

CURRENT STATUS OF PERMANENT MAGNETIC OBSERVATORIES IN FRENCH AUSTRAL AND ANTARTIC TERRITORIES

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ABSTRACT

The 5 permanent magnetic observatories of French Austral and Antarctic territories (Amsterdam, Concordia, Crozet, Dumont d'Urville and Kerguelen) are integrated as active participants in the worldwide network of magnetic observatories (INTERMAGNET), which monitor variations of the Earth's magnetic field at all time scales..

WHY FOR MAGNETIC OBSERVATORY DATA AT THE SATELLITE ERA?

The knowledge of the geomagnetic field made substantial progress within the last 20 years mainly thanks to the satellite vectorial data.

Detailed spatial description of the internal part (liquid core source and crustal sources) were significantly improved, as well as the characteristics of the secular variation. Investigations of the outer envelopes of the Earth, ionosphere and magnetosphere, have shown the prominent role of the interaction between the interplanetary magnetic field and the Earth's field in the solar wind-magnetosphere coupling and the energy transfer through the magnetopause and the magnetotail.

Ground magnetic observatories remain essential sources of data in both problematics. They provide information for the processing of the satellite data, which is crucial for the separation of the external and internal parts of the field; the knowledge of the secular variation field still mainly relies upon the observatory data which are also essential for survey data reduction. One way of characterizing the magnetic activity, directly connected to the solar activity and interplanetary state, is to elaborate magnetic indices [5]. Their computation relies entirely on observatory data. The observatory data are also incorporated, along with in situ measurements of various parameters (velocities, particle densities, interplanetary magnetic field) into the data bases which support the magnetospheric and Solar-Terrestrial physics studies.

MAGNETIC OBSERVATORY NETWORK

However, the global distribution of the permanent magnetic observatories is rather heterogeneous, the Southern hemisphere being poorly represented.

INTERMAGNET [4] is an international network aiming at establishing a global network of digital magnetic

observatories, providing advices for measuring and recording the field according to modern standards and facilitating data exchanges [7] in close to real time.

This network includes 114 observatories with only 26 of them (23% of total number of magnetic observatories) in the Southern hemisphere.

OPERATIONS IN FRENCH AUSTRAL AND ANTARTIC MAGNETIC OBSERVATORIES

The permanent magnetic observatories of the French Austral and Antarctic magnetic observatories (Figure 1) are localized in remote places in the Southern hemisphere and are fulfilling the INTERMAGNET standards.



Fig. 1 Location of the French Austral and Antarctic Magnetic Observatories.

In these observatories, the Earth's magnetic field is continuously recorded with sampling rates of 1s. A completely new acquisition system (MARCell 1.0 – Magnetic Acquisition and Recording Cell 1.0 [3]) was developed and installed. It allows to record : (i) variometer data, (ii) absolute value of the field intensity, (iii) various auxiliary parameters of interest both for controlling the sensors and acquisition environment and for facilitating the diagnostic of

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failures. It comprises also an integrating daily shipment protocols. The current concerns focus on resolution (< 1 pT), sampling rate and time accuracy (< 10 ms).

Absolute measurements of the magnetic field components are also performed regularly (every two days) by a trained observer along the year.

In the present state of the art, manual absolute measurements remain the most accurate way of controlling the base lines of the magnetometers, whatever their type. Efforts are made for several years towards more automation [1,6]. Nevertheless, these recent proposed solutions are either : still under development, still need the presence of an observer, or/and their instrumental reference frame is difficult to determine.

The observatories have still to be operated by a trained observer. This condition may be hard to fulfill in remote areas as in Concordia/DomeC base in Antarctica [2] or when strong economic pressure may result in a reduction of the observer staffs.

CONCLUSION

Despite the huge efforts made to survey the Earth's magnetic field with near-earth satellites, the ground based observatories remain indispensable.

The worldwide effort made towards one second synchronized recordings and quasi-real time dissemination still increases the role played by the ground-based observations in the understanding of the physics of the sources, whatever their nature and the complex interaction of various external layers with the interplanetary environment.

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