IMAGE Newsletter

Number 6 IMAGE Team **October 1998**

IMAGE magnetometer network: contribution to solar–terrestrial studies

General

IMAGE (**I**nternational **M**onitor for **A**uroral **G**eomagnetic **E**ffects) consists presently of 21 magnetometer stations. There are now involved 9 institutes from 6 countries (Finland, Germany, Norway, Poland, Russia, Sweden). Coordinates of the stations and contributing institutes are listed on page 3. The two new Swedish IMAGE stations included in January 1998, as well as two new stations are briefly introduced on page 4.

Short descriptions of two projects are given below in which IMAGE has a similar important contribution, although the primary viewpoints are very different.

MIRACLE

The **M**agnetometers – **I**onospheric **R**adars – **A**llsky **C**ameras **L**arge **E**xperiment (MIRACLE) is a two–dimensional instrument network constructed for mesoscale studies of auroral electrodynamics. It is maintained and operated in collaboration between several institutes. MIRACLE includes IMAGE magnetometers, STARE and CUTLASS radars and FMI all–sky cameras. It covers an area from subauroral to polar cap latitudes over a longitude range of about two hours of local time. The various instruments have different spatial resolutions, but basically the network is designed for studies in the spatial scales from few tens of km upward.

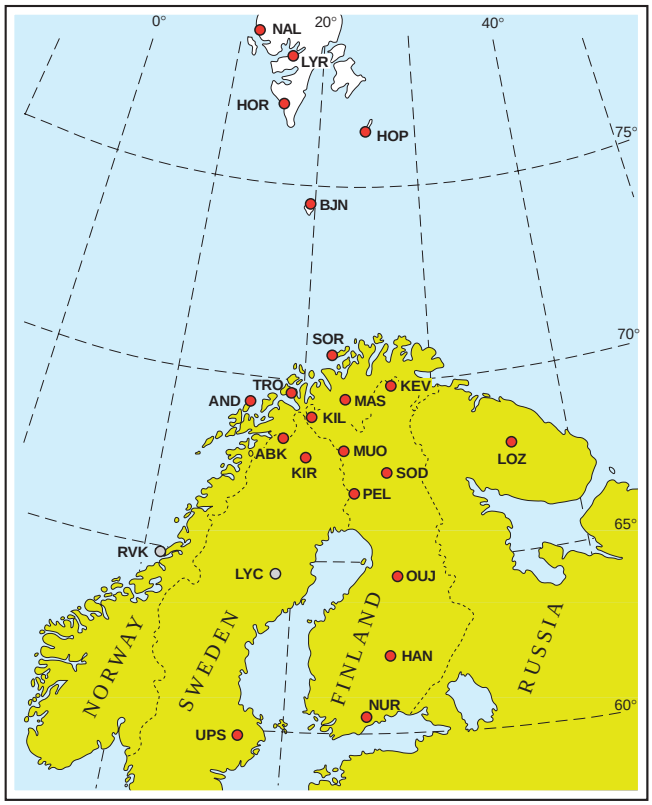


Fig. 1. IMAGE magnetometer network. Data from Lycksele (LYC) and Rørvik (RVK) will be soon added to IMAGE.

The initial current system at the substorm onset covers about 500 km in longitude, and pseudobreakups or other localized auroral forms are often in the scale size that can be recorded with a single all–sky camera (<600 km). Furthermore, the network can monitor the motion of larger–scale structures, such as the westward traveling surge or the eastward expanding auroral bulge.

The International Solar Terrestrial Physics program (ISTP) is designed to study the solar wind – magnetosphere – ionosphere interactions.

IMAGE *Newsletter* is published every-so-often by the IMAGE Team - people working within the IMAGE project.
PI of the IMAGE project: Ari Viljanen, Finnish Meteorological Institute, P.O.Box 503, FIN-00101 Helsinki, Finland.
Tel. +358-9-1929 4668, Fax: +358-9-1929 4603, e-mail: ari.viljanen@fmi.fi, WWW: http://www.geo.fmi.fi/image/

Several spacecraft monitor the key regions in these processes: the Sun and the upstream solar wind, magnetotail processes, and auroral phenomena. Whereas the global picture of the substorm evolution is now rather generally accepted, there are a number of missing pieces of information that finally will answer detailed questions such as exactly when substorms will occur or how large the disturbances will be. For these questions, it is necessary to include the mesoscale ionospheric processes, which all can be monitored and examined using the MIRACLE network, planned to be operative until 2004.

