

ESTEC/Contract No. 14069/99/NL/SB
ESA Space Weather Study (ESWS)
WP500. European Co-ordination

Catalogue of European Space Weather Resources

ESWS-RAL-RP-0001
Issue 1.1 19 November 2001

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1 Preface

1.1 Document change record

Issue	Date	Notes/remarks
0.1	26 Nov 2000	First draft for internal review
1.0	04 Jan 2001	First version for delivery to ESA
1.1	19 Nov 2001	Revised version: <ul style="list-style-type: none"> • More resources included • Updated statistical results • Deleted analysis of distribution by consortium • Added deeper analysis of measurement resources

1.2 Purpose of the document

This report is a summary catalogue of European space weather resources. This has been prepared as the first stage of WP500 of the Study for an ESA Space Weather programme (ESTEC Contract No. 14069/99/NL/SB). The work package is concerned with analysis of options for co-ordination of European space weather resources. Thus its first stage is to identify those resources as is done in this report.

1.3 Definitions, acronyms and abbreviations

BIRA	Belgian Institute for Space Aeronomy
EISCAT	European Incoherent Scatter Radar
ESA	European Space Agency
ESTEC	European Space Technology Centre
FMI	Finnish Meteorological Institute
SPEE	Study of Plasma and Energetic Electron Environment and Effects
SPENVIS	Space Environment Information System
SQL	Structured Query Language
SuperDARN	Super Dual Auroral Radar Network
SWEN	Space Weather Euro News
WP	Work Package

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1.4 Important Documents

- D1 Statement of Work for ESA Space Weather Programme, Appendix 1 to AO/1-3533/99/NL/SB
- D2 Study for an ESA Space Weather programme, RAL/RRS/116/99, Proposal in Response to ESA ITT AO/1-3533/99/NL/SB.
- D3 Roadmap for European co-ordination in space weather, ESWS-RAL-RP-0003
- D4 ESWS-RAL-TN-0001, A definition of instruments needed for space weather measurements

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2 Introduction

This report is a catalogue of some 222 European space weather resources that have been identified as a result of a survey undertaken during the course of our study. The catalogue has been used to analyse options for better co-ordination of European space weather activities [D3].

Any catalogue of this kind is inevitably a sample of a larger population. Thus it is important to understand the nature of the sampling, to explore its limitations and to develop ways of overcoming those limitations. To support this the report includes a statistical analysis of results. This has allowed us to identify possible weaknesses and to propose ideas for future improvements to the catalogue.

In this updated version of the catalogue some of the weaknesses in version 1.0 of the catalogue have been addressed. In particular, we have much better coverage of European resources in terms of expertise to build space instrumentation. But there remain important areas in which this work could be taken further – see section 6.

3 Structure of the document

The rest of this report is structured as follows:

- Section 4 describes the methodology used to collect and store information on space weather resources. This includes a discussion of what is considered as a European space weather resource, the various methods by which data have been obtained, the way in which resources have been classified and a short description of the relational database used to store data on resources.
- Section 5 presents the results of several statistical analyses of the result – namely the distribution of the resources according to a number of parameters, e.g. data sources, countries, resource types, etc. It now includes a deeper statistical analysis of ground-based measurement resources in Europe. This is a very large group of resources (95 out of the total 222) and is therefore susceptible to deeper statistical analysis.
- Section 6 presents options for further extension of the catalogue.
- Annex A presents a summary list of all European space weather resources that we have so far identified.

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4 Methodology

4.1 *What is a European space weather resource?*

This catalogue will be the basis for subsequent analysis of options for co-ordination of European space weather resources. Thus we have adopted an inclusive strategy to ensure the widest input to that analysis. We have included all of the following:

- Resources under the control of organisations based in any European country and not just the ESA Member States. This will allow the subsequent analysis to consider options for ESA collaboration with non-Member States.
- Resources under the control of organisations based in Canada – in view of Canada’s participation in ESA activities
- Resources controlled by pan-European and international organisations with European participation, e.g. ESA itself.
- Collaborative programmes led from the US but with significant European participation, e.g. SuperDARN

Note in particular that we have NOT restricted the catalogue to resources geographically based in Europe. There are many European resources in other geographic regions, e.g. there are significant British and French facilities in Antarctica and its surrounding regions.

