005	-1	0.8	180	-1.00	68.3
22	08	2005	-1	0.3	113	-1.00	72.9
23	08	2005	-1	1.5	267	-1.00	77.1
24	08	2005	-1	1.2	306	-1.00	76.1
25	08	2005	506	1.2	276	5.61	82.6
26	08	2005	-1	0.5	155	-1.00	77.9
27	08	2005	294	0.8	196	4.11	85.8
28	08	2005	-1	1.0	149	-1.00	71.4
29	08	2005	367	1.0	248	5.91	87.8
30	08	2005	493	1.1	317	7.98	91.9
31	08	2005	601	1.1	355	8.31	87.0
01	09	2005	-1	0.3	103	-1.00	72.9
02	09	2005	501	1.2	294	7.35	83.5

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
03	09	2005	198	0.6	158	3.64	84.5
04	09	2005	303	0.6	220	5.28	87.7
05	09	2005	93	0.2	110	2.73	84.6
06	09	2005	409	0.9	251	5.83	80.9
07	09	2005	308	0.7	216	4.92	89.9
08	09	2005	225	0.6	163	3.44	84.0
09	09	2005	244	0.6	186	4.18	87.2
10	09	2005	310	0.8	225	5.36	90.7
11	09	2005	278	0.8	201	4.27	88.5
12	09	2005	335	0.6	239	5.02	96.5
13	09	2005	437	0.8	310	8.64	98.7
14	09	2005	401	0.7	290	8.51	98.1
15	09	2005	511	0.5	405	9.19	95.6
16	09	2005	249	0.5	193	4.93	94.5
17	09	2005	235	0.6	191	5.19	94.7
18	09	2005	311	0.6	231	6.44	97.2
19	09	2005	231	0.6	175	4.37	91.4
20	09	2005	50	0.2	78	1.86	90.4
21	09	2005	70	0.3	93	2.24	83.2
22	09	2005	178	0.4	161	4.05	92.7
23	09	2005	129	0.4	135	3.09	94.9
24	09	2005	169	0.4	151	4.05	94.7
25	09	2005	98	0.2	107	2.56	91.8
26	09	2005	144	0.3	146	3.15	97.0
27	09	2005	84	0.2	106	2.43	97.4
28	09	2005	140	0.3	142	4.01	98.4
29	09	2005	113	0.3	133	3.97	98.3
30	09	2005	21	0.1	62	1.65	92.1
01	10	2005	29	0.2	65	1.75	88.4
02	10	2005	26	0.1	61	1.55	87.9
03	10	2005	58	0.2	85	2.13	90.8
04	10	2005	63	0.2	87	1.63	94.1

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
05	10	2005	47	0.1	76	1.82	94.0
06	10	2005	-1	0.2	51	-1.00	78.2
07	10	2005	-1	0.0	25	-1.00	66.8
08	10	2005	-1	0.0	33	-1.00	72.8
09	10	2005	-1	0.0	35	-1.00	77.6
10	10	2005	17	0.1	55	1.44	94.9
11	10	2005	4	0.0	38	1.19	83.3
12	10	2005	-1	0.0	28	-1.00	75.7
13	10	2005	11	0.1	46	1.10	96.2
14	10	2005	6	0.0	37	1.23	93.1
15	10	2005	-1	0.0	20	-1.00	70.5
16	10	2005	-1	0.0	5	-1.00	24.7
17	10	2005	1	0.0	26	0.89	82.5
18	10	2005	1	0.0	28	0.93	96.4
19	10	2005	0	0.0	18	0.51	82.3
20	10	2005	0	0.0	20	0.61	90.8
21	10	2005	0	0.0	18	0.63	90.5
22	10	2005	0	0.0	15	0.47	90.0
23	10	2005	0	0.0	12	0.46	91.5
24	10	2005	0	0.0	10	0.36	91.3
25	10	2005	0	0.0	8	0.29	94.0
14	02	2006	0	0.0	4	0.16	100.0
15	02	2006	0	0.0	7	0.22	100.0
16	02	2006	0	0.0	7	0.24	100.0
17	02	2006	0	0.0	9	0.27	92.0
18	02	2006	0	0.0	12	0.38	93.6
19	02	2006	0	0.0	12	0.43	83.2
20	02	2006	-1	0.0	0	-1.00	1.9
21	02	2006	-1	0.0	13	-1.00	76.4
22	02	2006	-1	0.0	14	-1.00	76.3
23	02	2006	0	0.0	19	0.53	84.6
24	02	2006	0	0.0	32	1.01	100.0

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
25	02	2006	0	0.0	31	0.93	98.7
26	02	2006	0	0.0	37	1.22	99.5
27	02	2006	1	0.0	42	1.10	100.0
28	02	2006	4	0.0	48	1.57	100.0
01	03	2006	5	0.0	53	1.54	100.0
02	03	2006	0	0.0	41	0.98	91.4
03	03	2006	13	0.1	64	1.35	100.0
04	03	2006	17	0.1	71	1.97	100.0
05	03	2006	20	0.1	73	1.94	100.0
06	03	2006	34	0.1	85	2.55	100.0
07	03	2006	37	0.1	87	3.33	100.0
08	03	2006	30	0.1	77	1.58	97.4
09	03	2006	4	0.0	58	1.22	95.6
10	03	2006	71	0.2	116	3.03	100.0
11	03	2006	24	0.1	77	1.66	97.3
12	03	2006	90	0.2	129	3.09	99.5
13	03	2006	16	0.1	68	1.44	91.6
14	03	2006	25	0.1	76	1.58	90.2
15	03	2006	86	0.2	129	2.71	97.8
16	03	2006	131	0.3	162	2.87	99.5
17	03	2006	146	0.3	183	4.79	100.0
18	03	2006	151	0.3	193	5.41	100.0
19	03	2006	136	0.3	185	4.38	100.0
20	03	2006	141	0.3	176	3.71	99.2
21	03	2006	175	0.4	201	4.72	100.0
22	03	2006	180	0.4	212	4.86	100.0
23	03	2006	98	0.3	141	2.63	95.6
24	03	2006	237	0.5	244	6.49	98.1
25	03	2006	266	0.5	262	7.26	100.0
26	03	2006	279	0.5	265	7.27	100.0
27	03	2006	334	0.6	288	8.13	100.0
28	03	2006	329	0.6	303	8.44	100.0

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
29	03	2006	355	0.6	322	8.91	100.0
30	03	2006	360	0.6	336	9.02	100.0
31	03	2006	383	0.6	351	9.32	100.0
01	04	2006	341	0.6	334	7.83	99.5
02	04	2006	233	0.5	241	4.58	97.7
03	04	2006	346	0.6	310	6.18	96.6
04	04	2006	192	0.5	208	3.85	94.1
05	04	2006	407	0.9	342	7.42	96.9
06	04	2006	385	0.8	335	6.77	98.3
07	04	2006	323	0.6	295	5.82	97.7
08	04	2006	271	0.6	253	4.75	93.3
09	04	2006	351	0.6	310	5.99	96.2
10	04	2006	405	0.8	354	6.77	96.3
11	04	2006	511	0.7	386	7.89	96.8
12	04	2006	728	1.2	507	11.39	99.0
13	04	2006	596	1.0	429	8.70	94.9
14	04	2006	454	0.7	357	6.57	96.1
15	04	2006	719	1.2	480	9.89	95.7
16	04	2006	655	1.2	466	10.26	94.8
17	04	2006	485	0.9	352	6.66	90.6
18	04	2006	910	1.5	600	15.02	94.7
19	04	2006	733	1.3	505	11.15	96.2
20	04	2006	912	1.4	631	16.11	98.2
21	04	2006	853	1.4	598	13.25	96.4
22	04	2006	851	1.4	573	12.63	89.6
23	04	2006	540	1.0	388	7.19	87.1
24	04	2006	-1	1.2	390	-1.00	77.8
25	04	2006	694	1.7	403	8.60	86.9
26	04	2006	958	1.8	552	12.14	100.0
27	04	2006	679	1.5	413	8.30	85.3
28	04	2006	812	1.7	581	13.80	88.1
29	04	2006	-1	1.3	269	-1.00	73.4

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
30	04	2006	926	1.3	575	11.46	95.0
01	05	2006	571	1.0	340	6.37	88.3
02	05	2006	1228	1.5	679	18.19	99.2
03	05	2006	1195	1.6	728	18.04	100.0
04	05	2006	1060	1.6	634	15.56	85.9
05	05	2006	220	0.5	222	4.54	95.5
06	05	2006	467	1.5	296	6.43	82.1
07	05	2006	401	1.5	324	6.34	93.6
08	05	2006	1412	2.0	878	20.16	100.0
09	05	2006	1655	2.0	958	23.53	100.0
10	05	2006	1744	2.0	974	23.87	100.0
11	05	2006	1267	1.9	721	15.21	100.0
12	05	2006	889	1.3	550	10.09	100.0
13	05	2006	1725	2.0	1007	23.88	100.0
14	05	2006	1591	1.9	919	21.32	100.0
15	05	2006	1763	2.0	1032	25.49	100.0
16	05	2006	1632	1.9	970	22.51	100.0
17	05	2006	1219	2.0	749	13.99	100.0
18	05	2006	1683	2.2	974	22.39	100.0
19	05	2006	1139	1.5	708	14.71	100.0
20	05	2006	1945	2.2	1097	25.89	100.0
21	05	2006	1652	2.3	928	20.34	100.0
22	05	2006	1573	2.4	902	18.63	100.0
23	05	2006	2202	2.7	1138	26.98	100.0
24	05	2006	1580	2.1	854	17.11	100.0
25	05	2006	1891	2.7	943	20.85	100.0
26	05	2006	2001	2.9	966	19.59	100.0
27	05	2006	1031	2.0	566	10.41	100.0
28	05	2006	1165	1.4	642	11.82	100.0
29	05	2006	1005	1.4	581	10.81	100.0
30	05	2006	1511	2.1	821	16.49	100.0
01	06	2006	1393	1.9	766	15.22	100.0

