IMAGE Newsletter

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IMAGE

a magnetometer network in Scandinavia

IMAGE (International Monitor for Auroral Geomagnetic Effects) is a joint Finnish-German project for setting up and maintaining a network of digital magnetometers in Finland and Northern Norway. IMAGE is a substitute for the earlier EISCAT magnetometer cross which sampled a wealth of good data from October 1982 to May 1991. During 1991 the EISCAT cross project underwent a major reorganization and the network is termed now IMAGE. The main new feature is the addition of three new stations so that IMAGE will provide a longer north-south profile, from the northern Norwegian coast down to the south of Finland. After the new stations have started operation this autumn the network will consist of nine recording stations (Fig.1 and Table 1).

Collaboration

The IMAGE project is a collaboration between four institutes, two in Germany and two in Finland.

Braunschweig Technical University in Germany is the coordinator of the project and will supply the instrumentation to the six northern stations. The group handles contaminated data and takes responsibility for the final data quality. The project leader at Braunschweig is Dr. Hermann Lühr.

The Adolf-Schmidt Observatory of the GeoForschungZentrum Potsdam in Niemegk Germany will be responsible for the routine processing of the data. At Niemegk the project is lead by Dr. Armin Grafe.

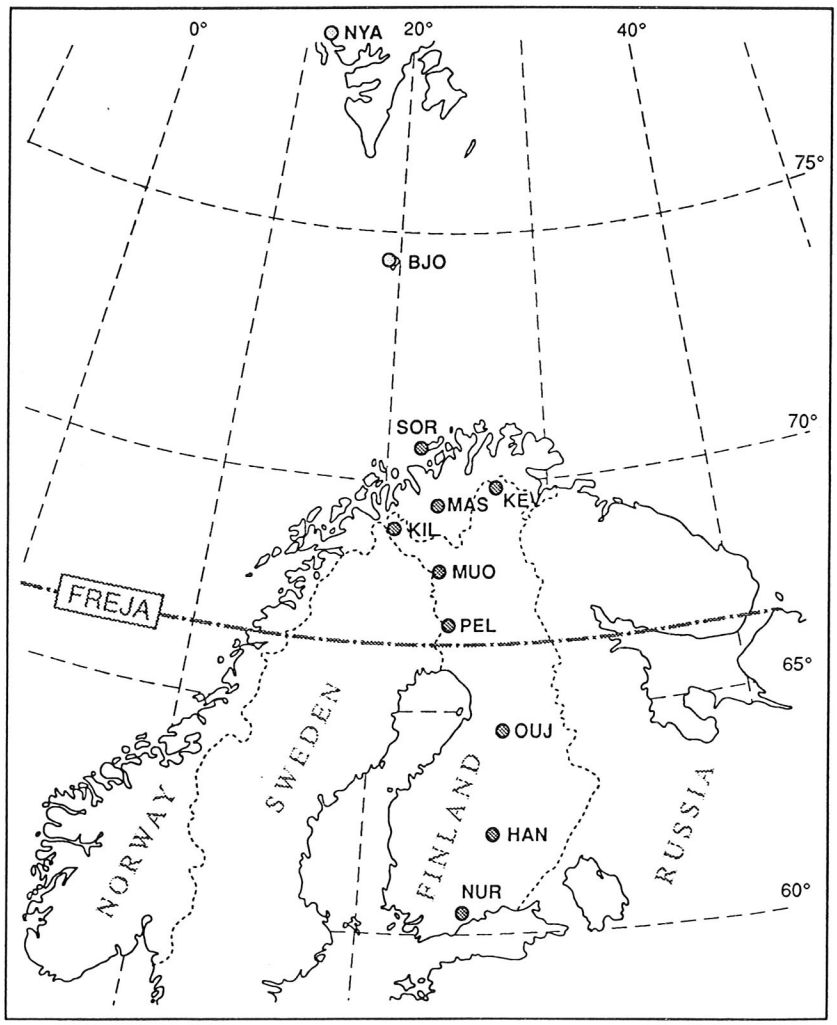

Figure 1. A map showing the locations of the IMAGE stations (dark circles). Also shown are the Norwegian stations on Bear Island (BJO) and Ny Ålesund (NYA) on Spitzbergen (light circles). The northernmost ground track (projection along field lines) of the Swedish-German FREJA satellite is also shown.

The Finnish Meteorological Institute (FMI) will supply the instruments for the three southern stations and also process the data from these stations. In addition FMI will collect the preliminary data from the other six stations and send it for further processing to Niemegk. Dr. Risto Pellinen is the leader of the IMAGE group at FMI.