Note also that this catalogue is just a list of resources and their technical capabilities. No attempt has been made to judge the relative merits of different resources. That would be a further major task that is beyond the scope of resources available to compile the catalogue.

4.2 *Data sources*

This catalogue is primarily based on a survey that took place between August and October 2000, but has been updated thereafter as new information have become available¹. A variety of sources of information were used as follows:

- We solicited inputs from operators of space weather resources. A note was distributed to the ESA electronic newsletter Space Weather Euro-News (SWEN) and to European users of the Space Environment Information System (SPENVIS) operated by BIRA.
- We analysed the European entries on two web servers providing information on space weather resources. These were (a) the SPEE server built by FMI under an earlier ESA contract and now maintained by them, and (b) the space weather server at ESTEC.
- We analysed information contained with our own proposal for the present contract and information that has arisen in the course of work under the contract
- We received several helpful inputs from ESA
- We made much use of the wide personal knowledge of the study team
- Most importantly, we examined the web sites of resources found using the sources described above. The links from these web sites led us to many other interesting resources.

¹ Further inputs are welcome – please contact Mike Hapgood (Email: <mailto:M.Hapgood@rl.ac.uk>).

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- A large amount of data was also obtained as feedback from WP421, the payload definition work package [D4].

4.3 Types of resources

As the survey progressed it became clear that there was a considerable variety of types of resources that might usefully be considered. The table below lists the types that have so far been identified, together with a short description of each type.

Note that this list includes existing facilities (Data centre, Ground-station, Information, Measurement), technological resources (Instrument, Platform), research activities from which new facilities might be developed (Concept), modelling activities that can be used to generate space weather products (Model) and programmatic resources (Network).

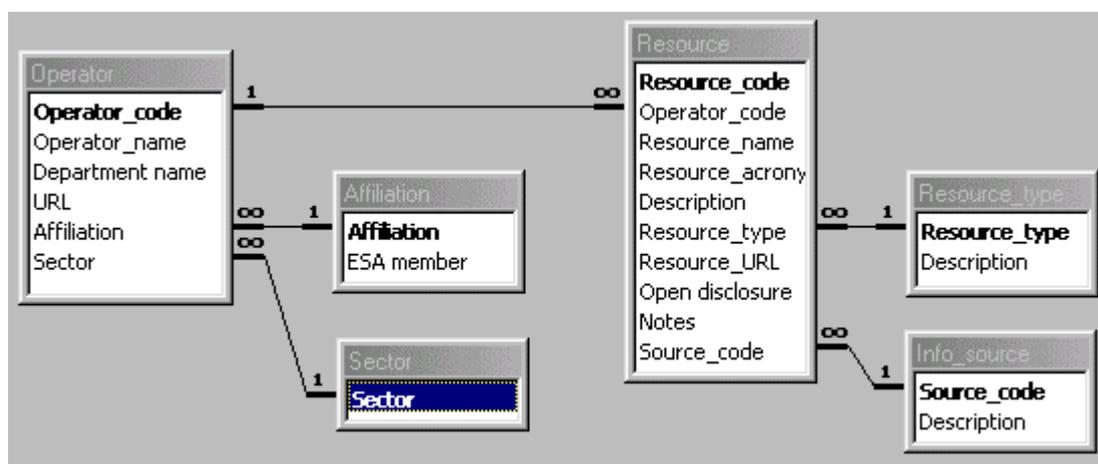
We also include a category of Historical resources; these are examples of historical studies that may illuminate future programmes. The examples recorded in this catalogue relate to military space weather studies performed in Europe during the Second World War. They indicate the long-standing nature of some of the problems caused by space weather.