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
02	06	2006	2048	2.7	1045	23.36	100.0
03	06	2006	2456	2.7	1241	29.12	100.0
04	06	2006	1973	2.4	1053	24.18	99.9
05	06	2006	1904	3.1	949	20.42	100.0
06	06	2006	1406	2.9	701	13.84	100.0
07	06	2006	565	0.7	342	6.59	100.0
08	06	2006	783	2.5	457	9.25	98.7
09	06	2006	1963	2.2	981	20.98	100.0
10	06	2006	1548	2.7	745	14.82	100.0
11	06	2006	714	1.2	422	8.12	100.0
12	06	2006	1542	2.5	706	13.55	100.0
13	06	2006	2382	3.2	1015	21.66	95.1
14	06	2006	1997	3.2	946	19.48	100.0
01	07	2006	999	1.5	513	9.74	100.0
02	07	2006	665	1.2	366	7.29	100.0
03	07	2006	521	1.1	321	6.41	100.0
04	07	2006	1247	2.0	580	10.99	100.0
05	07	2006	1193	1.9	590	10.21	100.0
06	07	2006	808	2.2	424	6.28	99.9
07	07	2006	1069	2.0	615	11.12	100.0
08	07	2006	2055	3.0	926	18.35	100.0
09	07	2006	836	1.2	435	6.43	100.0
10	07	2006	468	1.0	309	4.99	100.0
11	07	2006	1855	3.0	847	16.93	100.0
12	07	2006	978	2.1	495	8.93	100.0
13	07	2006	596	3.0	357	5.15	100.0
14	07	2006	1770	2.6	829	15.51	100.0
15	07	2006	1344	2.6	638	11.24	99.2
16	07	2006	393	0.8	246	4.43	87.5
17	07	2006	1453	2.0	749	15.12	100.0
18	07	2006	1327	2.9	668	12.89	100.0
19	07	2006	1432	2.0	708	14.15	100.0

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
20	07	2006	1486	1.9	673	13.30	100.0
21	07	2006	1428	3.0	593	11.32	92.4
22	07	2006	966	1.8	468	8.32	91.1
23	07	2006	2288	2.5	1033	23.63	99.7
24	07	2006	1326	1.9	642	11.94	100.0
25	07	2006	1080	1.7	517	9.36	100.0
26	07	2006	1240	2.0	571	10.38	99.9
27	07	2006	2203	2.7	948	21.24	100.0
28	07	2006	1666	2.9	724	15.19	100.0
29	07	2006	1646	2.8	726	14.24	100.0
30	07	2006	717	1.0	374	6.33	99.3
31	07	2006	1425	2.7	663	13.17	100.0
01	08	2006	1390	2.3	674	13.77	100.0
02	08	2006	1334	2.4	629	12.78	92.1
03	08	2006	616	1.2	330	5.77	92.1
04	08	2006	1249	2.5	572	11.15	91.7
05	08	2006	557	0.8	302	5.27	91.8
06	08	2006	1541	2.6	663	13.59	95.8
07	08	2006	687	1.4	341	5.76	87.8
08	08	2006	615	1.1	322	5.20	96.0
09	08	2006	1031	1.5	498	9.03	97.2
10	08	2006	698	1.8	368	6.78	96.9
11	08	2006	936	1.4	463	8.52	87.5
12	08	2006	824	1.6	420	8.70	81.1
13	08	2006	577	1.1	335	5.79	92.9
14	08	2006	1283	1.9	636	13.46	100.0
15	08	2006	1386	1.9	711	16.90	99.7
16	08	2006	1441	1.9	705	17.06	90.5
17	08	2006	-1	1.7	341	-1.00	77.8
18	08	2006	1043	1.9	516	11.99	84.0
19	08	2006	445	0.8	260	4.53	86.7
20	08	2006	922	1.6	452	9.07	86.9

Date			UVB erythe-mal dose	UVB index	UVA dose	Global Radiation daily sum	% of use-ful data
dd	mm	yyyy	[J_{eryth}/m^2]		[kJ/m^2]	[MJ/m^2]	[%]
21	08	2006	871	1.3	449	9.06	86.9
22	08	2006	695	1.6	368	7.40	83.6
23	08	2006	484	0.8	274	4.92	85.7
24	08	2006	620	1.3	340	6.78	86.1
25	08	2006	-1	0.9	258	-1.00	76.3
26	08	2006	369	0.9	224	4.09	81.0
27	08	2006	440	0.7	263	4.82	91.8
28	08	2006	399	0.7	245	4.60	89.3
29	08	2006	455	1.0	266	5.10	87.7
30	08	2006	845	1.3	478	12.59	97.5
31	08	2006	565	0.9	333	6.22	97.4
01	09	2006	665	1.2	385	8.94	94.8
02	09	2006	512	0.9	311	5.95	93.5
03	09	2006	521	0.9	326	6.54	94.4
04	09	2006	630	1.0	397	9.67	97.4
05	09	2006	638	1.0	378	8.68	94.2
06	09	2006	601	0.9	378	10.07	97.6
07	09	2006	517	0.9	326	7.06	95.8
08	09	2006	373	0.7	260	5.04	95.4
09	09	2006	388	0.6	262	4.79	94.4
10	09	2006	74	0.4	96	1.73	81.1
11	09	2006	191	0.6	169	3.27	92.0
12	09	2006	183	0.5	160	3.15	89.0
13	09	2006	220	0.5	188	3.44	94.1
14	09	2006	354	0.6	259	5.81	95.0
15	09	2006	196	0.5	159	2.77	87.7
16	09	2006	105	0.3	101	1.71	81.4
17	09	2006	105	0.3	112	2.09	85.7
18	09	2006	252	0.5	199	5.05	92.2
19	09	2006	194	0.4	178	3.60	96.1
20	09	2006	226	0.5	199	4.58	97.8

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Correlation Between Surface Visibility and Aerosol Optical Depth Recorded at Geophysical Observatory at Belsk

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Abstract

Correlation between surface visibility and aerosol optical depth has been analyzed on the basis of results of observations taken at the Geophysical Observatory at Belsk from March 2001 to May 2005. Marginal and conditional distributions of both variables as well as their cumulative distribution functions have been determined. Covariance in two-dimensional empirical distribution of both variables is negative. The values of correlation ratios from the sample (e_{xy} = 0.37; e_{yx} = 0.31) indicate that about 13.5% of the total variation of surface visibility can be explained by influence of aerosol optical depth, while about 9.5% of the total variation of aerosol optical depth can be explained by variations of surface visibility.

The value of correlation coefficient $r = -0.28$ for the study period indicates rather moderate linear correlation between surface visibility and aerosol optical depth. Empirical curves of regression of both characteristics in relation to each other indicate non-linearity of the relationships, while curvilinear indexes of interdependence suggest linearity of the relationships. Examination of linearity of linear regression models constructed on the basis of empirical data indicates that the dependence of both characteristics lies at the limit of linearity. At 0.05 significance level, the dependence of aerosol optical depth on surface visibility is linear, while the dependence of surface visibility on aerosol optical depth is nonlinear.

Statistical tests executed at 0.05 significance level indicate statistical significance of relationship between analyzed characteristics, essentially different from zero values of correlation ratios, and the value of correlation coefficient essentially less than zero.

1. Introduction

Recently, several works examining relationship between aerosol optical depth and surface visibility have been presented (Hand *et al*. 2004, Li and Lu 1997, Qiu and Yang 2000, Sztyler 2005). The authors pointed at considerable correlation between aerosol optical depth and surface visibility. It may be connected with the fact that aerosol particles in the atmosphere are concentrated mostly in near-surface layer. However, most of comparisons concerned observations that were made in urban or industrial regions. In this study an analysis of correlation between aerosol optical depth and surface visibility on the basis of results of observations taken at the Geophysical Observatory at Belsk – which is located in rural area, away from big cities and industrial regions – is presented.

2. Observation data

Data since March 2001 to May 2005 have been analyzed. Measurements of surface visibility at Belsk are made from the terrace about 10 m above the ground level, according to WMO recommendations (WMO 1983). The method requires various fixed landmarks at known distances from the point of observation. The visual range is the distance to the farthest landmark visible. Values of 10 graded scale used at Belsk Geophysical Observatory for surface visibility measurements are given in Table 1.

Table 1

Surface visibility	Visible landmark	Invisible landmark
0	–	50 m
1	50 m	200 m
2	200 m	500 m
3	500 m	1 km
4	1 km	2 km
5	2 km	4 km
6	4 km	10 km
7	10 km	20 km
8	20 km	50 km
9	50 km	–

Aerosol Optical Depth (AOD) has been registered at the Geophysical Observatory at Belsk since March 2001 by means of POM-01L Sky Radiometer (Nakajima *et al*. 1996). As AOD depends, and it is rather strong dependence, on wavelength, AOD obtained in 500 nm wavelength, the closest to maximum sensitivity of human eye, has been chosen from all the channels in which measurements are being made.

On the other hand, as hand-made measurements of surface visibility are executed at the Geophysical Observatory at Belsk once a day within 10–12 GMT interval, and changes in AOD values within a day can exceed 100%, AODs registered within 10–12 GMT interval have been chosen from measurements made all over the day. Averaged AODs for that interval have been calculated, and these averaged values of AOD were correlated with values of surface visibility.

391 pairs (surface visibility, AOD) obtained from measurements which were made within 10–12 GMT interval have been analyzed. Time series of surface visibility and AOD are shown in Figs. 1 and 2, respectively.

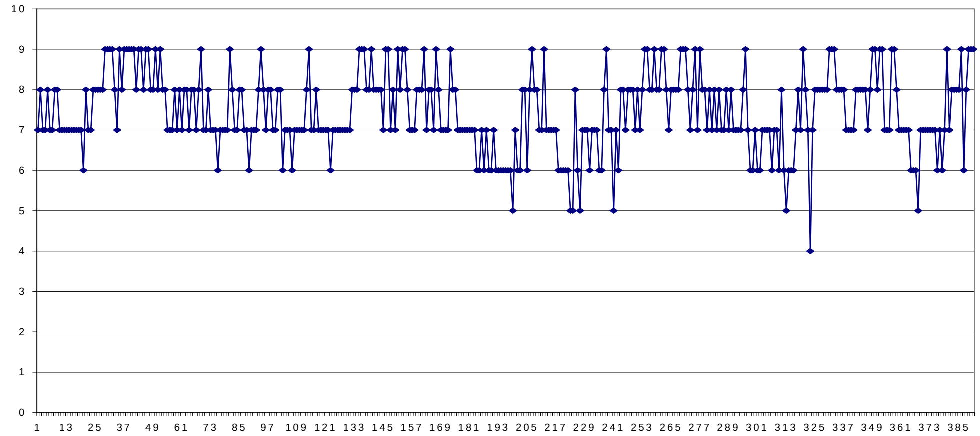

Fig. 1. Time series of surface visibility.