Especially, the MIRACLE network is well–suited for collaborative studies with the four Cluster II spacecraft to be launched in 2000. This combination will allow for effective separation of temporal and spatial structures as well as the projection of 3D processes in the magnetosphere to the ionospheric altitudes. Therefore, MIRACLE is an active part of the Cluster ground based coordination group headed by Mike Lockwood.

For more information, see
http://www.geo.fmi.fi/MIRACLE/
or contact the PI: tuija.pulkkinen@fmi.fi

BEAR

The Baltic Electromagnetic Array Research (BEAR), a part of EUROPROBE's SVEKALAPKO project, will realize an ultra–deep electromagnetic sounding in the Fennoscandian (Baltic) Shield. The experiment, which uses a wide magnetotelluric and magnetometer array, is designed to determine the electrical conductivity of the upper mantle beneath the ancient Fennoscandian Shield. The BEAR project together with other SVEKALAPKO (SVEcofennian orogen – KArelian craton – LAPland – KOla orogen) research, including e.g. seismic tomography, geothermal and xenolith studies, will investigate the formation and dynamics of the continental lithosphere in the plate tectonic processes.

The absence of the sedimentary cover makes the Fennoscandian Shield an extremely favourable place to probe upper mantle electrical properties because well–conducting sediments screen and distort deep EM images to such an extent that the resolution becomes very poor. The existing knowledge on the upper crustal conductivity, based on previous extensive studies, allows avoiding the influence of conductive regions within the traditional deep sounding schemes.

The basic magnetotelluric method to determine the Earth's conductivity relies on the plane wave assumption, which requires a laterally homogeneous source field. The vicinity of the auroral region regularly invalidates this condition, in particular at the long periods (1000–200000 s) required to reach a depth of 500 km.

The simultaneous operation of the BEAR array, consisting of about 50 portable magnetotelluric instruments and 20 permanent magnetic stations, will allow for a more complete description of the current systems in the ionosphere and in the solid Earth, and enable a more realistic modelling of the electrical properties of the upper mantle. This knowledge will be less affected by inhomogeneous source field effects than in previous attempts in Fennoscandia or elsewhere in the world.

The BEAR array operated in summer 1998 for 1.5 months at 49 magnetotelluric sites (magnetic and electric field recordings), 6 of them belonging to IMAGE. The array covered an area of about 1000 km x 1000 km (14–33 deg E, 57–67 N). Magnetic data from over 10 IMAGE sites north of the array and from some other sites extended the size of the array to 70 sites and 1000 x 1400 km (14–33 E, 57–71 N). The period range of the BEAR instruments is from about 10 s to d.c. The sampling interval at the BEAR stations was 2 s.

The BEAR Working Group consists of scientists from 18 institutes from Estonia, Finland, Germany, Russia, Sweden, UK and Ukraine. Information on the BEAR project can be obtained from the project PI Toivo Korja from the Geological Survey of Finland (toivo.korja@gsf.fi).

EUROPROBE is described on
http://www.geofys.uu.se/eprobe/
and SVEKALAPKO on
http://babel.oulu.fi/Svekalap.html

IMAGE CD–ROM's

Four CD–ROM's of EISCAT and IMAGE magnetometer data are now available:
1) EISCAT (1982–1990)
2) IMAGE (1991–September 1994)
3) IMAGE (October 1994–July 1996)
4) IMAGE (August 1996–December 1997)
Thepresent price of each is 500 FIM (+ VAT). Requests can be sent to FMI/GEO.

We can also produce CD–ROM's of other periods than those given above.

Table 1. Geographic and corrected geomagnetic coordinates of the IMAGE magnetometer stations.

The last column indicates the institute having the main responsibility of operating the station.
AO = Auroral Observatory (University of Tromsø), FMI = Finnish Meteorological Institute,
IGF = Institute of Geophysics (Polish Academy of Sciences), IRF = Swedish Institute of Space Physics,
PGI = Polar Geohysical Institute (Kola Science Centre), SGO = Sodankylä Geophysical Observatory (of the University of Oulu), SGU = Geological Survey of Sweden.

