IMAGE Newsletter

Number 4 IMAGE Team June 1996

IMAGE magnetometer network - current status -

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IMAGE (International Monitor for Auroral Geomagnetic Effects) is a joint Finnish-German-Norwegian-Polish project for maintaining a network of digital magnetometers in Fennoscandia and Svalbard. IMAGE can be regarded as the successor of the EISCAT magnetometer cross that operated in northern Fennoscandia from October 1982 to May 1991.

Presently the IMAGE network consists of 16 stations (Fig. 1, Table 1). The main responsibility of the project was transferred in October 1995 from the Technical University of Braunschweig (TUB) to the Finnish Meteorological Institute (FMI).

FMI operates NUR and HAN stations and together with the University of Oulu the OUJ station, and processes data of these sites. FMI also collects preliminary data of the six Lapland stations (PEL, MUO, KIL, MAS, KEV, SOR). The magnetometers for the Lapland sites were provided by TUB.

Sodankylä Geophysical Observatory takes care of the technical service and calibration of the northern stations, including the Sodankylä Observatory.

Adolf-Schmidt Observatory of the GeoForschungZentrum Potsdam, Germany, and TUB are responsible for the verification of the final data set.

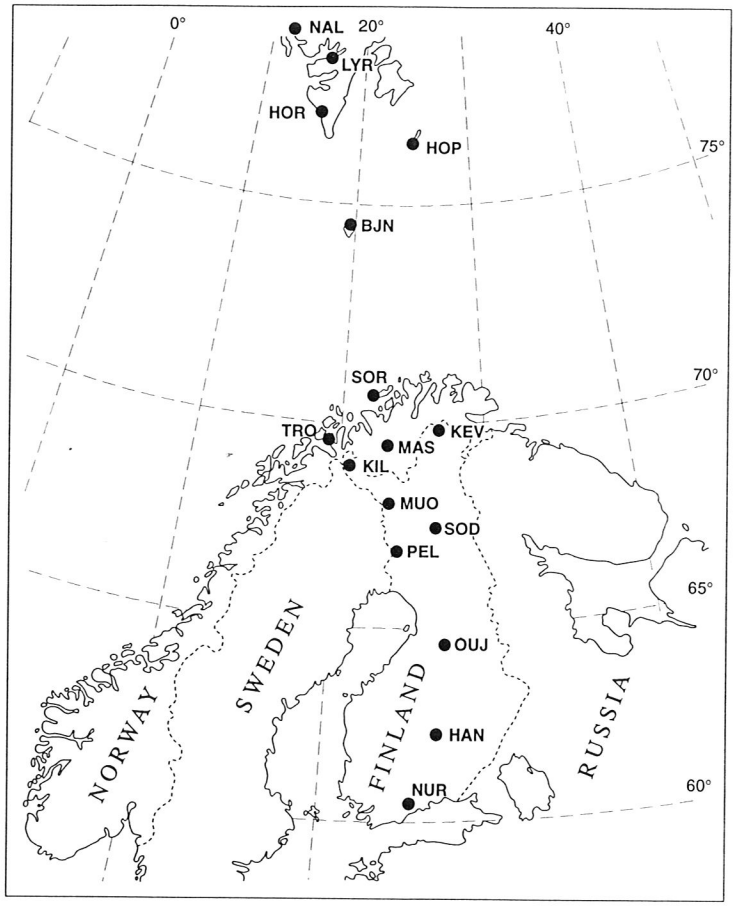

Fig. 1. IMAGE magnetometer stations.

The Auroral Observatory of the University of Tromsø, Norway, operates five stations in the region of Arctic Ocean (TRO, BJN, HOP, LYR, NAL). Since October 1993, their data have been added to the IMAGE data base.

The Institute of Geophysics of the Polish Academy of Sciences in Warsaw, Poland, has a station at HOR whose recordings have also been included in the IMAGE data since October 1993.

IMAGE *Newsletter* is published every-so-often by the IMAGE Team - people working within the IMAGE project.
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Table 1. Geographic coordinates of the IMAGE magnetometer stations. The last column indicates the institutes that have the main responsibility of maintaining the station. [FMI = Finnish Meteorological Institute, UO = University of Oulu, SGO = Sodankylä Geophysical Observatory, AO = Auroral Observatory (University of Tromsø), IGF = Institute of Geophysics (Polish Academy of Sciences); concerning the tasks of the German partners, see text.]