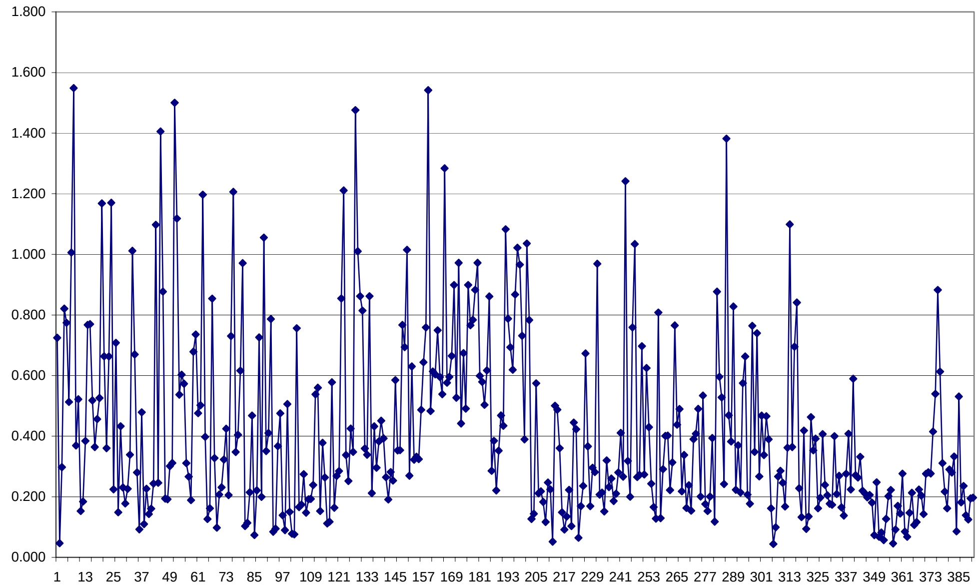

Fig. 2. Time series of aerosol optical depth.

Correlation matrix of characteristics X (surface visibility – discrete characteristic) and Y (AOD – continuous characteristic) has been made on the basis of the data sets. The 0.1 spread of class interval has been taken in the case of AOD, so 16 right-hand closed class intervals have been obtained.

3. Results of analysis

Results of some calculations for both examined characteristics are presented in Table 2.

Table 2

Parameter	Surface visibility	AOD
Minimum value	4	0.044
Maximal value	9	1.549
Average value	7.4	0.420
Variance	0.94	0.092
Standard deviation	0.97	0.303
Variability coefficient	0.1	0.72

Empirical marginal distributions of characteristics are shown in Figs. 3 and 5. Their empirical cumulative distribution functions are shown in Figs. 4 and 6.

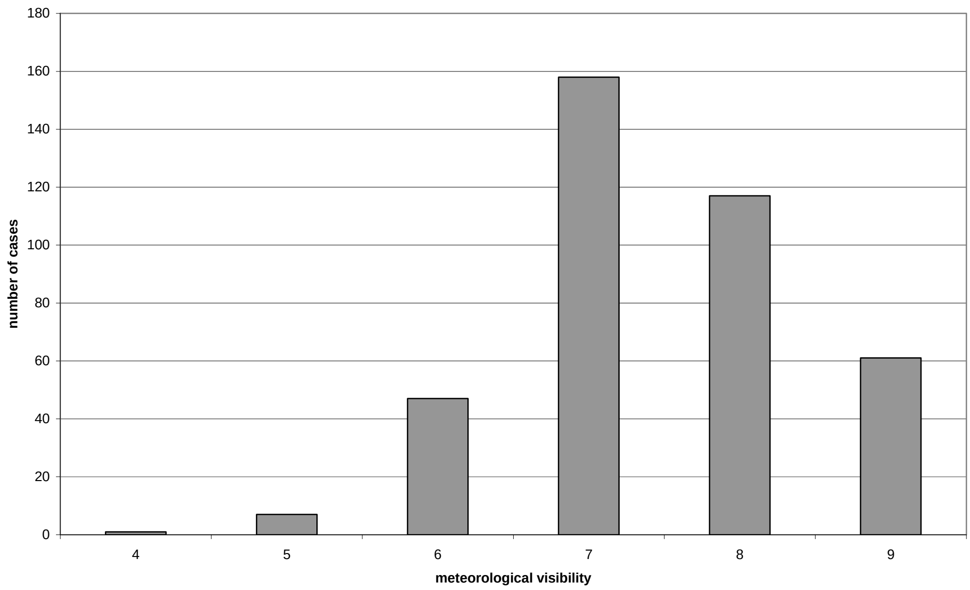

Fig. 3. Empirical marginal distribution of surface visibility.

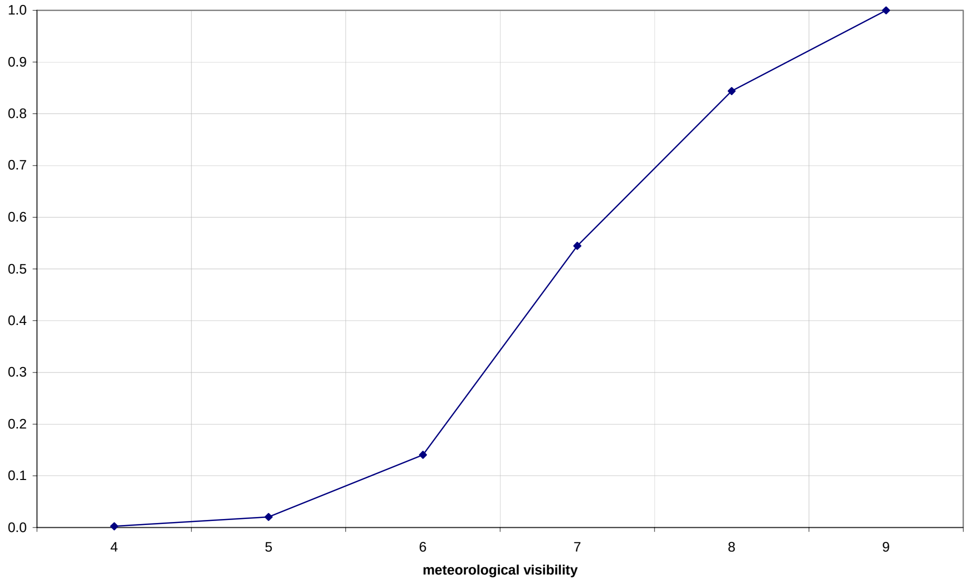

Fig. 4. Empirical cumulative distribution function of surface visibility.

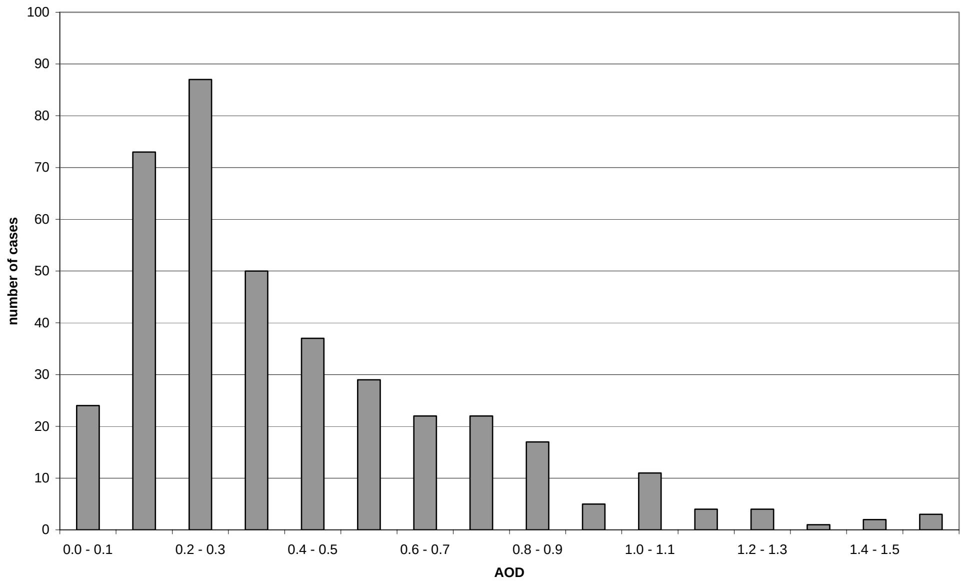

Fig. 5. Empirical marginal distribution of aerosol optical depth.

The most numerous are AODs from the 0.2–0.3 interval. AODs greater than 0.8 make only 12% of all cases, but they shift the average AOD by nearly about 70% to the value of 0.420. Nearly 50% of values of AOD do not exceed 0.3.

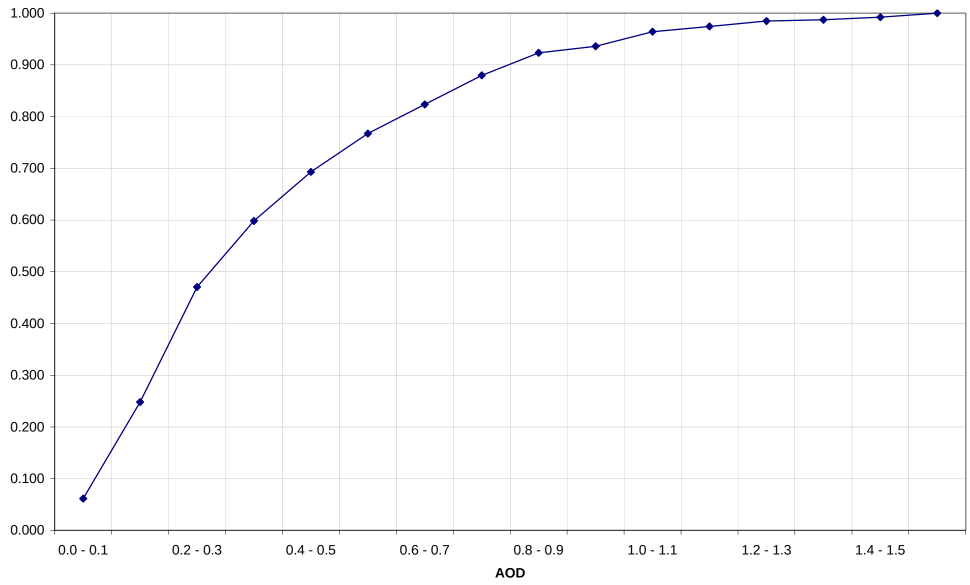

Fig. 6. Empirical cumulative distribution function of aerosol optical depth.