Resource Type	Description
Concept	Intellectually developed concept relevant to future space weather activities.
Data centre	Centre which archives and disseminates data that may be relevant to space weather
Ground-station	Station for reception of spacecraft telemetry – and possibly uplink of commands
Historical	Record of historical space weather studies that may illuminate future programmes.
Information	Source of general information (not just data) relevant to space weather
Instrument	Scientific instrument that can be used for measurements of parameters relevant to space weather
Measurement	Service that provides regular measurements of parameters relevant to space weather
Model	Model or software from which space weather services are or might be provided
Network	Group of people and/or organisations that plays a role in European space weather activities
Platform	Expertise in satellite platforms – especially the smaller types (mini-, micro- and nano-satellites) that may be important for a space weather programme

4.4 Database

Information on individual space weather resources has been recorded in a relational database. This allows considerable flexibility in the production of different reports on the resources, e.g. statistical analyses, different classification hierarchies. The reports based in the rest of this document are derived from the database. Other report formats are possible.

In designing the database every attempt has been made to ensure normalisation of the basic tables. For example, the diagram below shows the core database tables and their relationships. The key factor is that information about operators has been separated from that about resources (because many operators control multiple resources). Some key attributes of the main tables are controlled by referential integrity rules linked to subordinate tables. For example, the affiliation (country, international organisation, etc) of an operator is controlled by reference to a list of allowed affiliations.



For a description of the fields shown in this diagram see the summary list of resources in Annex A. You may also find it helpful to examine the statistical results presented in the next section.

5 General statistical results

The results presented in this section were derived from our database of space weather resources. In each case we prepared an SQL query that would extract a list of the suitable data, typically a list of numbers of resources in various categories. This list was copied into an Excel spreadsheet where it was processed to generate the graphics and tables shown below.

5.1 Distribution by data source

The pie chart below shows how the information on resources was distributed from different sources. You can see the dominant role played by the tracing of web links. Personal knowledge, the instrument definition work (WP421) and users' own inputs are also very important.

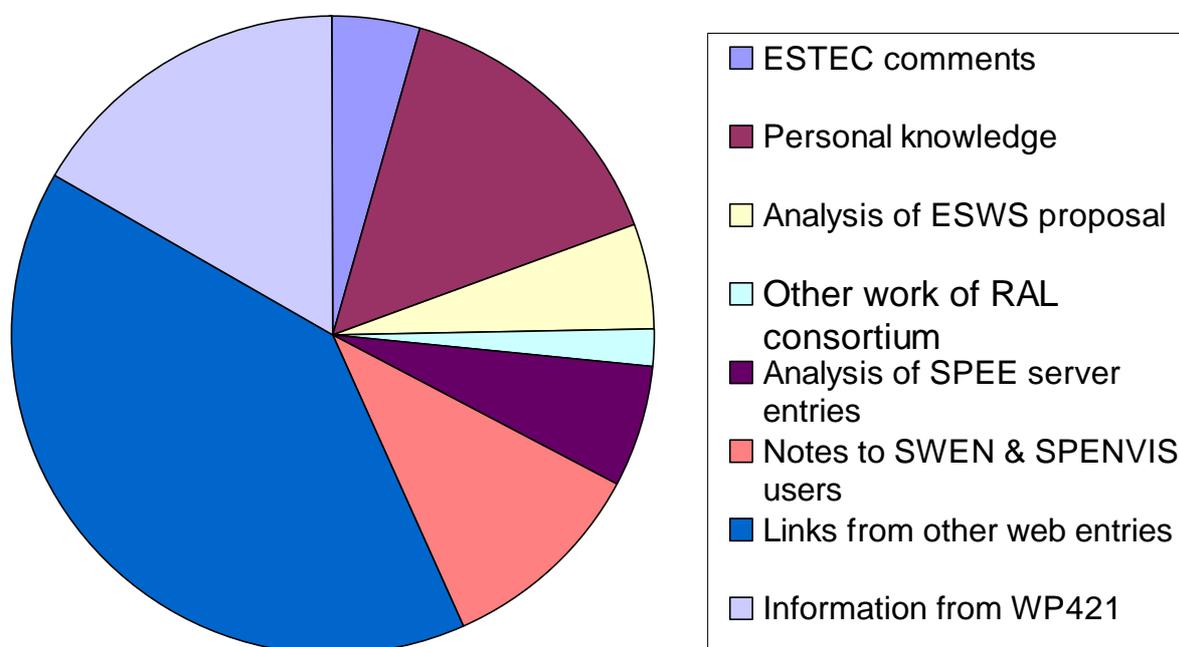


Figure 1 Distribution of catalogued resources by data source

The significant role of personal knowledge is unavoidable (the alternative would be to ignore that knowledge) but must be treated with caution as it may bias some of the other results discussed below.