Code	Name	Lat	Long	Institute
NUR	Nurmijärvi	60.50	24.65	FMI
HAN	Hankasalmi	62.30	26.65	FMI
OUJ	Oulujärvi	64.52	27.23	FMI+UO
PEL	Pello	66.90	24.08	FMI+SGO
SOD	Sodankylä	67.37	26.63	SGO
MUO	Muonio	68.02	23.53	FMI+SGO
KIL	Kilpisjärvi	69.02	20.79	FMI+SGO
MAS	Masi	69.46	23.70	FMI+SGO
TRO	Tromsø	69.66	18.94	AO
KEV	Kevo	69.76	27.01	FMI+SGO
SOR	Sørøya	70.54	22.22	FMI+SGO
BJN	Bear Island	74.50	19.20	AO
HOP	Hopen Island	76.51	25.01	AO
HOR	Hornsund	77.00	15.60	IGF
LYR	Longyearbyen	78.20	15.82	AO
NAL	Ny Ålesund	78.92	11.95	AO

All stations are equipped with tri-axial magnetometers recording the standard geographic magnetic components (X, Y, Z). The present sampling interval is 10 seconds, but for special campaigns it can be changed to 5 seconds at selected stations. The final data are stored in IAGA format (IAGA News No. 20, p. 112). The availability of final data is illustrated in Fig. 2.

The data are distributed on magnetic tapes, on floppy disks (short events), or by ftp. The EISCAT magnetometer data (Oct 1982 - Dec 1990) are available also as a CD-ROM (at a nominal price from FMI). CD-ROMs of newer data are in preparation.

A scientific objective of IMAGE is to study moving two-dimensional current systems like traveling convection vortices, westward traveling surges and omega bands. The long latitudinal profile gives a possibility to study eastward and westward electrojets as well as splitting of electrojets.

IMAGE is also a ground-based element of satellite missions (e.g. INTERBALL, POLAR), especially together with ionospheric radar systems (e.g. STARE, SuperDARN) and all-sky cameras and riometers. In common studies with satellites, we can for example focus on the fine structure of field-aligned currents.

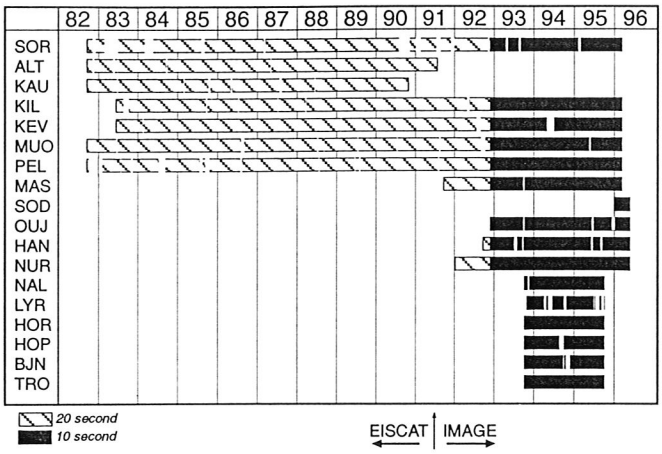

Fig. 2. Availability of verified data of the EISCAT magnetometer cross and the IMAGE magnetometer network (June 1996). Information of near-real time data is given on IMAGE WWW pages.

Pulsation effects at the EISCAT/IMAGE magnetometer stations

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To study geomagnetic pulsations, recordings of long magnetometer profiles (like IMAGE) can be used as follows:

1. The propagation mechanism of the Pi2 pulsations from the auroral ionosphere to the mid-latitude ionosphere is an unresolved problem. The wave characteristics are not well understood, because there have not been many continuous observations of these variations over an extensive latitudinal region.

Using data of August-September 1990 of the magnetometer networks EISCAT and SAMNET (maintained by the University of York, England), 22 Pi2 events of different times and of various magnetic activity were selected. For these events, polarization parameters, frequency spectra and relations of phases and amplitudes were investigated (example shown in Fig. 1). The phase reversals, the amplitude maxima and the polarization structures were discussed in relation to the location of the substorm current wedge.

2. Ground-based observations of Pi2 enable investigations of boundary layers in the near-space in connection with satellite experiments. It is generally supposed that any propagation mechanism of Pi2 from auroral to mid-latitudes is influenced by the plasmapause.