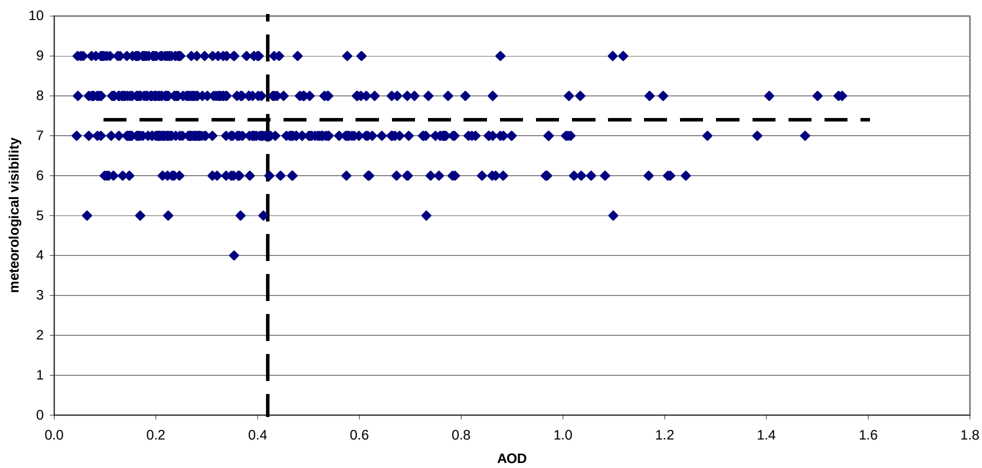

Fig. 7. The joint distribution of surface visibility and aerosol optical depth.

On the other hand, in marginal distribution of surface visibility large values predominate. Visibilities smaller than 4 (below 1 km) have not been noticed in analyzed period of time. Analysis of variance of the distribution, standard deviation and variability coefficient indicates small diversification of surface visibility and large diversification of AOD.

After standardization of AOD it turned out that there are 6 outliers in empirical set of the *Y* characteristic. As it was difficult to establish whether a mistake occurred while taking measurements, those values have not been removed from the data set.

The joint distribution of both characteristics is shown in Fig. 7. The average values of surface visibility and aerosol optical depth have been marked by dashed lines.

The covariance in two-dimensional empirical distribution of surface visibility and AOD is negative. It means that for greater values of surface visibility, values of AOD are generally smaller.

The χ^2 test has been used to examine the hypothesis of independence (or dependence) of the analyzed variables:

$$\chi^2 = \sum_{i=1}^{k}\sum_{j=1}^{l}\frac{\left(n_{ij} - \breve{n}_{ij}\right)^2}{\breve{n}_{ij}^{\ 2}},$$

where k is the number of classes of X characteristic, l is the number of classes of Y characteristic, n_{ij} is the ij-th element of correlation matrix (i = 1, ..., k; j = 1, ..., l), $\breve{n}_{ij}$ are the expected (hypothetical) cell frequencies in correlation matrix under an assumption that X and Y characteristics are independent (H_0 is true), and there are n data items in a sample.

The test is a measure of discrepancy between observed and hypothetical distributions. The X and Y values had been separated into groups before the χ^2 statistic was calculated, so that sufficiently large numbers of observations of hypothetical distribution could be found in every element of correlation matrix of hypothetic frequencies of X and Y characteristics. Making the assumption that significance level α = 0.05, the critical value $\chi^2_{\ 0.05;15}$ = 24.996 has been got. As the calculated value χ^2 = 65.4 is contained in critical region determined by $P(\chi^2 \geq \chi^2_{\ \alpha,(k-1)(l-1)}) = \alpha$ relation, the null hypothesis about lack of dependence between surface visibility and AOD should be rejected for advantage of an alternative hypothesis. Frequencies in empirical distribution differ too much from those which should occur if variables were independent. The null hypothesis should be rejected also for the significance level α = 0.0005. Hence, with 0.0005 probability of wrong decision, we can state that there is a relationship between analyzed characteristics.

Cramer's convergence coefficient was used to measure the strength of the relationship:

$$V = \sqrt{\frac{\chi^2}{n(m-1)}},$$

where m = min(k, l). V = 0.24 was obtained. It indicates rather moderate relationship between surface visibility and AOD.

Conditional distributions of variables specified in correlation matrix were analysed as well, in order to estimate additionally the correlation between variables (surface visibility and AOD). Empirical regression curves have been drawn to state the shape of dependence of analyzed characteristics.

Figure 8 shows empirical curve of regression of surface visibility in relation to AOD, while Fig. 9 shows the second empirical curve of regression (AOD in relation to surface visibility).

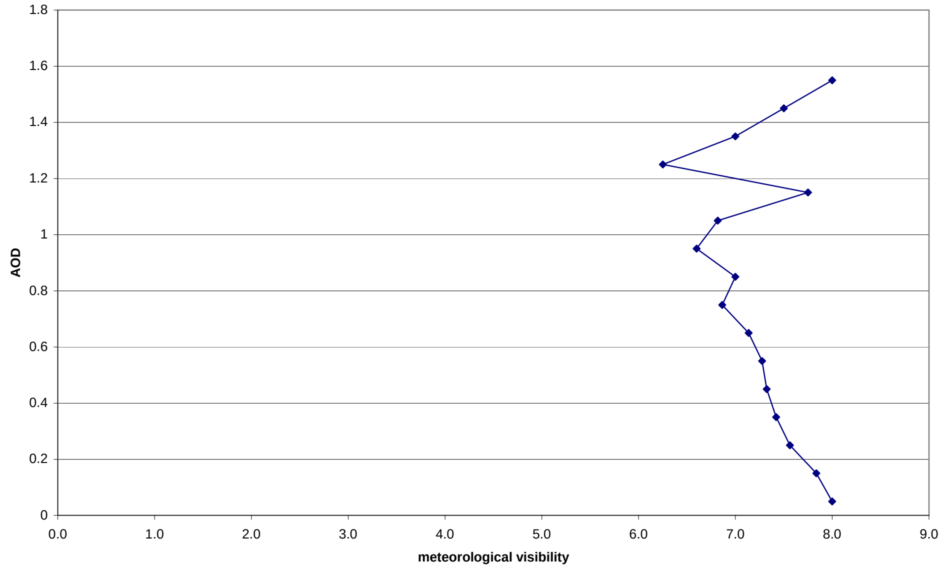

Fig. 8. Empirical curve of regression of surface visibility in relation to AOD.

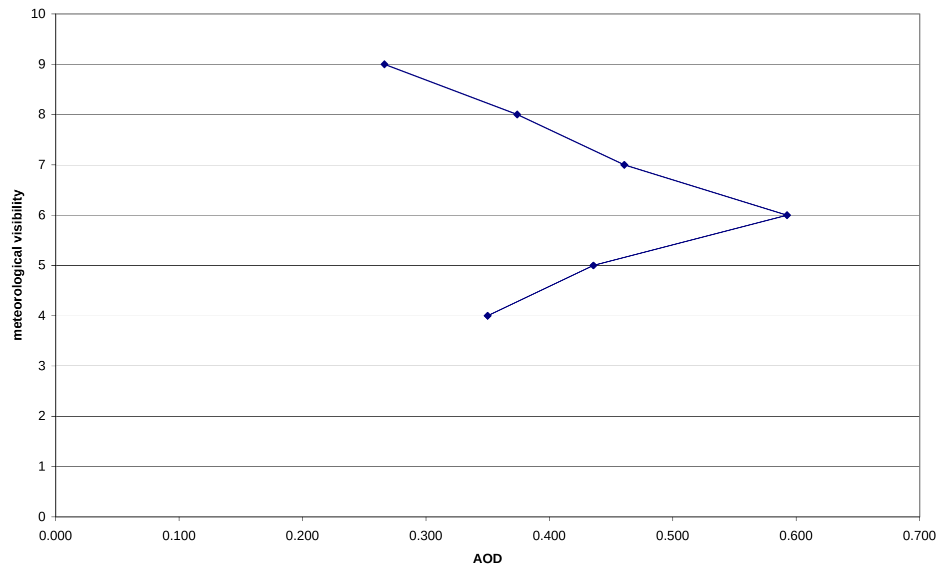

Fig. 9. Empirical curve of regression of aerosol optical depth in relation to surface visibility.

In particular, Fig. 9 indicates the non-linearity of the relationship. When the surface visibility increases, the averaged (conditional) AOD at first increases and then decreases.

Similarly, in Fig. 8, as AOD increases, the surface visibility decreases at first and then, after temporary fluctuations, begins to increase. That may be a result of small number of data with big values of AOD. Besides – as it was mentioned earlier – the six biggest AOD values are untypical.

Analysis of variance between analyzed characteristics has been carried out in order to make an additional determination of the strength of dependence between them. Each time, the other of variables was used as classification factor, and its values were used to divide the population into groups. The values of correlation ratios of one variable in relation to the other are results of that analysis.

We have got $e_{xy}^2 = 0.1340$, $e_{yx}^2 = 0.0930$ ($e_{xy} = 0.37$, $e_{yx} = 0.31$). This means that 13.4% of total variability of surface visibility (*X*) can be assigned as an influence of AOD (*Y*), and 9.3% of total variability of AOD (*Y*) can be assigned to variations of surface visibility (*X*). So the dependence between surface visibility and AOD, and vice versa, is not too strong.

