Geomagnetic observatory GAN

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Participating institutions

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- With support and help from:
  - Jakub Velímský (Charles University in Prague)
  - Lars W. Pedersen (DTU Space)
  - Jürgen Matzka (DTU Space)
  - Lukas Zimmermann (ITECO Ingenieurunternehmung AG)
  - Rudolf Widmer-Schnidrig (BFO Observatory, Univ. Stuttgart)
  - John Riddick (BGS, retired)
The objective of geomagnetic observatories is to record continuously, and over the long term, the time variations of the magnetic field vector and to maintain the accurate absolute standard of the measurements. *(IAGA Guide for Magnetic Measurements and Observatory Practice, 1996)*
Intermagnet

- 116 operating observatories
- Strict quality standards
  - Definitive Data Accuracy: ±5 nT
  - Vector Magnetometer
    - Resolution: 0.1 nT
    - Dynamic Range: 8000 nT High Latitude, 6000 nT Mid/Equatorial Latitude
    - Sampling rate: 1 Hz
    - Thermal stability: 0.25 nT/°C
    - Long term stability: 5 nT/year
  - Scalar Magnetometer
    - Resolution: 0.1 nT
    - Accuracy: 1 nT
    - Sampling rate: 0.033 Hz (30 sec)
- Data available on CDs and online
Site selection

- initial visit January 2009 (Alexei & Chris)

**Figure 4:** Magnetic anomalies (in units of nT) in the close proximity of the proposed VAR and OVH site. Note the gradient is generally small, less than 1 nT/m.

**Figure 5:** Magnetic anomalies (in units of nT) in the close proximity of the proposed ABS site. Note the gradient is generally small, less than 1 nT/m.
Instruments

Absolute measurements

- fluxgate Declinometer/Inclinometer Instrument MINGEO 020 (Zeiss THEO 020 + DMI Model G FGM)

- measurement accuracy < 3”
Instruments

Absolute measurements

- Overhauser precession magnetometer (Gemsys GSM-90F1)
  - accuracy 0.2 nT
Instruments

Relative measurements

- fluxgate magnetometer (suspended FGM-FGE variometer)

  Resolution: 0.1 nT
  Long time drift: $< 3 \text{ nT/year}$
  Temp. coeff. of sensor: $< 0.3 \text{ nT/°C}$
  Temp. coeff. of electronics: $< 0.1 \text{ nT/°C}$
Observatory sketch
Hut designs

- concrete pillars
- concrete block walls
- wooden/glassfiber roofs
- brass fitting
Hut designs

ABS

CROSS-SECTION VIEW OF THE ABS HUT & SHEET TO KEEP ON THE BARS

0.127m

2.5m

1.0m

0.0508m

0.0499m

0.0089m

0.005m

DIA 0.300m

Surface Level

Hard Wood

Sface Level

0.018m

0.499m

0.499m

0.499m

0.499m

0.499m

0.5m

0.5m

0.5m

0.5m

2.5m

2.5m

2.5m

2.5m

3m

0.5m

0.55m

0.55m
Hut designs

ABS

ABS FRONT VIEW - 01

Surface level

Plywood Sheet to keep on the bars inside hut

Bottom of the window is at a height of the pillar
Hut designs

Electronics
Hut designs
Overhauser
Hut designs
Variometer
Hut designs
Connection scheme

SolarBox 12V DC

Datalogger

OVM electronics

FGM electronics

OVM sensor

FGM sensor

Solar Panel

Met Office

WiFi access point

PC

router

ETH

GPS antenna

WiFi antenna

Electronics hut
Datalogger

- Alix3d2 board
  - AMD Geode 500 MHz, 256 MB Dram, 4 GB CF card
  - fanless, 5 W peak, 12 V DC
  - 1 Ethernet, 2 USB, 1 RS-232
  - Wistron DCMA81 miniPCI card (WiFi, 2.4 GHz, WPA2)

- Voyage linux 0.6.1
- Data recorded via simple program in Python
  - 1 s data sampling with GPS trigger and stamp from OVM
  - conversion of FGM voltages to nT
  - computation of 1 min averages using Gaussian filter

- Data stored locally (capacity at least 2 year)
- Regular synchronization of data to computers in the MetOffice and ETH (rsync)
- Display of data via cgi script and www browser
Current problems

- interference in OVM during charging of batteries from the solar panel (approx. 9:00–16:00 GMT)
  - probable cause: PWM used in charging process
  - suggested remedies: DC-DC converter, secondary battery charged overnight from the main battery
  - to be tested with another GEM-90 in Zurich this summer
Current problems

- temperature variations of FGM sensors (up to 5 °C daily variations)
- styrofoam: installed yesterday
- more water?
- tri-iso external insulation?
- white paint on huts
To do list

- absolutes training program in Hyderabad (planned in June 2011)
- implementation of baselines in the processing chain
- output format according to Intermagnet standard
- long-term control of quality
- application to Intermagnet
- for induction studies: measurement of horizontal electrical field