Using data of the first half of 1992, Pi2 events were selected in times when a satellite crossed the northern hemisphere in approximately the same time sectors. For these events, amplitudes, power spectra, phase relations and polarization parameters were compared to the electron

density profiles measured by a satellite (Figs. 2 and 3).

3. Magnetospheric resonance effects may cause distortions in standard magnetotelluric sounding curves near local resonance frequencies. A peak power can be expected in Y and Z during Pi2 events. This can lead to false interpretations of the earth's conductivity. Misinterpretations can be avoided if an extensive magnetometer network like IMAGE+SAMNET is available.

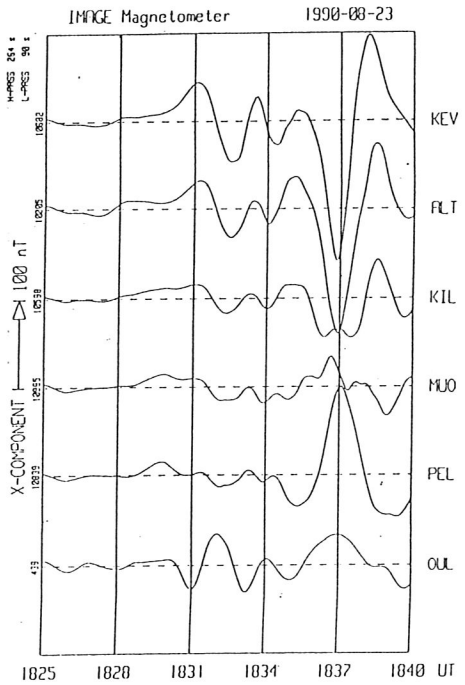


Fig. 1. Example of the differences in phases and amplitudes of X along the EISCAT magnetometer chain with the OUL station of the SAMNET network.

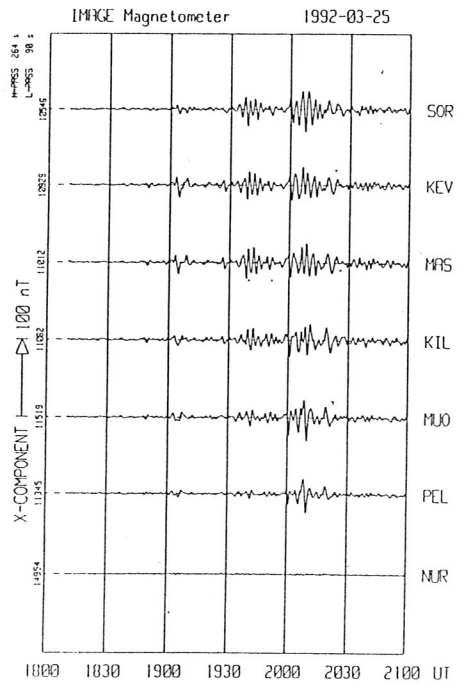
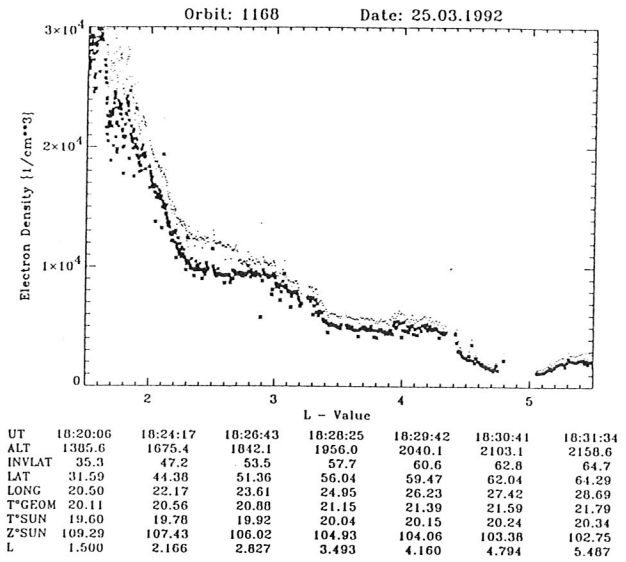


Fig. 2. X component during the Pi2 event of March 25, 1992, as recorded by IMAGE.