The statistics:

$$F_{xy} = \frac{e^2_{xy}/(l-1)}{(1-e^2_{xy})/(n-l)}$$

and

$$F_{yx} = \frac{e^2_{yx}/(k-1)}{(1-e^2_{yx})/(n-k)},$$

where n is the size of the sample, l is the number of conditional distributions of variable Y, k is the number of conditional distributions of variable X, e_{xy} and e_{yx} are the correlation ratios from the sample, have been used in order to verify the hypothesis of lack of correlation dependence of surface visibility on AOD and vice versa. The lack of correlation dependence of surface visibility on AOD or vice versa was the null hypothesis towards the alternative hypothesis that such a dependence exists. If null hypothesis would be true, statistics F_{xy} and F_{yx} would have the F-Snedecor's distribution with $v_1 = l - 1$ ($v_1 = k - 1$) and $v_2 = n - l$ ($v_2 = n - k$) degrees of freedom. The critical region of the test is specified by the value of F_α that fulfils the relation: $P(F \geq F_\alpha) = \alpha$, where α is the significance level. Values of $F_{xy} = 3.87$ and $F_{yx} = 7.90$ have been obtained.

For the significance level $\alpha = 0.05$ the critical levels are:

$F_{\alpha xy} = F_{0,05;15;375} = 1.67$,

$F_{\alpha yx} = F_{0,05;5;385} = 2.21$.

As values of both statistics, F_{xy} and F_{yx}, calculated from the sample exceeded the critical values, the null hypotheses about the lack of dependence of surface visibility on AOD and vice versa should be rejected for the advantage of an alternative hypotheses. This means that correlation ratios from the sample took values significantly different from zero.

The next parameter that was used for estimating the strength of relation between variables was the correlation coefficient that measures the linear correlation of variables:

$$r = \frac{c_{xy}}{s_x s_y},$$

where c_{xy} is the covariance in two-dimensional empirical distribution of X (surface visibility) and Y (AOD) variables, s_x and s_y are the standard deviations in empirical marginal distributions of X and Y variables.

The result of $r = -0.28$ has been obtained for the study period. This result indicates rather moderate linear correlation between surface visibility and AOD with negative direction. However, the estimation of strength of this relation can be underrated if it would be – as empirical curves of regression indicate – nonlinear. Then correlation ratios would be more suitable as measures of the strength of correlation. Therefore, the differences between correlation ratios and correlation coefficient, which are measures of nonlinearity, have been calculated. We obtained:

$$m_{xy} = e_{xy}^2 - r^2 = 0.0554,$$

$$m_{yx} = e_{yx}^2 - r^2 = 0.0145 .$$

As the obtained values of measures of nonlinearity are not too big, it seems that relations between variables are linear.

Because relations between correlation ratios and correlation coefficient can be only the basis for general estimation whether the dependence between variables can be recognized as linear or nonlinear, the linear dependence between investigated characteristics has been assumed and classical models of linear regression have been built on the basis of experimental data, showing how conditional expected values of one of the variables change according to the values, the other variable adopts. Then the examination of their curvilinearity has been done. This allowed to draw out more precise conclusions concerning linearity of regression. The sum of square deviations that are not explained by regression has been separated into the sum of square deviations that represent pure error and square deviations resulting from the lack of fitting of straight line to empirical data. Errors of fitting were differences between the values of straight line function fitted by the least squares method and the values of empirical regression resulting from averaged values of Y variable in subsets of the sample with the same values of X. Comparison of averaged square deviations for fitting error (of model) and pure error made it possible to verify the hypothesis whether regression function Y in relation to X is linear in population. The testing statistic had the form:

$$F = \frac{[\sum_{i=1}^{r}(\hat{Y}_i - \overline{Y}_i)^2]/(r-2)}{[\sum_{i=1}^{r}\sum_{j=1}^{n_i}(Y_{ij} - \overline{Y}_i)^2]/(n-r)} .$$

The numerator of the fraction represents the mean square of fitting error (error of model) while the denominator represents the mean square of pure error. Factor $(r – 2)$ is the number of degrees of freedom for the sum of squares of fitting error, while $(n – r)$ is the number of degrees of freedom for the sum of squares of pure error. Factor r is the number of classes of X variable, while n_i expresses the number of repeated observations for $X = X_i$.

If regression Y in relation to X is linear then F statistic has F-Snedecor's distribution with the number of degrees of freedom of numerator $v_1 = r – 2$ and of denominator $v_2 = n – r$. Critical region for this test – at α significance level – is expressed by $F_{\alpha,r\text{-}2,n\text{-}r}$ value that comply with the condition:

$$P(F \geq F_{\alpha,r\text{-}2,n\text{-}r}) = \alpha.$$

If the F value is not less than $F_{\alpha,r\text{-}2,n\text{-}r}$ (critical), then we reject the hypothesis about linearity of regression.

Taking as X the surface visibility and AOD as Y, we got: $F = 1.5197$, $F_{\alpha,r\text{-}2,n\text{-}r} = F_{0.05,4.385} = 2.37$ and $F < F_{0.05,4.385}$, so there is no reason for rejecting the null hypothesis about linearity of regression of AOD in relation to surface visibility.

Taking AOD as X and surface visibility as Y, we got: $F = 1.7883$, $F_{\alpha,r\text{-}2,n\text{-}\mathrm{r}} = F_{0.05,14.375} = 1.71$ and $F < F_{0.05,14.375}$, so – at the 0.05 significance level – the null hypothesis about linearity of regression of surface visibility in relation to AOD should be rejected.

At last, the hypothesis that correlation coefficient equals zero has been verified. If this hypothesis would be true, the statistic:

$$t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2} ,$$

where r is an empirical correlation coefficient from the sample, would have t-Student's distribution with $(n\text{-}2)$ degrees of freedom. This time the critical region is defined by the following relation:

$$P(|t| \geq t_\alpha) = \alpha ,$$

where α is the significance level, t_α is the critical value taken from t-Student's distribution table.

As the alternative hypothesis is the hypothesis saying that correlation coefficient is (significantly) less than zero, the one sided test is appropriate in this case. It is defined by the relation:

$$P(t \leq -t_{2\alpha}) = \alpha .$$

Taking $\alpha = 0.05$ we obtained:

$$t = -5.76\ ,$$

$$t_{2\alpha} = t_{0.1;389} = 1.645\ .$$

As $t = -5.76 < -1.65 = -t_{0.1;389}$, the value of statistic from the sample lies inside the critical region and the hypothesis about the lack of dependence between surface visibility and AOD should be rejected for advantage of an alternative hypothesis. This means that the value of correlation coefficient from the sample is significantly less than zero.

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KORELACJA POMIĘDZY WIDZIALNOŚCIĄ METEOROLOGICZNĄ I GRUBOŚCIĄ OPTYCZNĄ ATMOSFERY NA PODSTAWIE POMIARÓW WYKONANYCH W OBSERWATORIUM GEOFIZYCZNYM W BELSKU

Streszczenie

Na podstawie materiału obserwacyjnego z okresu od marca 2001 do maja 2005 roku. zebranego w Obserwatorium Geofizycznym w Belsku, zbadano zależności ko-

relacyjne pomiędzy widzialnością meteorologiczną mierzoną za pomocą reperów i grubością optyczną aerozolu mierzoną radiometrem. Określono rozkłady brzegowe i warunkowe obu cech oraz dystrybuanty tych rozkładów. Średnia widzialność meteorologiczna mierzona w dziesięciostopniowej skali w godzinach południowych wynosiła 7,4 (ok. 15 km), zaś średnia grubość optyczna aerozolu wyniosła 0,420. Kowariancja w dwuwymiarowym rozkładzie empirycznym obu cech ma wartość ujemną. Wartości stosunków korelacyjnych z próby (e_{xy} = 0,37; e_{yx} = 0.31) wskazują na to, iż ok. 13,5% całkowitej zmienności widzialności meteorologicznej może być przypisana wpływowi grubości optycznej aerozolu, zaś ok. 9,5% całkowitej zmienności grubości optycznej aerozolu może być przypisana wpływowi widzialności meteorologicznej. Wartość współczynnika korelacji r = –0,28 wskazuje na umiarkowane liniowe skorelowanie widzialności meteorologicznej i grubości optycznej aerozolu. Empiryczne krzywe regresji cech względem siebie wskazują na nieliniowość związków, zaś wskaźniki krzywoliniowości zależności jednej cechy od drugiej sugerują liniowość związków. Badanie liniowości zbudowanych na podstawie danych empirycznych liniowych modeli regresji wskazuje na leżącą na granicy liniowości zależność obu cech. Na poziomie istotności 0,05 zależność grubości optycznej aerozolu od widzialności meteorologicznej jest liniowa, zaś zależność widzialności meteorologicznej od grubości optycznej aerozolu jest nieliniowa. Przeprowadzone na poziomie istotności 0,05 testy statystyczne wskazują na statystyczną istotność związku między analizowanymi cechami, istotnie różne od zera wartości stosunków korelacyjnych oraz istotnie mniejszą od zera wartość współczynnika korelacji.

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Morphological Classification of Vertical Profiles of Aerosol Extinction Coefficient in the Troposphere Obtained from Lidar Measurements at Belsk Observatory in 2000–2003

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Abstract

The paper presents an attempt at morphological classification of vertical profiles of aerosol extinction coefficient in the troposphere on the basis of results of lidar returns obtained in two channels: green (wavelength of 532 nm) and infrared (wavelength of 1064 nm). The selected six types of profiles are characteristic of:

1. Clear troposphere;
2. Troposphere "loaded from the bottom";
3. Troposphere "loaded from the top";
4. Troposphere "loaded from the bottom up to the top";
5. Troposphere "loaded" with Sahara's aerosol;
6. Troposphere containing thin stratus clouds transparent for laser beam.

A method of "screening" of clouds and layers of aerosol from ice and water clouds on the basis of profiles of Ångström exponent has been applied. Also, the 24-month variation of monthly averaged optical depths of the atmosphere for aerosol component obtained from lidar measurements made at 532 nm wavelength, and from radiometric measurements made at 500 nm wavelength has been presented.