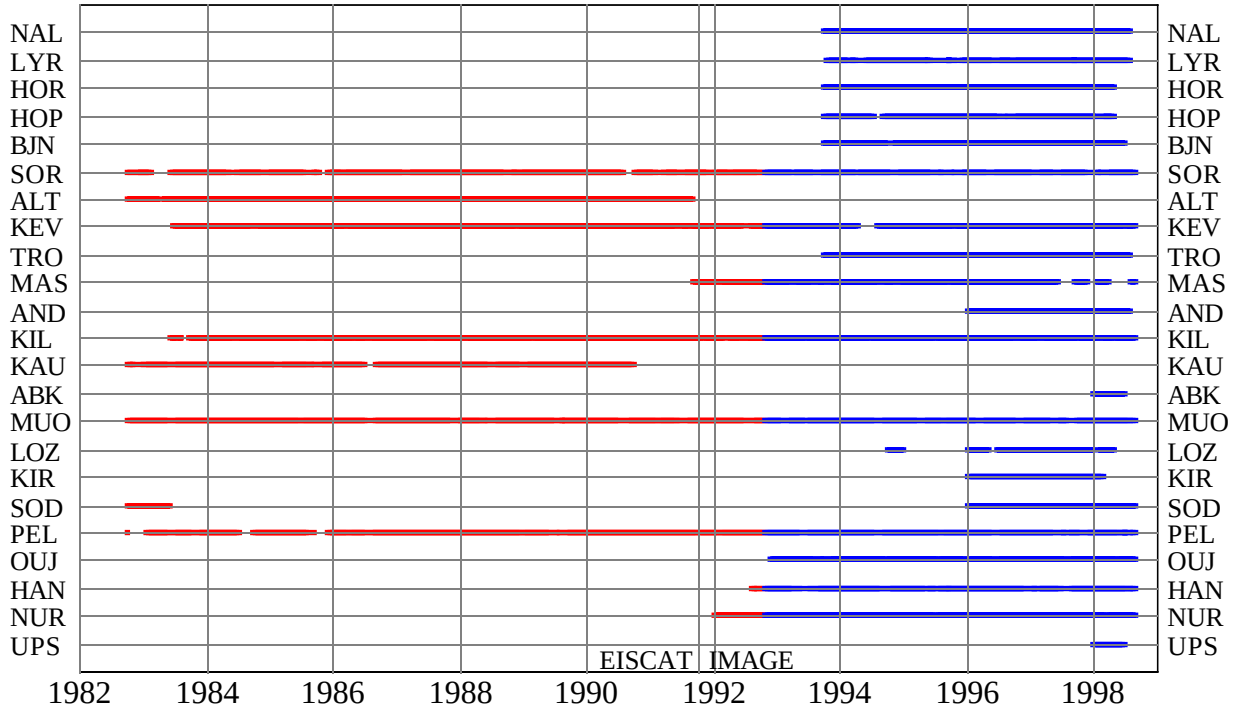
The German partners, Technical University of Braunschweig and GeoForschungsZentrum Potsdam, are participating in the final verification of the data.

Data from Hankasalmi and Kilpisjärvi are also used by the SAMNET project.

Code	Name	Lat	Long	CGM–Lat	CGM–Long	Institute
UPS	Uppsala	59.90	17.35	56.45	96.22	SGU
NUR	Nurmijärvi	60.50	24.65	56.81	102.54	FMI
HAN	Hankasalmi	62.30	26.65	58.62	104.99	FMI
OUJ	Oulujärvi	64.52	27.23	60.89	106.54	FMI+SGO
PEL	Pello	66.90	24.08	63.46	105.38	FMI+SGO
SOD	Sodankylä	67.37	26.63	63.82	107.71	SGO
KIR	Kiruna	67.84	20.42	64.60	103.14	IRF
LOZ	Lovozero	67.97	35.08	64.10	114.89	PGI
MUO	Muonio	68.02	23.53	64.62	105.70	FMI+SGO
ABK	Abisko	68.35	18.82	65.21	102.27	SGU
KIL	Kilpisjärvi	69.02	20.79	65.78	104.31	FMI+SGO
AND	Andenes	69.30	16.03	66.36	100.92	AO
MAS	Masi	69.46	23.70	66.07	106.92	AO+FMI+SGO
TRO	Tromsø	69.66	18.94	66.54	103.44	AO
KEV	Kevo	69.76	27.01	66.21	109.73	FMI+SGO
SOR	Sørøya	70.54	22.22	67.24	106.71	AO+FMI+SGO
BJN	Bear Island	74.50	19.20	71.33	108.73	AO
HOP	Hopen Island	76.51	25.01	72.93	115.91	AO
HOR	Hornsund	77.00	15.60	74.02	110.48	IGF
LYR	Longyearbyen	78.20	15.82	75.12	113.00	AO
NAL	Ny Ålesund	78.92	11.95	76.07	112.25	AO

Corrected Geomagnetic Coordinates (CGM) for the year 1998 were calculated by the online service on the World Wide Web at http://nssdc.gsfc.nasa.gov/space/cgm/cgm.html.

