IMAGE Newsletter

Number 9 — December 2007

Those were the days ...

An early document describing the EISCAT magnetometer cross and written by Hermann Lühr in 1981 or 1982 stated that: "... This project comprises seven temporary magnetometer stations ... In addition to that we will include magnetic data from existing observatories in our investigations and besides that we hope to inspire other scientists to join us with magnetometers to complete the network".

... still going strong

IMAGE is a network of 30 magnetometer stations in northern Europe from subauroral to polar cap latitudes. Its prime objectives are to study auroral electrojets and moving two-dimensional current systems. Together with other ground-based recordings, such as radars, riometers, all-sky cameras and satellite observations, IMAGE is an essential part in the investigations of high-latitude magnetospheric and ionospheric physics.

This Newsletter is devoted to the 25th anniversary of the network. Since the facts of IMAGE are available on WWW, we like to give here a somewhat different presentation. A historical look from the Norwegian viewpoint reflects the development of the whole network. We also summarise the cornerstones which have guaranteed the success of IMAGE.

IMAGE: *International Monitor for Auroral Geomagnetic Effects*
http://space.fmi.fi/image/

The Norwegian magnetometer network

Truls Lynne Hansen, Tromsø Geophysical Observatory

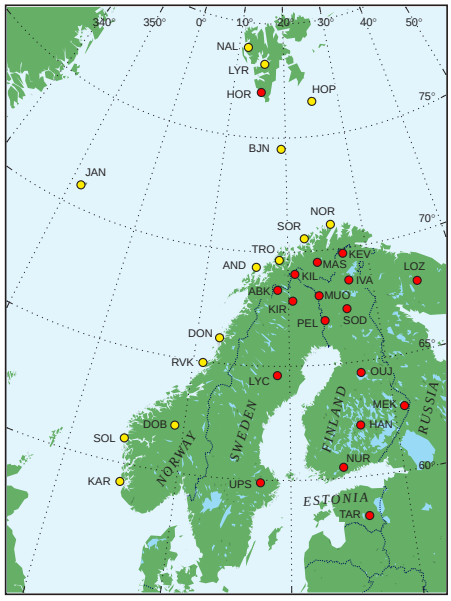
From A to D

When the predecessor of IMAGE – the EISCAT Magnetometer Cross - was established in the early 1980's, geomagnetic observations in Norway were still in the age of photographic recording. Thus they were unable to contribute to the new network of digital instruments. Over the past 25 years the Norwegian network has, however, undergone a dramatic transformation.

In 1982, geomagnetic observations in Norway were carried out at four observatories: Dombås (DOB), Tromsø (TRO), Bear Island (BJN) and Ny-Ålesund (NAL), all with classical instruments and photographic recording. Additionally, a fluxgate magnetometer with chart recording was run at Jan Mayen (JAN). Today there are digital 14 stations, and most of them offer near-real time data access.

The modernization was initiated in 1986, when the first new fluxgate instrument replaced the classical one in Ny-Ålesund. Tromsø and Bear Island followed soon. At Dombås, a digital instrument was introduced in 1989. This observatory belonged at that time to the University of Bergen and it was not incorporated in the Tromsø network until 1999.

The new instruments were built at the University of Tromsø in accordance with a design developed by the Danish Meteorological Institute. We were able to produce the instruments at relatively low cost, and by 1996 our digital network had expanded including Hopen (HOP), Andenes (AND) and Longyearbyen (LYR). When the IMAGE project in its present form was established, the inclusion of the Norwegian station in 1993 therefore was a natural step.



All our magnetometers record 10 second averages with three orthogonal fluxgate sensors. The electronics uses 400 Hz excitation, 2nd harmonic detection and feedback. The A/D converter is integrated in the electronics unit and a stream of ASCII data goes into an ordinary PC with a LINUX operating system. PC clocks provide time stamps. They are updated several times per day by GPS or Internet clocks so that time

is correct with one second. Except for Hopen and Jan Mayen, data transfer to Tromsø takes place via Internet. Several stations use ISDN or GPRS routers for communication. The magnetograms are available at http://geo.phys.uit.no/

Still expanding

In the mid 1990's, the oil industry at the Norwegian continental shelf increasingly requested geomagnetic information for their so-called directional drilling; the Earth's magnetic field is an import tool in wellbore navigation. This purpose led to a further expansion to the south: Karmøy (KAR), Solund (SOL), Rørvik (RVK) and in the days of writing, Dønna (DON). As part of this expansion the IMAGE station at Sørøya (SOR) was also equipped with a Norwegian instrument. Our contracts with the oil industry today are crucial for the maintenance of the network.

In connection with the ongoing International Polar Year, the space physics group at the University of Bergen obtained funding for another supplement of IMAGE, and decided to locate the station close to the North Cape (NOR) in September 2007.

Towards real-time monitoring of the polar space environment

IMAGE provides a data bank with open access with some verification delay. In our days of rapid electronic communication across borders, a similar open access to real-time data is feasible. In Tromsø, we already make such use of data from magnetometers in Denmark, Greenland and Finland and process them along with our own data. Examples of value added products are real-time equivalent currents (http://geo.phys.uit.no/eljet/) and the West-Greenland stacked plot (http://geo.phys.uit.no/GrStack/). In the not too far future we hope to realize an "open access real-time region" from Finland to Greenland, from Svalbard to Denmark and perhaps beyond. We believe this real-time open access will motivate several future studies and applications.

IMAGE now

IMAGE relies on four cornerstones: data production, data dissemination, research, and enthusiastic team.

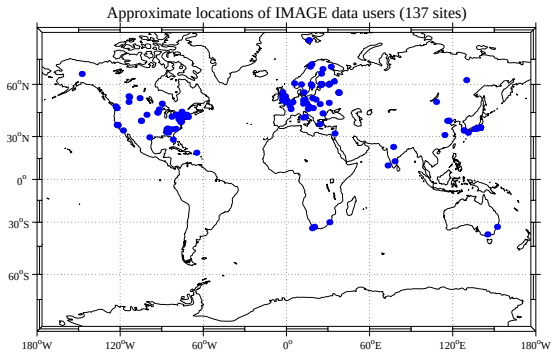
Data production

Measurements are performed with modern equipment, often in hard environmental conditions in the polar region. The careful verification of the data is a special asset of IMAGE.

Kevo, Finland

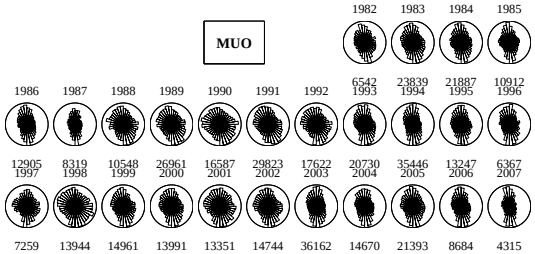
Data dissemination

The leading principle in data distribution is open access. With simple and liberal rules of the road, we like to encourage the whole scientific community to use IMAGE data in their studies.



Research

The oldest stations have already operated for more than two sunspot cycles. This makes it possible to investigate the polar geomagnetic climate.



Directional distribution of large $d\mathbf{H}/dt$ vectors in Muonio in 1982-2007

IMAGE team

The spatial extension of IMAGE has been possible thanks to the voluntary informal networking of several European institutes. The present Principal Investigator is Ari Viljanen at the Finnish Meteorological Institute.

Participants of the IMAGE 25th Anniversary at the Adolf-Schmidt-Observatory for Geomagnetism in Niemegk, 8 October 2007 (photo: Michael Purucker)