1. Introduction

Investigation of 4-dimensional aerosol field in the atmosphere, that means time -space changes of aerosol properties, in local and global scale, is of great importance in the study of the Earth global climate changes. Of greatest potential in this field is a laser radar working in the optical range – a lidar. Lidar returns enable getting aerosol extinction profiles in the atmosphere with large spatial resolution – of the order of tens of meters – to an altitude of about 40 km. All components of the atmosphere: gas, aerosol, dust, clouds and precipitations, are optically active. A signal recorded during lidar sounding contains information on all these components that are present on the way of laser beam. Fitting technical parameters of a lidar as well as a place and time of measurements, and adapting suitable procedures of measurements processing, we can investigate one of atmosphere constituents mentioned above and eliminate the others.

2. Determining vertical profiles of aerosol extinction coefficient from lidar returns

At wavelengths at which the lidar at Belsk Observatory works, namely $\lambda_1 = 532$ nm (green channel) and $\lambda_2 = 1064$ nm (infrared channel) (Puchalski 2003), the volume scattering coefficient is practically equal to the volume extinction coefficient, because at this range of wavelengts the atmospheric aerosol does not reveal, in average, absorbtion properties (elastic scattering). In this case, vertical profiles of aerosol extinction can be expressed by vertical profiles of scattering. The level of received echo signal, technical parameters of the lidar, and optical properties of sounding medium are related by the lidar equation. In the atmosphere consisting of gaseous and aerosol components and for monostatic lidar with parallel optics, a signal from transitory zone and full reception zone is described by the lidar equation of the following form (Klett 1981, Sasano et al. 1985, Puchalski 1990, 1991):

$$P(z,\lambda) = P_0(\lambda)\frac{c\Delta t}{2} R_a G(z) \frac{\beta_1(z,\lambda)+\beta_2(z,\lambda)}{z^2}$$
$$\exp\left\{-2\int_0^z \left[\alpha_1(z',\lambda)+\alpha_2(z',\lambda)\right] dz'\right\}.$$

where $P(z, \lambda)$ is the power of signal received from an atmospheric element at a distance z and wavelength λ, $P_0(\lambda)$ is the power of laser pulse transmitted into the atmosphere, c is the velocity of light in the air, Δt is the laser pulse duration, R_a is the receiver effective aperture, $G(z) = g(z)x(z)$ is the function describing modulation of signal in transitory zone, $g(z)$ is the overlapping factor, $x(z)$ is the collimating factor, $\alpha_1(z, \lambda)$ is the profile of volume aerosol scattering coefficient, $\alpha_2(z, \lambda)$ is the profile of volume air molecules scattering coefficient, $\beta_1(z, \lambda)$ is the profile of aerosol backscattering coefficient, and $\beta_2(z, \lambda)$ is the profile of air molecules backscattering coefficient.

Optical properties of the atmosphere in lidar equation are represented for each measuring channel by the four profiles: two, $\alpha_1(z, \lambda)$ and $\beta_1(z, \lambda)$, characterize the light scattering on aerosols (Mie scattering) and two, $\alpha_2(z, \lambda)$ and $\beta_2(z, \lambda)$, describe the light scattering on gaseous component (Rayleigh scattering) (Van de Hulst 1957). For air molecules, $\alpha_2(z, \lambda)$ and $\beta_2(z, \lambda)$ depend on each other and their relation along the sounding path is constant, $\alpha_2(z, \lambda)/\beta_2(z, \lambda) = S_2$. This relation is known in the literature as a lidar ratio. The lidar ratio S_2 along the sounding path is constant because there is no stratification of scattering function of air molecules in the atmosphere. For aerosol in the troposphere the lidar ratio $S_1(z, \lambda) = \alpha_1(z, \lambda)/\beta_1(z, \lambda)$ is not generally constant because of stratification of its scattering function (of aerosol particles size and their refractive index).

In order to solve the lidar equation it is necessary to know the lidar ratio $S_1(z, \lambda)$ for investigated layer of the atmosphere. This is the most important problem to solve in the process of investigation of aerosol field in the atmosphere by means of lidar, since this relation is not known for aerosol *a priori*, as it is in the case of air molecules (Puchalski 1975, Sasano et al. 1985). Up to now, this problem has been solved with great simplification. Mean values of S_1 for investigated layer have been estimated and lidar equation has been solved under the assumption that $S_1(z)$ is constant along the sounding path (Bosenberg 2003). One should add that the solution of lidar equation under the assumption of variability of lidar ratio $S_1(z, \lambda)$ along the sounding path does not result in any difficulties from mathematical point of view (Puchalski 1999). Taking practical advantage of this solution is problematic at the moment because of the lack of sufficient information about changes of aerosol scattering function along the sounding path.

Studies on determining aerosol lidar ratio are carried on nowadays on the basis of particle distributions obtained from radiometric measurements (Cattrall et al. 2005). A solution of lidar equation for the atmosphere containing air molecules and aerosols with an assumption of constant and known lidar ratio S_1 for aerosol can be presented as follows:

$$\alpha(z,\lambda) = \frac{U(z,\lambda)\exp[A(z,\lambda)]}{\dfrac{U(z_0,\lambda)}{\alpha(z_0,\lambda)} + 2\int\limits_{z_0}^{z} U(z',\lambda)\exp[A(z,\lambda)]dz'},$$

$$\alpha(z,\lambda) = \alpha_1(z,\lambda) + \frac{S_1}{S_2}\alpha_2(z,\lambda),$$

$$A(z,\lambda) = 2(S_1 - S_2)\int\limits_{z_0}^{z} \beta_2(z',\lambda)dz'.$$

where: $\alpha(z, \lambda)$ is the normalized total volume scattering coefficient at λ wavelength, z_0 is the biggest distance present in the profile, $U(z, \lambda)$ is the echo signal recorded by the lidar, $A(z, \lambda)$ is an auxiliary function.

During 2000-2003 the lidar station at Belsk Observatory participated in net measurements in the framework of "European Aerosol Research Lidar Network to Establish an Aerosol Climatology" (EARLINET). 24 lidar stations from the West, South and Central Europe participated in the program. The program was partially supported by means of European Committee grant (N0 EVR1-CT-1999-40003, "A European Aerosol Research Lidar Network to Establish an Aerosol Climatology"). Some of results of measurements made in Belsk Observatory in frame of this program have been used in this article.

Profiles of scattering coefficient in the troposphere were derived from lidar equation for the 250 to 8975 m range of altitudes *H* with the step of 50 m. Every discrete value of scattering coefficient was a mean over 50 m interval and assigned to the center of the interval. Every profile was obtained from two soundings made along the lines at 15^0 and 85^0 to the horizon. The profile for altitudes from 250 to 1150 m was calculated from the first sounding, and for altitudes from 1200 to 8975 m from the second. Then both profiles were put together to get one profile from 250 to 8975 m. The values $S_1 = 45$ (Bosenberg 2003, Cattrall 2005) for aerosol, and $S_1 = 22$ (Puchalski 1975) for water-ice clouds were assumed. Profiles of $\alpha_2(z)$ and $\beta_2(z)$ have been calculated from Optical Model of the Atmosphere (Bielenkij et al. 1987), $\alpha_1(z_0)$ value has been estimated from Optical Model of Continental Aerosol (Kriekov et al. 1982) and verified indirectly from radiometric measurements.

A lidar echo recorded while sounding of the atmosphere contains information on all the constituents of the atmosphere which met by laser beam on its path. The time of measurements while aeorol costituent is investigated is specially selected in order to eliminate presence of clouds, precipitations, fogs, smoke and pollutants of local origin. Estimation of optical state of atmosphere made by an observer is not always correct, especially after sunset. So series of returns are being screened in order to eliminate phenomena that disturb measurements. The screening of some of measurements is complicated and requires many-sided treatment. Lidar profiles got from measurements made in the troposphere in 2000-2003 were initially screened then integrated and screened once more. 151 vertical profiles of extinction coefficients were obtained in this way. Analysis of these profiles made it possible to undertake an attempt of their morphological classification.

Six types of vertical extinction coefficient distributions, for optically active objects existing in the troposphere, transparent for laser beam, like layers and clouds of aerosol, weakly developed water-ice clouds and thin water clouds, have been distinguished. The following types were distinguished of distributions characteristic of:

1. Clear and undisturbed and clear disturbed troposphere;
2. Troposphere loaded from the bottom;
3. Troposphere loaded from the top;
4. Troposphere loaded from the bottom up to the top;
5. Troposphere loaded with Sahara's aerosol;
6. Troposphere containing thin ice-water clouds transparent for laser beam.

Examples of vertical extinction profiles for "clear and undisturbed troposphere" (1) and "clear disturbed troposphere" (2) are presented in Fig. 1.

The optically clear atmosphere consisting of air molecules and aerosols is characterized by small value of optical thickness $\tau_1 < 0.1$ and small values of extinction coefficient $\alpha_1(H) < 0.1$ 1/km [Appendix 1]. Disturbances are revealed by the presence of distinct aerosol layers, for example, at the borders of temperature inversion zones or by the presence of weak clouds of Ci type.

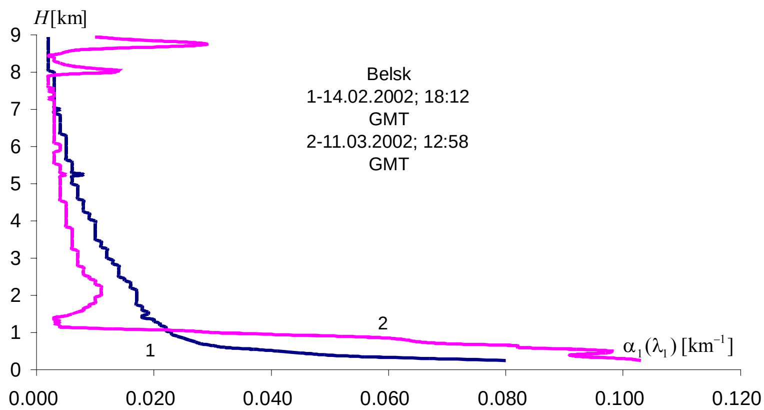

Fig. 1. Examples of vertical profiles of extinction coefficient typical for “clear and undisturbed troposphere” (1) and for “clear but disturbed troposphere” (2) calculated from lidar returns in green channel at λ_1 = 532 nm wavelength.

