

## Final project report

<i>Project ID</i>	2003/2.03
<i>Title</i>	Wide band electromagnetic field measurements at MSZ geomagnetic observatory
<i>Principal investigator</i>	Paolo Palangio
<i>Institution</i>	INGV
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<i>Duration</i>	2 years
<i>Assigned funding</i>	25.000,00 Euros

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### Activities and results

The principal purpose of this project is to create an antarctic observatory for continuous monitoring of the electromagnetic signals in ULF-ELF-VLF bands (0.001 Hz-100 kHz). The new observatory has been installed at MZS, around OASI area, at the end of 2003. Because the spectral density of the feeblest magnetic natural signal in polar regions is about  $[2-5] \text{ fT}/\sqrt{\text{Hz}}$  it was necessary to develop the technology for a very low noise magnetometers and acquisition systems (hardware and software). The level of instrumental noise needs to be lower than  $2 \text{ fT}/\sqrt{\text{Hz}}$ .

The first year of the project (2003) was mainly devoted to the development of technology. During 2003 two magnetometers and one electrometer have been designed at L'Aquila Geomagnetic Observatory, involving an italian industry in a collaborative way.

The background noise level of the developed instrumentation is of the order of  $[1-2] \text{ fT}/\sqrt{\text{Hz}}$ .

Figures 1, 2, 3 and 4 show some examples of the technology developed in the frame of this project (electric and magnetic sensors) installed in Antarctica.

The technology developed in the frame of this project can also be used in other research areas such as the electromagnetic sounding of the earth interior (magnetotelluric and GDS).

In 2004 started one yearly scholarship for Dott.ssa Claudia Rossi in order to undertake data analysis and statistics on data collected by the new antarctic observatory. Abstracts and posters were presented at international congresses on natural electromagnetic signals which permeate the magnetosphere and Earth-ionosphere cavity.

Detailed results of the study were published on "Annals of Geophysics" The project has reached the end of its life, the investment stage has been completed, and all the objectives of the project have been completed and achieved.

#### Activities carried out in Italy

The first year of the project (2003) was devoted to the design of instrumentation:

- 1) magnetometer for the higher band (10 Hz – 100 kHz, fig.2)
- 2) magnetometer in the ULF-VLF band (fig.3)
- 3) electrometer in the band from 10 Hz to 100 kHz (fig.1)
- 4) acquisition system

The second year the activity was devoted to the analysis of data acquired by the antarctic observatory and publishing the research results on international journal

#### Activities carried out in Antarctica MZS

- 1) Construction of 3 concrete bed with aluminium frame work for the 3 main instruments fig.1, fig.2 and fig.3.

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2) Installation of the observatory and calibration of the instrumentation.

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### Products

#### A – papers in scientific magazines

1. Rossi C., Palangio P., Rispoli F. (2007): "[Investigations on diurnal and seasonal variations of Schumann resonance intensities in the auroral region](#)" *Annals of Geophysics* 3 / 50 (2007)

#### B – book chapters

#### C - proceedings of international conferences

#### D – proceedings of national meetings and conferences

#### E – thematic maps

#### F – patents, prototypes and data bases

#### G – exhibits, organization of conferences, editing and similar

1. C.Rossi, P.Palangio, Poster Session: "Investigations on diurnal and seasonal variations of Schumann resonance oscillations in the auroral region" – European geophysical Society XXVIII General Assembly, 2003, Nice (France).
2. C.Rossi, P.Palangio, Poster Session: "Schumann resonances measurements in polar regions" - EGU 2004, 25-30/04/2004, Nice (France).

#### H - formation (PhD thesis, research fellowships, etc.)

1. In 2004 started one yearly scholarship for Dott.ssa Claudia Rossi on the theme: "analysis of electromagnetic signals measured in polar regions"
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### Research units

Manuele Di Persio - CTER INGV  
Lucilla Alfonsi - ricercatrice INGV  
Claudia Rossi - ricercatrice INGV  
Stefania Lepidi - primo ricercatore INGV  
Marco Pietrella - ricercatore INGV  
Vincenzo Romano - ricercatore INGV

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FIG.3 ULF CALIBRATION SENSORS (0.001 Hz - 40 Hz)

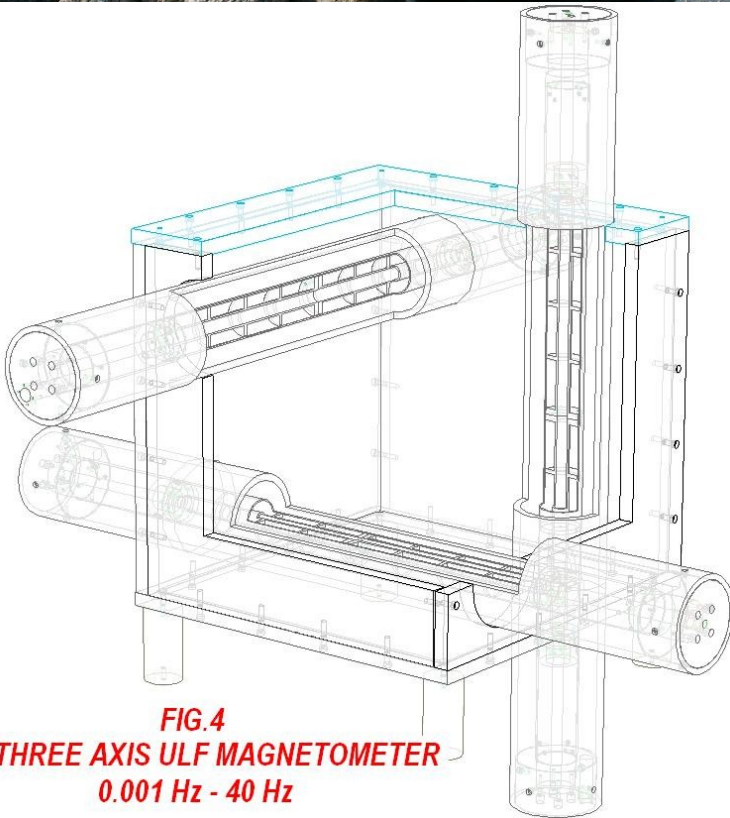


FIG.4  
THREE AXIS ULF MAGNETOMETER  
0.001 Hz - 40 Hz