

Comparison of Observatory Data in Quasi-Real Time

Krzysztof NOWOŻYŃSKI and Jan REDA

Institute of Geophysics, Polish Academy of Sciences
ul. Księcia Janusza 64, 01-452 Warszawa, Poland
e-mails: kn@igf.edu.pl, jreda@igf.edu.pl

Abstract

The quality of magnetic observations depends on such factors as: parameters of the recording instruments, and mainly their stability; the accuracy with which the so-called bases are being determined; the precision with which the sensors are positioned and the accuracy of scale values determination.

Every observatory has its own procedures for verifying these parameters. In this paper we present a method of data verification based on: (a) comparison of data calculated from vector magnetometer records with the proton magnetometer records, (b) comparison with data recorded at other observatories.

We present Internet software enabling a comparison between any two observatories. It is possible to compare current data (Reported or Adjusted) as well as Definitive data. The address of Web page for making the comparison is the following: <http://rtbel.igf.edu.pl>

Key words: INTERMAGNET, geomagnetic observations.

1. Introduction

Magnetologists working at geophysical observatories make much effort to improve the quality of geomagnetic field observations. The refinement of observation methods concerns both the geomagnetic field recording and the absolute measurements, decisive for monitoring the so-called secular variations.

The main factors affecting the quality of geomagnetic observations are the following:

- accuracy of determination of the so-called bases of recordings and their stability,
- accuracy of determination of the so-called scale values of the recordings,

- accuracy of positioning of the orientation of sensors,
- effect of thermal changes on the geomagnetic field recording,
- level of regional and local noise.

The experience of magnetologists shows that one of the most efficient ways of improving the quality of data is the widely understood comparison. The comparison may refer to measuring instruments, as for instance comparison of instruments for absolute measurements at IAGA workshops (Jankowski and Sucksdorff 1996). Another example is a comparison of momentary values at 02 h and 11 h, performed through several tens of years by many European observatories. It seems that the era of Internet offers quite new possibilities for performing comparison of geomagnetic observations.

2. Comparisons Between Observatories with the Use of Web Application

Comparisons of magnetic observations at adjacent, not very distant observatories may be of great importance for refining the quality of observations. We may expect the comparison of recordings to be helpful for detecting some faults that may happen, such as:

- changes in “magnetic levels” of a given observatory, resulting from erroneous determination of base levels,
- errors in the determination of scale values of the recording,
- errors or mistakes in the setting of clocks of the magnetic field recording instruments.

These were the reasons that motivated us, at the Institute of Geophysics, to develop a software enabling a comparison between the observatories belonging to the INTERMAGNET. The first version, created in 1997, provided a possibility of comparing only the two Polish observatories, Belsk (BEL) and Hel (HLP). This application has remained operative up now (<http://www.igf.edu.pl/mag/index.poland.html>, author: Michał Jankowski), and the experience with its use is very good. Basing on this experience, we created a new version, with much greater abilities, available at <http://rtbel.igf.edu.pl/>.

The internet page <http://rtbel.igf.edu.pl/> serves for graphical representation of observatory data collected in the framework of the INTERMAGNET project. Available are the archival data in the final version for all the observatories as well as the current data from those observatories that decided to submit the data in the IMFV1.22 format to the address imc@igf.edu.pl.

The new application makes it possible to compare any two observatories belonging to the INTERMAGNET. Of course, it is most sensible to compare adjacent observatories. The INTERMAGNET data can be visualized as one-day data or for 30-day period. There is an option to choose which components, X, Y, Z, or F, are to be visualized. The page enables us to see data from one or two observatories simultaneously. In addition, there is a possibility to display the K indices determined by the observato-

ries, as well as the K indices calculated by the ASm method (Nowożyński *et al.* 1991) or the energy indices E (Reda and Jankowski 2004).

The main part of the Web application welcoming window is shown in Fig. 1. A comparison of magnetograms from two nearby observatories is shown in Fig. 2.

The screenshot shows a web browser window with the URL <http://rtbel.igf.edu.pl/>. The page title is "INTERMAGNET Magnetic Observatories one minute magnetic field comparison". Below the title, there is a "Magnetogram selection" section. It includes a dropdown menu for "Observatory" set to "BEL - Belsk", a "Date" selector for "30 November 2006", and a "Compare with observatory" dropdown set to "- No -". There are checkboxes for "Components" (X, Y, Z, F, dF) and "Magnetic activity indices" (K, K(Asm)¹⁾, E²⁾). The "Plot size (in pixels)" is set to "400x100" and "Plot height (nT)" is set to "Auto". At the bottom, there are buttons for "Show selected magnetogram" and "Cancel selection".

Fig. 1. The main Web application menu.