In Fig. 2 examples of aerosol extinction profiles $\alpha_1(H, \lambda)$ for green (1, 3) and infrared (2, 4) channels typical for the “troposphere loaded from the bottom” are presented. In that case, practically whole amount of aerosol is contained in the layer of the troposphere up to altitude of 2-3 km. Profiles of Ångström exponent $m(\lambda_1, \lambda_2, H)$ [Appendix 1], for extinction profiles shown in Fig. 2 are presented in Fig. 2a. In the first case (lines 1, 2) we have the poorly mixed layer (powerful change of $m(\lambda_1, \lambda_2, H)$ exponent with altitude) in other (lines 3, 4) with the well mixed layer (weak change of $m(\lambda_1, \lambda_2, H)$ with altitude).

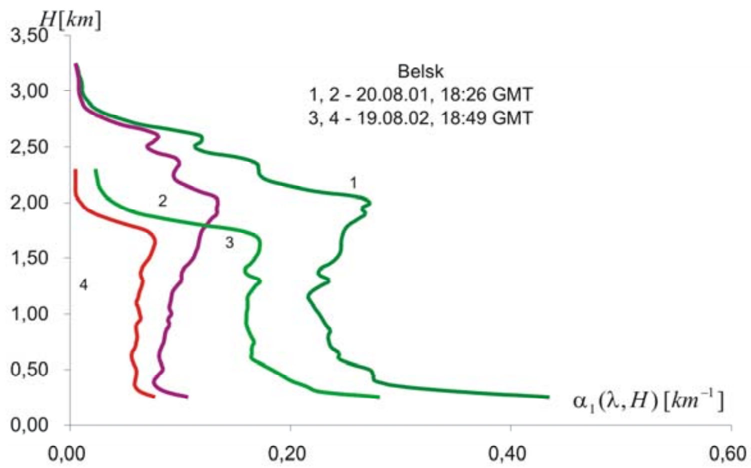

Fig. 2. Examples of aerosol extinction profiles $\alpha_1(H, \lambda)$ for green (1, 3) and infrared (2, 4) channels typical for “troposphere loaded from the bottom”.

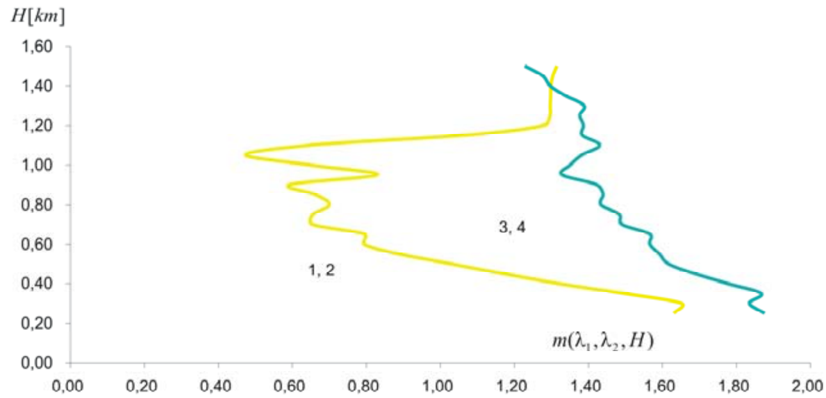

Fig. 2a. Ångström's exponent $m(\lambda_1, \lambda_2, H)$ profiles for the extinction profiles presented in Fig. 2. The first case (lines 1, 2) illustrates poorly mixed layer – considerable change of $m(\lambda_1, \lambda_2, H)$ with altitude, the second case (lines 3, 4) illustrates well-mixed layer – slight change of $m(\lambda_1, \lambda_2, H)$ with altitude.

In Fig. 3 examples of extinction profiles for the "troposphere loaded from the top" are shown. Optically active objects present on hights of 5-9 km were possesing some of properties of aerosol clouds (value of $\alpha_1(H, \lambda_1) < 0.5$ km^{-1}), while other features did not confirm that. The corresponding profiles of Ångström exponent presented in Fig. 3a indicate that these are ice and water clouds, as exponent $m(\lambda_1, \lambda_2, H) < 0.5$. On such altitudes, there can be ice clouds of Ci, Cc and Cs type and weakly developed water clouds with small droplets of Ac type (Chrgian 1961, Feigelson 1964). In the upper troposphere, greater concentrations of aerosol are being found hardly ever.

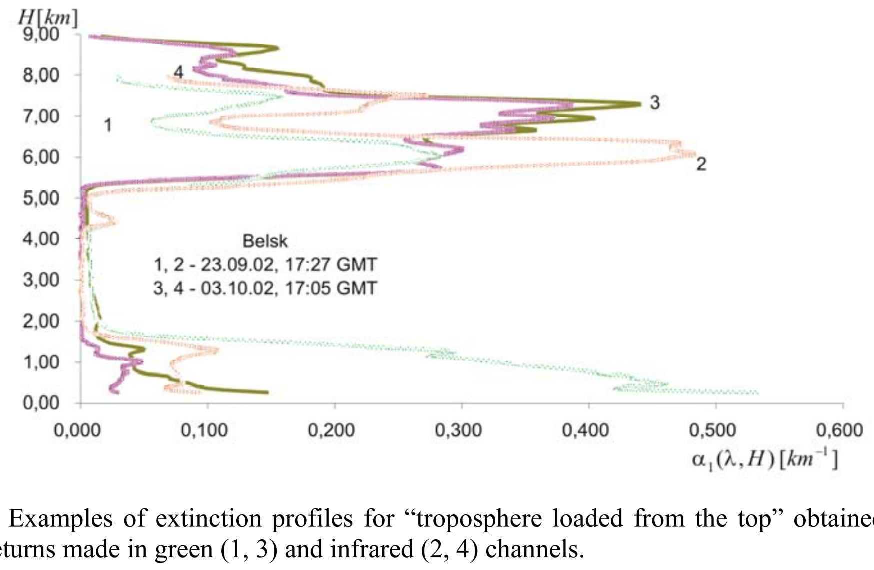

Fig. 3. Examples of extinction profiles for "troposphere loaded from the top" obtained from lidar returns made in green (1, 3) and infrared (2, 4) channels.

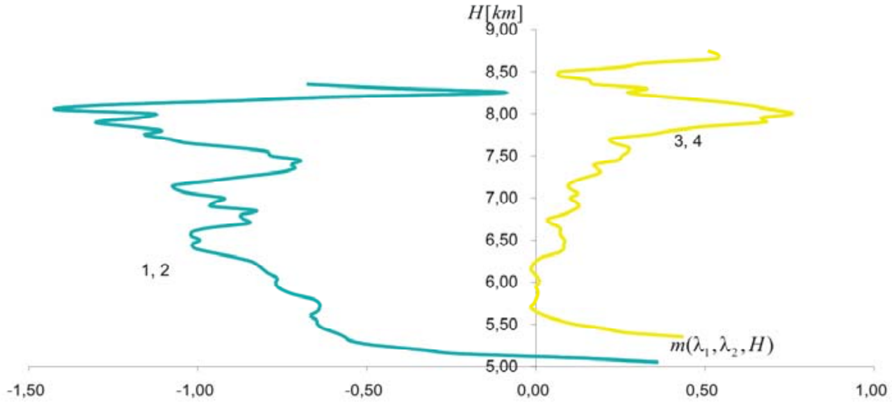

Fig. 3a. Profiles of Ångström exponent $m(\lambda_1, \lambda_2, H)$ for the extinction profiles shown in Fig. 3.

In Fig. 4 examples of extinction profiles in green channel for the "troposphere loaded from the bottom up to the top" (lines 1, 2) are presented.

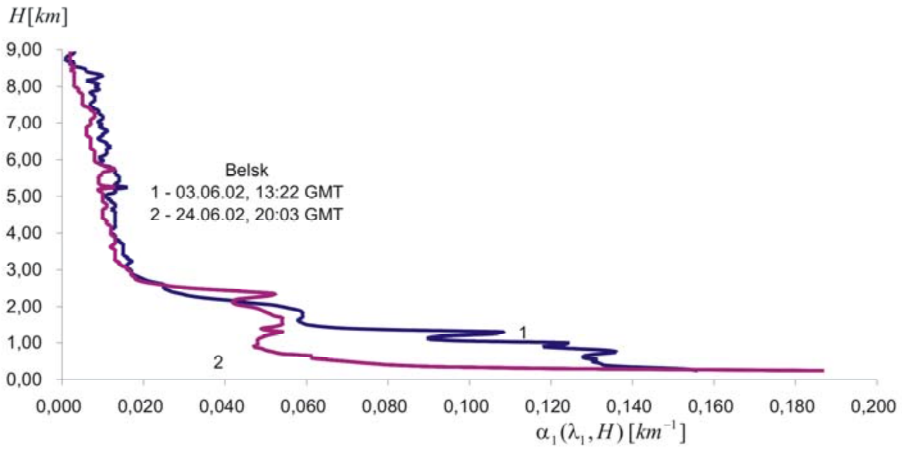

Fig. 4. Examples of extinction profiles for the "troposphere loaded from the bottom up to the top" got from lidar returns made in green channel.

The value of aerosol extinction for the middle and upper troposphere in this case exceeds considerably the values for the atmosphere described by Optical Model of Continental Aerosol (Kriekov et al. 1982). This kind of distribution can appear in the case of large forest or peat-bog fires that take place in considerable distance from measurement site.

Examples of extinction profiles in green channel for the "troposphere loaded with Sahara's aerosol" are shown in Fig. 5. These cases are rare and can be detected only when alerts are issued by the European network EARLINET (Papayannis et al. 2004).

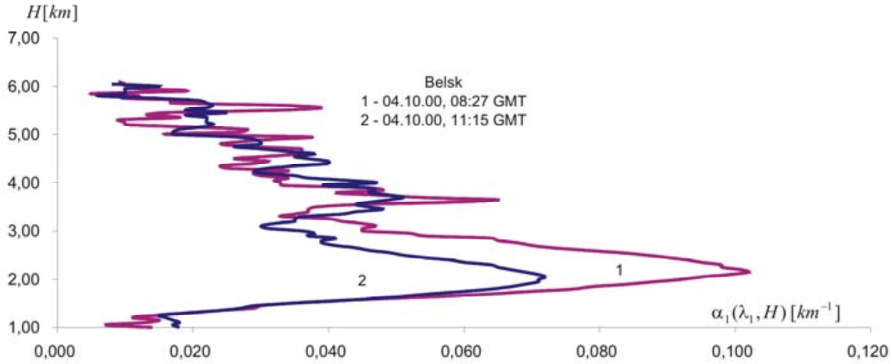

Fig. 5. Examples of extinction profiles for the "troposphere loaded with Sahara's aerosol" got from lidar returns made in green channel.