5.2 Distribution by country

The pie chart below shows the distribution of catalogued resources according to the country in which their operator is based. Note that there are three special categories in addition to countries. These are (a) resources operated by ESA, (b) resources operated by other pan-European organisations (e.g. EISCAT), and (c) resources operated by global organisations (with European participation).

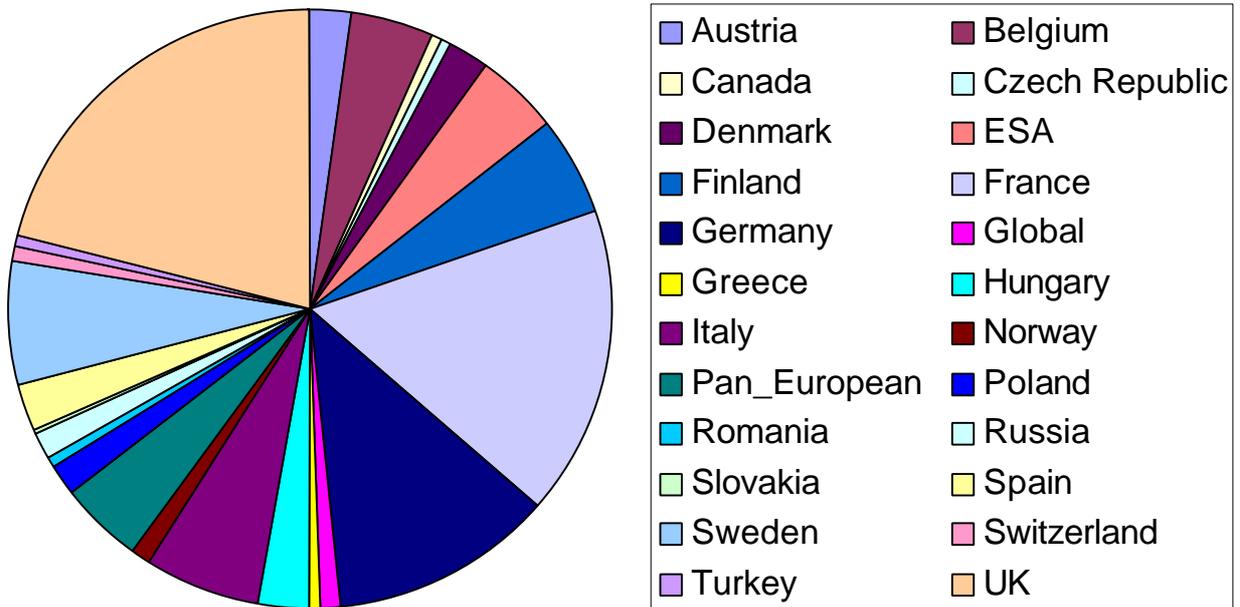


Figure 2 Distribution of catalogued resources by country

The countries with the largest numbers of catalogued resources are France, Germany and the UK as one might expect given their strong economic position and interest in solar-terrestrial physics. Italy is also well-represented if at a slightly lower level. The apparently greater number of UK resources is probably a bias arising from the author's personal knowledge of UK resources. It should be corrected as further resources are added to the database. Most of the Scandinavian countries (Denmark, Finland and Sweden) are also well represented - as one would expect given their strong role in studies of solar-terrestrial physics. However, the tiny fraction of entries from Norway seems bizarre - but it must be remembered that Norway is the host to many resources operated by pan-European organisations. The latter are strongly represented in the catalogue and include several key resources located at Tromsø and on Svalbard.

5.3 Distribution by type

This pie chart below shows how the catalogued resources are distributed between the different types of resources that were identified in the course of the survey.