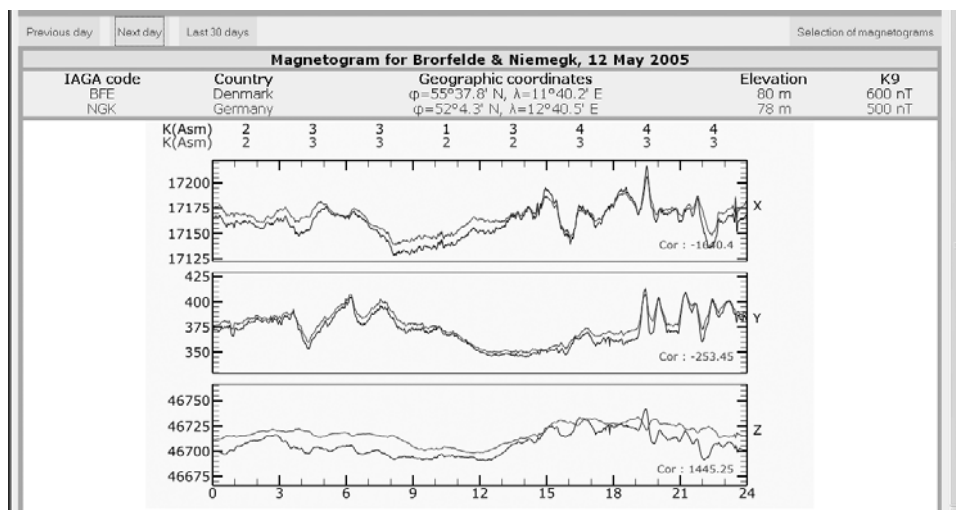


Fig. 2. An example of comparison of magnetograms from two adjacent observatories.

Figure 3 presents 30-day plot of components X, Y, and Z from two adjacent observatories. In this case, the Web application helped us detect a jump-like change in the Y component (by about 50 nT) in one of the observatories. The change was caused by erroneous determination of the smoothed base level. We purposefully deleted the names of the observatories, since our aim is to demonstrate the abilities of the Web application, not to publicize the observational errors.

The continuous recording of total field F has been performed in more and more observatories. Such a recording is optional for the INTERMAGNET observatories (St-Louis *et al.* 2004). A comparison of the total field calculated from the vector magne-

tometer, F_v , with that directly recorded by the scalar magnetometer, F_s , may be very important. Such comparisons are possible with the help of the Web application discussed here, as shown in Fig. 4. The figure displays 24-hour F_v – F_s curves from two observatories: curves (a) and (b). In this case, the application detected a very local, internal observatory disturbances in one of the observatories (curve (b)), that were easy to eliminate.

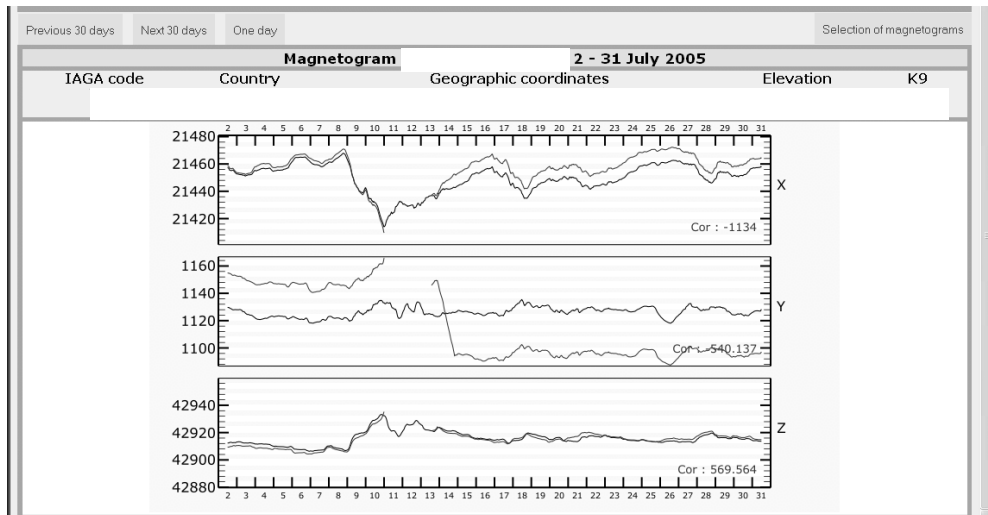


Fig. 3. An example of 30-day comparison of data from two adjacent observatories.

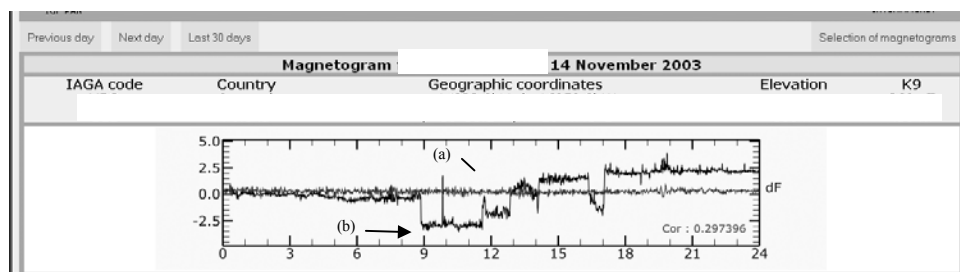


Fig. 4. Plots of differences F_v – F_s for two observatories.

3. Summary

The Web application described here has worked for over a year. It proved to be very useful for verifying the Definitive data before their final compilation on CD-ROM 2005. The authors encourage the personnel of the INTERMAGNET observatories to use this application for Reported and Adjusted data. The only thing to be done in order to use this software for such data is to send the magnetic data in the IMFV1.22 format to the address imc@igf.edu.pl. The Web application is available from the page <http://rtbel.igf.edu.pl/>.

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