

Geomagnetic observatory GAN



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 - ▶ Jürgen Matzka (DTU Space)
 - ▶ Lukas Zimmermann (ITECO Ingenieurunternehmung AG)
 - ▶ Rudolf Widmer-Schnidrig (BFO Observatory, Univ. Stuttgart)
 - ▶ John Riddick (BGS, retired)

Geomagnetic observatories

- ▶ 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*)

- ▶ 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: $0.25 \text{ nT}/^{\circ}\text{C}$
 - ▶ Long term stability: $5 \text{ nT}/\text{year}$
 - ▶ 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)

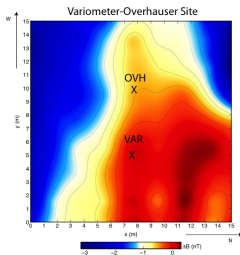


Figure 4: Magnetic anomalies (in units of nT) in the close proximity of the proposed VAR and OVH site. Note the gradient is generally small, less than 1 nT/m.

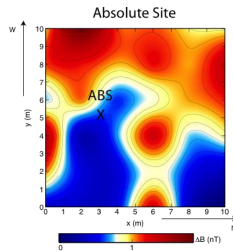


Figure 5: Magnetic anomalies (in units of nT) in the close proximity of the proposed ABS site. Note the gradient is generally small, less than 1 nT/m.

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

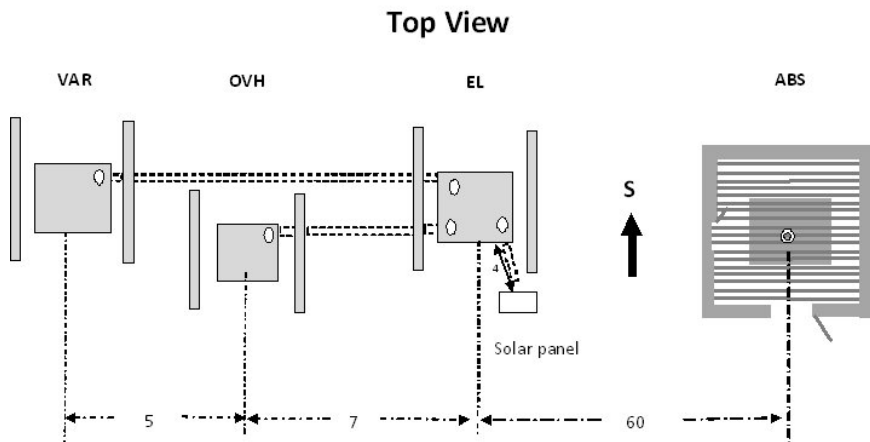
Relative measurements

- ▶ fluxgate magnetometer (suspended FGM-FGE variometer)



- ▶ Resolution: 0.1 nT
Long time drift: $< 3 \text{ nT/year}$
Temp. coeff. of sensor: $< 0.3 \text{ nT/}^{\circ}\text{C}$ Temp. coeff. of electronics:
 $< 0.1 \text{ nT/}^{\circ}\text{C}$

Observatory sketch

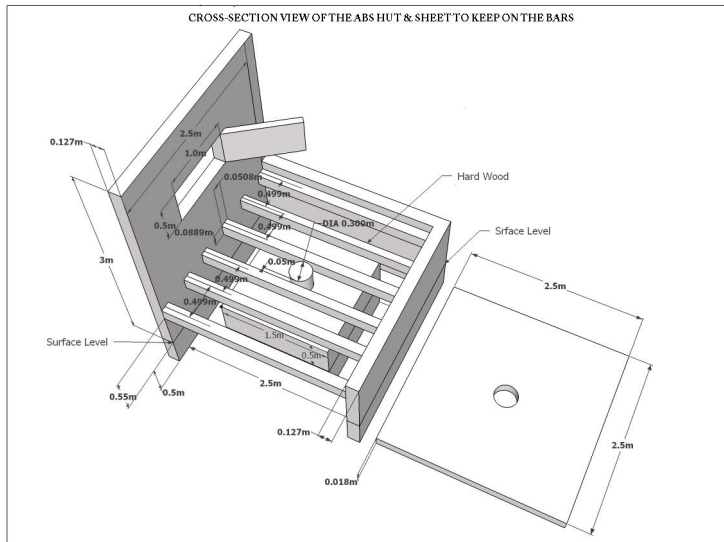


Hut designs

- ▶ concrete pillars
- ▶ concrete block walls
- ▶ wooden/glassfiber roofs
- ▶ brass fitting