The Sodankylä Geophysical Observatory (SGO) will take care of the technical service and the magnetic calibration of the

Table 1. The geographic coordinates of the IMAGE stations

Station Name	Code	Latitude(°)	Longitude(°)
Söröya	SOR	70.54 N	22.22 E
Masi	MAS	69.46	23.70
Muonio	MUO	68.02	23.53
Pello	PEL	66.90	24.08
Kilpisjärvi	KIL	69.02	20.79
Kevo	KEV	69.76	27.01
Oulujärvi	OUJ	64.52	27.23
Hankasalmi	HAN	62.30	26.65
Nurmijärvi	NUR	60.50	24.65

six northern stations. Johannes Kultima is responsible for IMAGE activities at Sodankylä.

Further technical support is supplied by the University of Tromsö in Norway through Truls Lynne Hansen.

All four groups take actively part in the scientific evaluation of the acquired data.

Instrumentation

All the stations are equipped with tri-axial fluxgate magnetometers which record the X-, Y- and Z-component of the magnetic field. The recordings are averaged over a selectable time period which during routine operation is 20 seconds, but for special campaigns it could be changed to 10 seconds or 5 seconds.

The instrumentation for the six northern stations is provided by the Braunschweig Technical University. These magnetometers have a measuring range of ±2000 nT with 1 nT resolution. The data loggers have 12 bit A/D converters and take 3.2 samples per second. Time is read from crystal oscillators which have an accuracy of a few seconds per year. The data is stored onto DC-300 cartridges which are then sent every two or three weeks to the FMI.

The three southern stations are run by the FMI and are equipped with fluxgates built by the Danish Meteorological Institute. These have a measuring range of ±5000 nT and 0.1 nT resolution. The data acquisition systems are built at the FMI and have 22 bit A/D converters. The time signal is taken from Omega clocks. The instruments are equipped with ordinary PC's which will store the data on their hard disks. The data is then delivered to FMI on floppy disks.

Data exchange

The IMAGE data will be stored in the so called IAGA format (*IAGA News* No. 20, p.112) in merged files (all stations in one file). The data will be available to all groups who are investigating auroral phenomena and requests can be sent to any of the above mentioned institutes. Currently the data will be distributed on magnetic tapes or floppy disks (short intervals). In the future it will also be available through computer networks. After some years the whole IMAGE data set will also be published on CD-ROM disc and DAT tape.

The collection of the data from the stations and data processing will take about two months. This is the typical lead time for data to be available.

Scientific objectives

Prime objective of the network is the study of moving two-dimensional current systems e.g. vortices, omega bands etc., but also other auroral phenomena will be studied. Especially the long profile allows to observe the eastward and westward electrojets simultaneously and permits to compare the dynamics of both. Also one important objective of the IMAGE network will be to support the upcoming satellite projects FREJA and INTERBALL.

New stations at Hankasalmi and Oulujärvi

As compared to the former EISCAT magnetometer cross the main difference of the new IMAGE chain is its longer extension to the Southern Finland. In order to achieve this longer coverage the data from Nurmijärvi observatory has been included in the IMAGE data set since January-92. In addition two new recording stations, one at Hankasalmi and one at Oulujärvi, are being installed this summer and autumn.

The Hankasalmi station (HAN) is situated in Central Finland about 300 kilometers north of Helsinki and 40 kilometers east of the city of Jyväskylä. The underground concrete pillar for the magnetometer was erected already in September 1991 as well as the cabling to the nearby house where the data acquisition PC will be located. The installation and testing of the magnetometer were done during this summer and on August 13th the magnetometer started continuous data recording. Hankasalmi is also the place where the STARE radar has been operating for several years. The radar is located about 200 meters northwards from the magnetometer. As the beam of the radar is directed to the north and since it is located at the other side of a hill it should not cause significant disturbances to the magnetometer. Test measurements during the fall-91 indeed proved that no effects due to the radar were observed. The Hankasalmi station is managed and maintained by the Nurmijärvi observatory under the leadership of Kari Pajunpää.

The Oulujärvi station (OUJ) is located at the

shore of lake Oulujärvi about 100 kilometers southeast of the city of Oulu and about 45 kilometers northwest of the city of Kajaani. The place is owned by the University of Oulu which has run there a small field station for several years. During the last winter the Geophysical Observatory of the University of Oulu built small houses for the magnetometer and for absolute measurements. The installation of the instruments were carried out during October and it is planned that the station will start produce data in November. The magnetometer is owned by the Geophysical Observatory of the University of Oulu which will also take care of the maintenance of the instruments.

