Final project report

Project ID 2002/3.02
Title Antarctic Reference Model -2
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Duration 2 years
Assigned funding 30 987.41 €

Activities and results

After the first phase of the project Antarctic Reference Model (ARM) covering the years 1999-2001, the satellite missions CHAMP and Ørsted, launched in 1999 and 2000, respectively, have opened new perspectives to the ARM model, thanks to the uniform distribution of data and complete coverage of the continent. The validation and the use of these data was the main point of the next phase of the project (the so-called ARM2; 2002-2003), contributing to define the best reference model for Antarctica. The research was therefore carried out in three phases: collection and validation of all new data, with particular attention to the recent satellite data, development of the new updated version of ARM, and its comparison with global models. Despite of the greater accuracy of the model ARM compared with the IGRF, the use of observatory data only was insufficient, because of their lack of regional coverage. The data from the Boomerang mission (measurements collected by a sensor installed on a stratospheric balloon that flew over Antarctica during December 1998-January 1999) have helped to avoid such inconvenience. The different types of data were compared each other and with the older version of ARM and some statistical tests permitted to us to reject the observations that deviated too much from the average behaviour. The external magnetic contamination possibly present in the satellite data has been strongly reduced taking into account only magnetically quiet days and specific threshold values for the magnetic activity indices Kp, Dst and AE, and also looking for the lowest value for the By component of the interplanetary magnetic field. Another step has only considered the inclusion of measures taken during the austral winter for the minor contribution of magnetosphere currents.

All the data in the form of X, Y, Z components and total intensity F, were analyzed and modelled according to the observation point (geographic coordinates, height, epoch) with Spherical Cap Harmonic Analysis (SCHA). This technique is based on the expansion of the geomagnetic potential in spherical cap harmonics with integer order but usually non integer degree. The SCHA appears to provide the best results when the geomagnetic field is mapped on a limited area of the Earth's surface and had already been applied to generate the preliminary versions of the ARM model. The regional model, synthesized on a regular grid in the Antarctic area in different epochs, was compared with the IGRF model, improving the performance with respect to the main field and to the secular variation. The complete definition of ARM will be particularly useful for improving the next generations of global models over Antarctica, and for the process of compiling a new version of the map of magnetic anomalies for Antarctica in the framework of the Antarctic Digital Magnetic Anomaly Project (ADMAP). A web page was built during the first ARM and continuosly updated shows details and progresses of the project.

Products

A – papers in scientific magazines
2. Calcara M., Beranzoli L., Braun T., Calore D., De Santis A., Etope G., Favali P., Frugoni F., Gasparoni F.,


B – book chapters


C - proceedings of international conferences


Programma Nazionale di Ricerche in Antartide (PNRA)

Assembly Nizza (France) 21-26 April 2002.

D – proceedings of national meetings and conferences

E – thematic maps
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F – patents, prototypes and data bases
1. Official Website for ARM Project.
2. Software on the ARM website for automatic interrogation and providing magnetic components in Antarctica, period 1960-2005.

G – exhibits, organization of conferences, editing and similar
1. De Santis, Invited Chairman in the Workshop: Challenges for Geomagnetism and Seismology for the XXI century, Tortosa - Ebro, Spain, 28/9-1/10/2004, for the celebration of the centenary of the activities of the Geophysical and Astronomical Observatory of Ebro (Spain).

H – formation (PhD thesis, research fellowships, etc.)

Research units

Research Unit 1: Responsible, A.De Santis, other components: M. Chiappini, G. Dominici, R. Tozzi
Research Unit 2: Responsible J.M. Torta, other component: L.R. Gaya Piqué

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Notes