Data availability: EISCAT/IMAGE magnetometers (1982-1998)



New IMAGE stations

Geological Survey of Sweden (Sveriges Geologiska Undersökning = SGU) operates geomagnetic observatories at Uppsala and Abisko. The new Uppsala observatory, replacing Lovö, is located in Fiby. Data from these sites have been added to the IMAGE database since January 1998. Near–real time data are available at URL http://swdcdb.kugi.kyoto-u.ac.jp/imagdir/imag1/quick.html.

We will also include data from Lycksele (Sweden, 64.6 N, 18.7 E) and Rørvik (Norway, 64.9 N, 10.8 E) to IMAGE. The former site, operated by IRF–K, was renewed in July 1998, and the latter was installed by AO in the end of September 1998. The total number of IMAGE stations will thus be 23. The latest information is best found on IMAGE WWW pages.

IMAGE data via WWW

There are several online possibilities to browse and transfer IMAGE data via WWW:

• http://www.geo.fmi.fi/image/data.html :
Links to IMAGE data pages.
•http://www.geo.fmi.fi/image/prel/ :
Near real time magnetograms.
• http://www.geo.fmi.fi/image/gif/ :
Online daily magnetograms (gif files stored on a hard disk).
•http://www.geo.fmi.fi/image/gif/gif_form.html :
User–defined magnetograms (gif and PostScript).
•http://www.geo.fmi.fi/image/request.html :
Instructions for online data file requests.

Large amounts of data are preferably distributed on CD–ROM's.

IMAGE meeting 1998

The 7th IMAGE team meeting was held in Tromsø, Norway, on 1–2 October 1998. The organizer was the Auroral Observatory of the University of Tromsø. The number of participants was 14.

The first meeting day included status reports by each contributor, and information of co–operation with other projects. The second day included scientific talks, discussions about future plans and the presentation of the Auroral Observatory. The next meeting will be arranged by FMI/GEO in Finland in 2000.

IMAGE references

As the basic reference to the IMAGE magnetometer network the following paper can be cited:
Lühr, H., A. Aylward, S.C. Buchert, A. Pajunpää, K. Pajunpää, T. Holmboe and S.M. Zalewski, 1998: Westward moving dynamic substorm features observed with the IMAGE magnetometer network and other ground–based instruments. *Annales Geophysicae*, **16**, 425–440.

Concerning the latest information, access to the data etc., the IMAGE WWW pages can also be referred to (http://www.geo.fmi.fi/image/).

Contact persons

FMI/Helsinki:	FAX: +358–9–1929 4603
Lasse Häkkinen (data)	lasse.hakkinen@fmi.fi
Heikki Nevanlinna	heikki.nevanlinna@fmi.fi
Ari Viljanen (PI)	ari.viljanen@fmi.fi
FMI/Nurmijärvi:	FAX: +358–9–8787 0350
Kari Pajunpää	kari.pajunpaa@fmi.fi
UO/Oulu:	FAX: +358–8–553 1414
Sven-Erik Hjelt	seh@sveka.oulu.fi
SGO/Sodankylä:	FAX: +358–16–619 875
Johannes Kultima	johannes.kultima@sgo.fi
Pekka Vilkki	pekka.vilkki@sgo.fi
AO/Tromsø:	FAX: +47–77–645580
Truls Lynne Hansen	truls.hansen@phys.uit.no
Børre Holmeslet	borre.holmeslet@phys.uit.no
TUB/Braunschweig:	FAX: +49–531–391 5220
Karl-Heinz Glassmeier	khg@geophys.nat.tu-bs.de
GFZ/Niemegk:	FAX: +49–338–436 2423
Armin Grafe	grafe@gfz-potsdam.de
Hans-Joachim Linthe	linthe@gfz-potsdam.de
GFZ/Potsdam:	FAX: +49–331–288 1732
Hermann Lühr	hluehr@gfz-potsdam.de
IGF/Warsaw:	FAX: +48–22–370 522
Jerzy Jankowski	jerzy@igf.edu.pl
IRF/Kiruna:	FAX: +46–980–79050
Ingemar Häggström	ingemar@irf.se
SGU/Uppsala:	FAX: +46–18–179304
Birna Olafsdottir	birna.olafsdottir@sgu.se
PGI/Apatity:	FAX: +7–81555 74330
Alexander Yahnin	yahnin@pgi-ksc.murmansk.su