For both of these stations the triaxial fluxgate magnetometers are being built by the Danish Meteorological Institute. A similar instrument has been in use at Nurmijärvi since September -91 and found to be reliable and accurate. DMI has used similar magnetometers on many of its Greenland stations. The measuring range of the instrument is ±5000 nT with 0.1 nT resolution. The data loggers with 22 bit A/D converters are being built at the Finnish Meteorological Institute. The timing info will be read from Omega receivers. The magnetic recordings and the timings will be automatically combined by a PC which will store the data onto a hard disk. About every two weeks the data will be sent in floppy disks to Nurmijärvi where it will be converted into IAGA-format. The data is then further delivered to FMI which will send it along with Nurmijärvi data to Niemegk for inclusion in the IMAGE-data set.

The baselines for both stations will be measured during this autumn. It is planned that thereafter the Oulujärvi baselines will be measured frequently so that it will produce observatory level data. The baselines for the Hankasalmi station on the other hand will be determined less frequently.

EISCAT magnetometer cross data on CD-ROM and DAT

The EISCAT magnetometer cross which operated from October 1982 to May 1991 produced a large amount of data. With its seven recording stations and with twenty second resolution about 2.3 Gigabytes of data have been collected. Since the beginning of the project in 1982 the data has been stored on magnetic tapes. Altogether well over one hundred tapes have now been filled with this data. Times for which there are data available from the different stations are shown in Fig. 2. As can be seen, the network has been rather reliable.

With the appearance of new high capacity archiving media such as CD-ROM discs which can store as much as 680 Megabytes of data on a single disc and DATs (Digital Audio Tapes) with capacities up to 2 Gigabytes plans are already made to store the whole EISCAT magnetometer set on these new medias. The data format which has been used in storing the EISCAT magnetometer data on magnetic tapes is the so called IAGA format (*IAGA News* No. 20, p.112). It is a text format so it consumes a lot of valuable disk space. At the Danish Meteorological Institute (DMI) the whole EISCAT magnetometer data set has been converted into a binary format (so called GADF format) and the size of the data set has been compressed into about one fourth of the size of the IAGA format. In such a format the whole data set will nicely fit into a single CD-ROM disc.

The EISCAT magnetometer data set has been put into a DAT cassette during the summer-92 at FMI. A copy of the DAT cassette will be available to all interested parties. A copy of the DAT cassette will also be sent to World Data Center A in Boulder, USA, which is going to put the data set onto a CD-ROM disc. In both the DAT and CD-ROM versions the format for the data will be the GADF binary format used at the DMI. Some computer software for converting the data from the particular binary format into IAGA and other formats will be included. The CD-ROM version will probably be available at the end of 1992 or beginning of 1993. For further information, contact Jouni Rynö, Finnish Meteorological Institute, Department of Geophysics, Box 503, SF-00101, Helsinki, Finland; fax: 358-0-1929539; e-mail: Jouni.Ryno@fmi.fi.

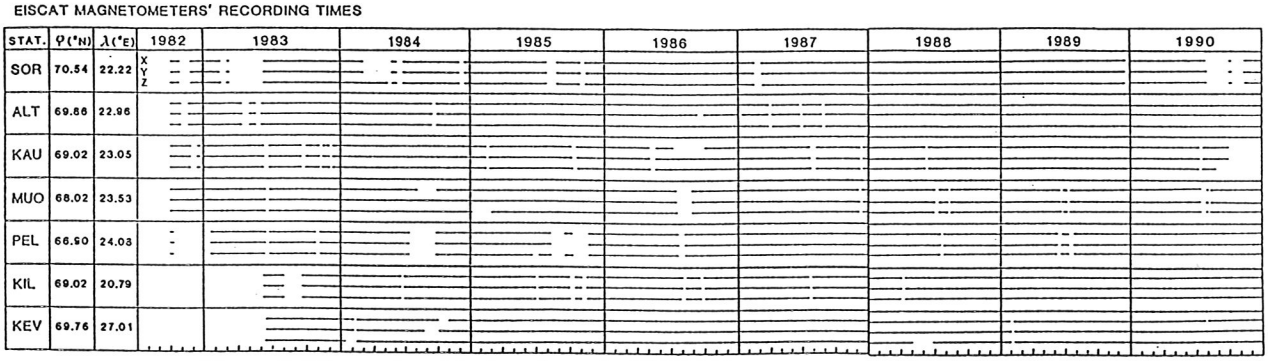

Figure 2. Times of usable data from the EISCAT magnetometer cross stations

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