UT	18:20:06	18:24:17	18:26:43	18:28:25	18:29:42	18:30:41	18:31:34
ALT	1385.6	1675.4	1842.1	1956.0	2040.1	2103.1	2158.6
INVLAT	35.3	47.2	53.5	57.7	60.6	62.8	64.7
LAT	31.59	44.38	51.36	56.04	59.47	62.04	64.29
LONG	20.50	22.17	23.61	24.95	26.23	27.42	28.69
T*GEOM	20.11	20.56	20.88	21.15	21.39	21.59	21.79
T*SUN	19.60	19.78	19.92	20.04	20.15	20.24	20.34
Z*SUN	109.29	107.43	106.02	104.93	104.06	103.38	102.75
L	1.500	2.166	2.827	3.493	4.160	4.794	5.487

Fig. 3. Electron density observed by MAGION 3 satellite over the IMAGE chain immediately before the onset of the Pi2 event in Fig. 2.

5th IMAGE meeting at Sodankylä, October 5–6, 1995

The 5th meeting between the IMAGE team members from Germany, Finland, Norway and Poland was held at the Sodankylä Geophysical Observatory, Finland, on October 5–6, 1995. The following major items were agreed at the meeting:

1) The main coordination responsibility of the IMAGE project was transferred from the Technical University of Braunschweig to the Finnish Meteorological Institute. The new Principal Investigator of the project after Hermann Lühr is Ari Viljanen.

2) The IMAGE project can provide near-real time data from several stations. This is presently possible from all Finnish stations (responsible institute is FMI), and from the Norwegian stations Tromsø and Longyearbyen (University of Tromsø). The delay of getting data from other stations is varying from some weeks to some months. For updated information, contact the IMAGE WWW pages.

3) The 6th IMAGE meeting will be arranged in 1997, and it will be hosted by the Polish Academy of Sciences. The meeting is planned to be science oriented, and particular emphasis will be paid to co-operative studies with other projects like SuperDARN, EISCAT, INTERBALL, etc.

IMAGE Rules of the Road

The IMAGE project has an open data politics, i.e. the final EISCAT/IMAGE magnetometer data are freely available for any scientific use. However, the following viewpoints should be taken into account:

1) Indicate clearly that you use magnetometer data to avoid possible confusions e.g. with EISCAT radar data, or with the IMAGE satellite (Imager for Magnetopause-to-Aurora Global Exploration)!

2) The recommended basic reference to the EISCAT magnetometer cross is Lühr, H., S. Thürey and N. Klöcker, 1984: The EISCAT–Magnetometer Cross. Operational Aspects–First Results. *Geophysical Surveys*, **6**, 305–315.

Concerning IMAGE, a possible reference is Viljanen, A. and L. Häkkinen, 1996: IMAGE magnetometer network. *Proceedings of the 2nd International Workshop for the co–ordination of ground–based observations and Cluster* (to be published).

However, for updated information, it is recommended to give a reference to the WWW home page of IMAGE.

3) If magnetometer data are used in a remarkable way we would appreciate also an acknowledgement. It can be in a compact format in which participating countries and the leading institute is mentioned.

A sample acknowledgement of IMAGE data of all stations of the year 1994 could be like "the IMAGE magnetometer data used in this paper were collected as a German–Finnish–Norwegian–Polish project conducted by the Technical University of Braunschweig". More information of EISCAT/IMAGE contributors can be found in earlier Newsletters and on our WWW pages.

4) PI wishes to obtain reprints of refereed papers in international journals to maintain the list of EISCAT/IMAGE related publications. The list is available in WWW at URL http://www.geo.fmi.fi/image/publications.html.

5) Data of some IMAGE stations (like Sodankylä and Norwegian stations) are available in Internet before they have been included in the final data set. If such data are used, then follow the rules defined by the providers. For more information, see the following WWW addresses:

Tromsø: ftp://crom.uit.no/homepage/nobs.html
Sodankylä: http://space.sgo.fi/

IMAGE in World Wide Web

Due to frequent changes and development of the IMAGE project, we recommend to check the (near) real-time information in World Wide Web by starting from the IMAGE home page (URL: http://www.geo.fmi.fi/image/).

Pages are maintained primarily by Ari Viljanen. Suggestions to improve the WWW service and corrections of possible errors are welcome.

As a new user-friendly service we like to especially mention the quick-look magnetograms that are now available on WWW pages (http://www.geo.fmi.fi/image/gif/). We also plan to distribute digital data via WWW.

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For postal addresses, see IMAGE WWW-pages.

Note: Finnish telephone numbers will be changed in October 1996.

Data requests

All checked data of the EISCAT and IMAGE magnetometer networks are available at FMI, Niemegk and Braunschweig.