Sahara's aerosol is formed as a result of sand storms over Sahara desert, where sand is rised up and transported on altitudes of 1 to 6 km by means of atmospheric streams over Europe. It is characterized by extinction coefficient $\alpha_1(\lambda_1, H) < 0.1$ 1/km. Because of the importance of this phenomenon (transportation of huge amount of sand from Africa to Europe), Sahara's aerosol has been separated as an independent type of loading of the troposphere.

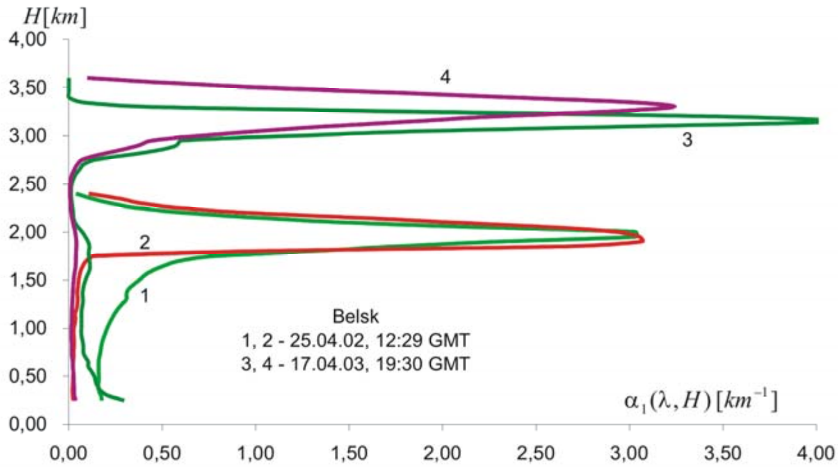

Fig. 6. Examples of extinction profiles for troposphere with small density stratus clouds got from lidar returns made in green (1, 3) and infrared (2, 4) channels.

In Fig. 6 examples of extinction profiles $\alpha_1(\lambda, H)$ for low-level thin clouds of St type, obtained in two channels, green (profiles 1 and 3) and infrared (profiles 2 and 4) are presented, while in Fig. 6a the corresponding plots of Ångström exponent $m(\lambda_1, \lambda_2, H)$ are shown.

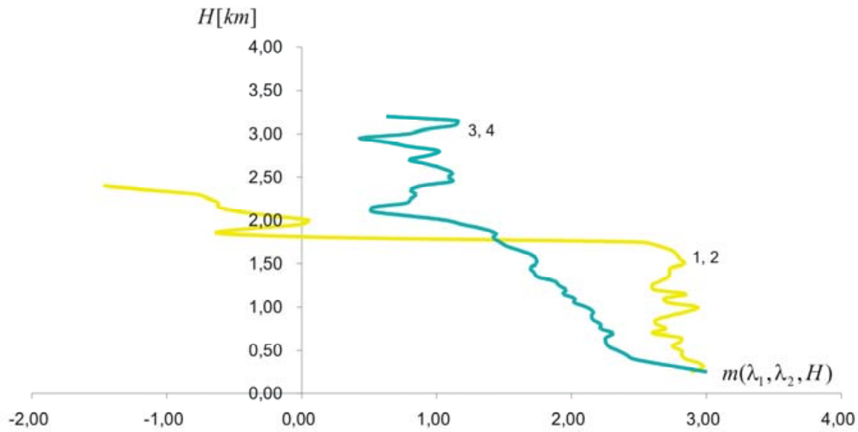

Fig. 6a. Profiles of Ångström exponent m(λ_1, λ_2, *H*) corresponding to the profiles of extinction shown in Fig. 6.

The first cloud, represented by profiles 1 and 2, has more large droplets it has lower values of *m*(λ_1, λ_2, *H*) exponent than the second cloud represented, by profiles 3 and 4, which has greater values of *m*(λ_1, λ_2, *H*) exponent. Besides, there is no vertical stratification of droplets dimensions in the first cloud (the two profiles overlap). Powerfull stratification of droplets dimensions takes place in the second cloud as the profile in infrared is shifted towards the top in relation to the profile in green channel. This indicates the occurrence of big droplets at the top boundary of the cloud. The air under the first cloud is well mixed – small changes of *m*(λ_1, λ_2, *H*) with altitude, while under the second cloud we have stratification of aerosol particles size manifested by considerable monotonic change of *m*(λ_1, λ_2, *H*) with height.

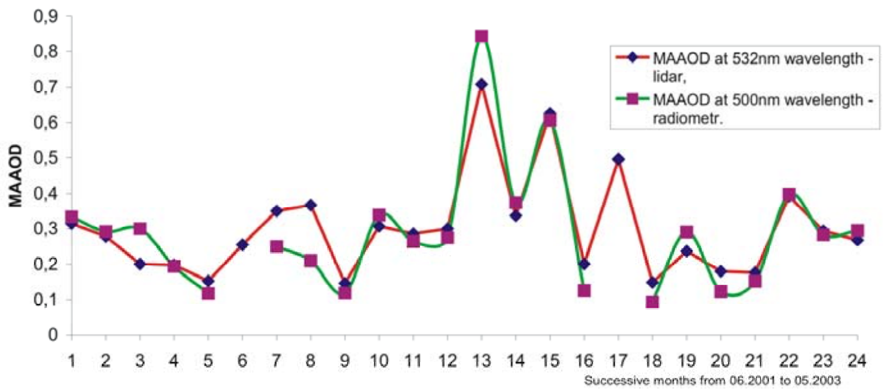

Fig. 7. Variation of monthly averaged aerosol optical depths (MAAOD) of the atmosphere, calculated for aerosol component from lidar returns and from parallel measurements by means of sun radiometer for 24 months from Jun 2001 to May 2003.

In Fig. 7 plots of monthly means of aerosol optical depths (MAOD) derived from lidar returns on 532 nm wavelength and the same means obtained from parallel radiometric measurements made with sky radiometer are presented. The results have been obtained from measurements made during 24 months from June 2001 to May 2003. Agreement of the two plots confirms sufficient accuracy of the lidar method of measurements of aerosol optical thickness in spite of considerable simplifications assumed as concerns the lidar ratio in lidar equation.

APPENDIX 1

Optical depth of atmospheric layer of geometrical thickness H, $\tau_1(H)$ is given by the equation:

$$\tau_1(H) = \int_0^H \alpha_1(z)\,dz\,.$$

The formula that describes dependence of light extinction in the atmosphere α_1 on wavelength λ, got for actinometric measurements by Ångström in 1929 is still a helpful tool for simple description of optical state of the atmosphere, delivering at the same time concise information about sizes of aerosol particles (Ångström 1929, Bokoye et al. 1997).

$$\alpha_1(\lambda) = b\lambda^{-m},$$

where b is a constant and m is an exponent in Ångström formula.

In average, the size distribution of aerosol particles in the atmosphere is described by Junge exponential distribution (Junge 1963):

$$\frac{dN(a)}{d\log a} = Ca^{-\nu},$$

where $N(a)$ is the numerical concentration of aerosol particles with radius a in 1 cm^3, C is a constant, and ν is the parameter of distribution.

As it has been shown by the author, there exists a precise dependence between exponent m in Ångström formula and Junge distribution parameter ν, $m = f(\nu)$ (Puchalski 1966). In the first approximation, $m = \nu - 2$. For the air molecules (Rayleigh's atmosphere) exponent $m = 4$, for continental aerosol $0.7 < m < 1.9$ (Woodman 1974), for small droplets in fogs and clouds $0.2 < m < 0.7$, for big droplets and ice crystals $m = 0$. For some specific sizes of particles with radius from 1 to 2 μm, $0.5 > m > -1.5$. Constant value of m exponent with altitude, $m(\lambda_1, \lambda_2, H)$ = const., is characteristic for a well mixed layer (lack of stratification of particles spectrum). Changes of m with altitude indicate that stratification of aerosol particles spectrum exists.

Profile of $m(z)$ in an optical object that is probed by lidar can be – together with profile of extinction coefficient $\alpha_1(z)$ and optical depth τ_1 – a decisive factor for discerning whether we are dealing do with aerosol layer or water-ice cloud.

Typical aerosol optical depths of the troposphere not disturbed by fogs, clouds, rainfalls or snowfalls are contained within $0.1 < \tau_1(\lambda_1) < 0.8$ interval for green channel (Puchalski 2001), while typical extinction coefficients – within $0.05 < \alpha_1(\lambda_1) < 0.5$ km^{-1} interval. For ice and water clouds $\tau_1(\lambda_1) > 1$, while $5 < \alpha_1(\lambda_1) < 45$ km^{-1} (Chrgian et al. 1961).

Exponent m in Ångström's formula for lidar channels of λ_1 = 532 nm and λ_2 = 1064 nm can be calculated from the following formulas:

$$m(z) = \ln A(z) / \ln B,$$

$$A(z) = \alpha_1(z, \lambda_1) / \alpha_1(z, \lambda_2),$$

$$B = \lambda_2 / \lambda_1.$$

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Contents

PUBLICATIONS OF THE INSTITUTE OF GEOPHYSICS
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D. ATMOSPHERE PHYSICS

List of our publications since 1997 dealing with the atmosphere physics; the full list is published on the cover of our former issues.

D-53 (322) Atmospheric ozone, solar radiation 1999.

D-54 (324) Atmospheric Electricity and Meteorological Observations Świder 1999.

D-55 (332) Atmospheric ozone, solar radiation 2000.

D-56 (333) Results of atmospheric electricity and meteorological observations. S. Kalinowski Geophysical Observatory at Świder - 2000.

D-57 (341) Meteorological Conditions Hornsund, Spitsbergen, 2000/2001.

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