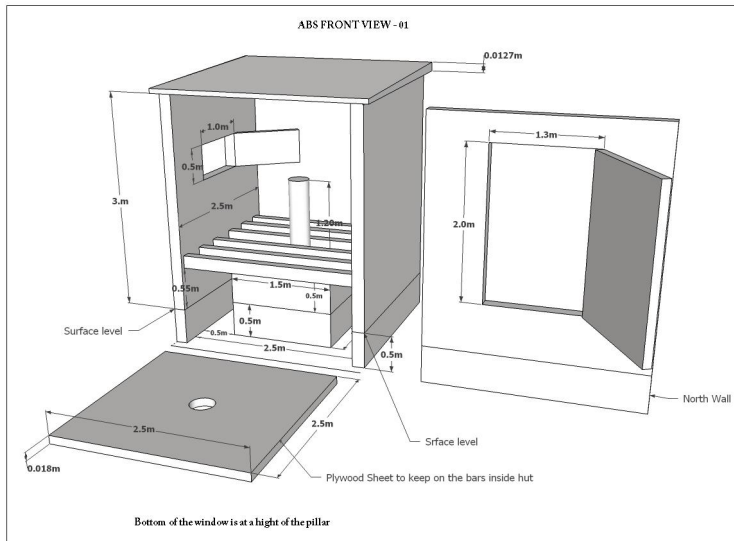
Hut designs

ABS



Hut designs

ABS

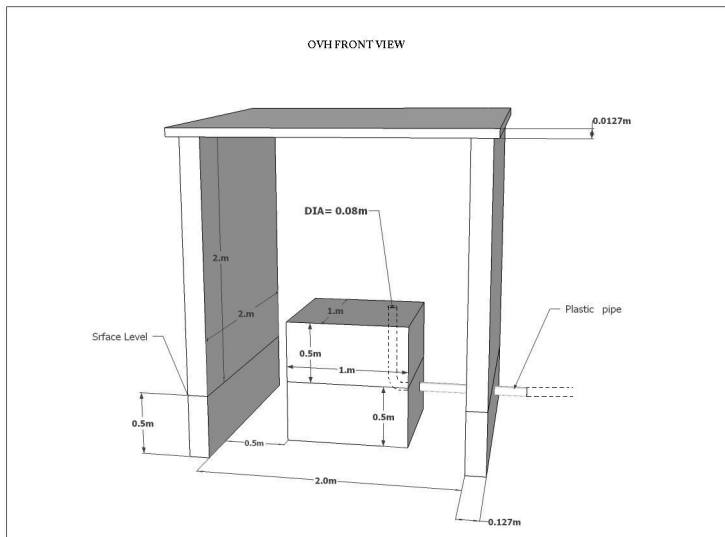


Electronics



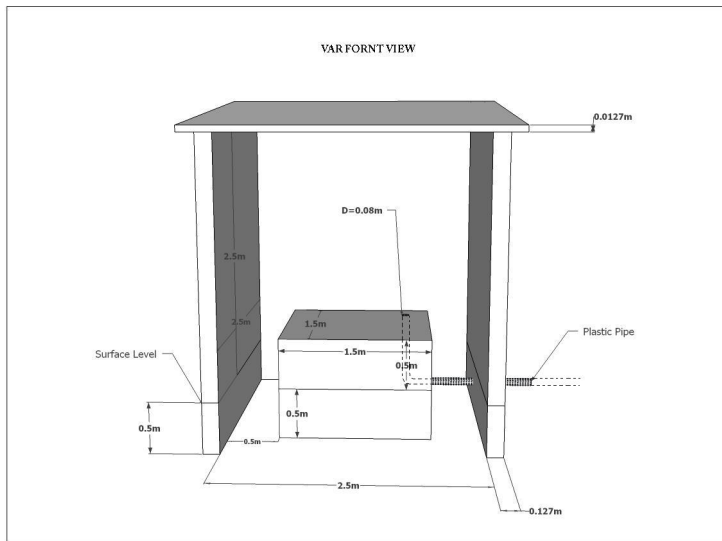
Hut designs

Overhauser



Hut designs

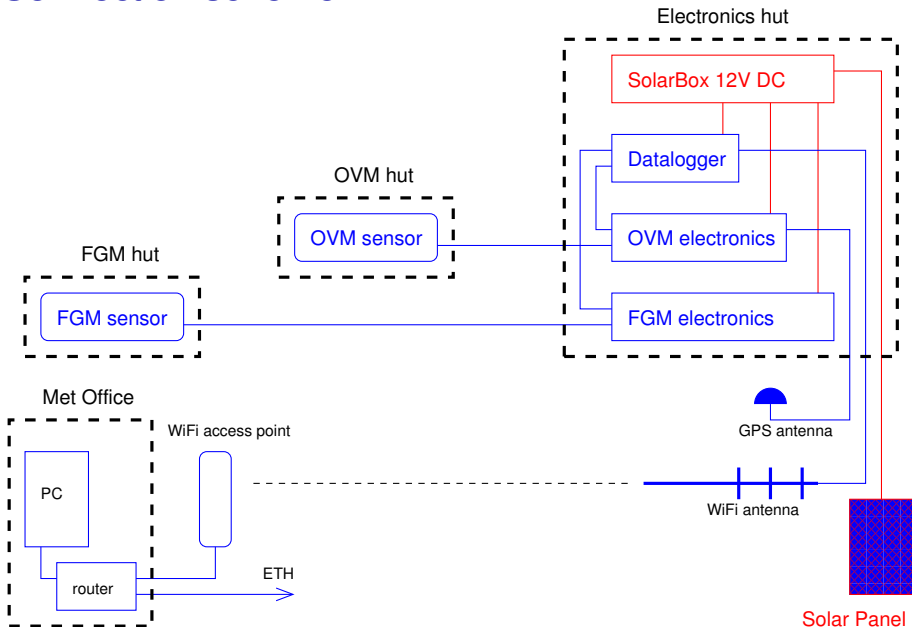
Variometer



Hut designs



Connection scheme



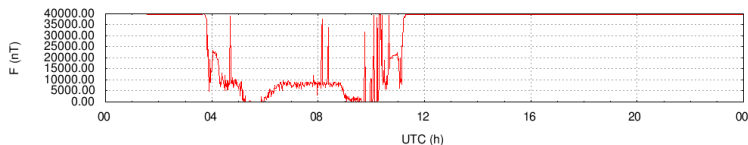
Datalogger

- ▶ 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