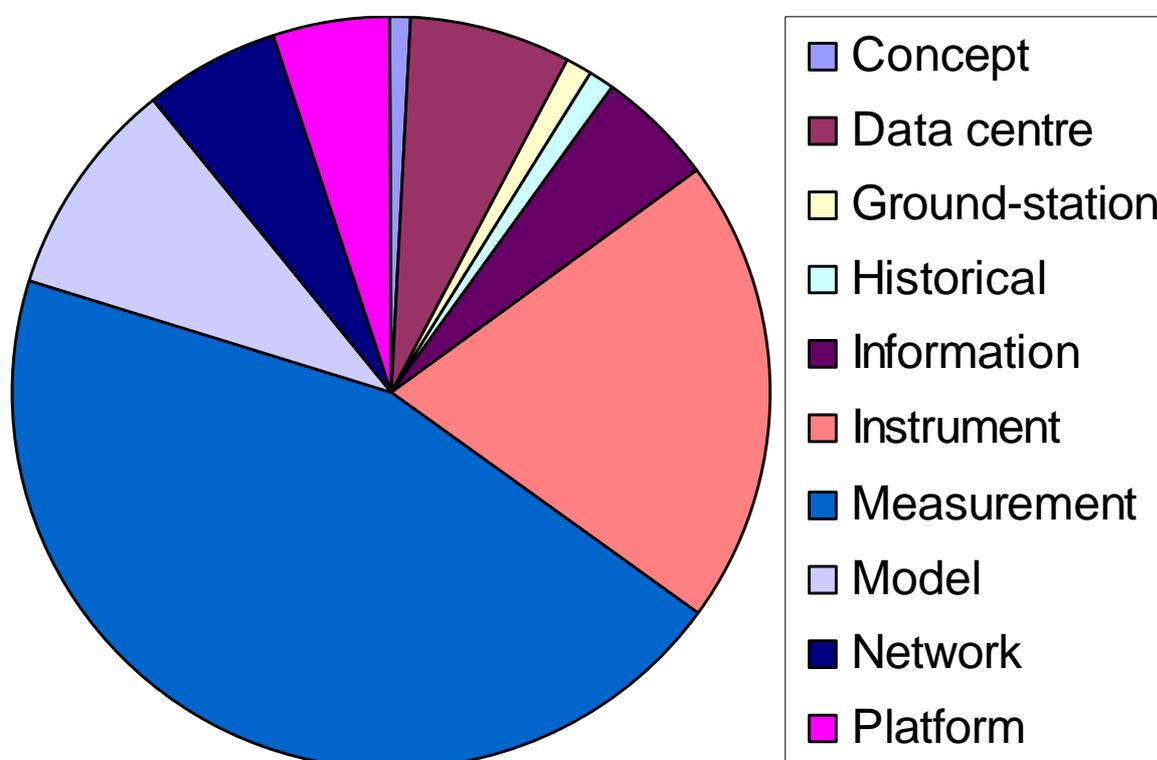


Figure 3 Distribution of catalogued resources by type

You can see that the catalogued resources are pre-dominantly measurements of space weather parameters together with the associated expertise in instrumentation. Modelling and information services (data centres and information servers) are also well-represented. The growing community interest in space weather is also clear – as represented by the significant contribution of network resources.

The representation of resources that could underpin the development of a new space-based programme of measurements of space weather parameters is somewhat variable. There is strong representation of instrument expertise and significant representation of platform expertise. But ground-station resources are poorly represented. Additional data is needed in the last area.

One area that is poorly represented is concept resources - research knowledge that could be used to develop new technologies for space weather measurements and prediction techniques. It is difficult to believe that this represents the real situation in Europe and thus it is proposed that a further survey should be carried out after the end of the study - with the aim of capturing more data from this category.

5.4 Distribution by sector

The pie chart below shows the distribution of resources between those operated by different types of organisations - namely academic, private sector and public sector. As one might expect, the field is almost entirely dominated by academic and public sector bodies. There is, as yet, little private sector activity in terms of European space weather resources.

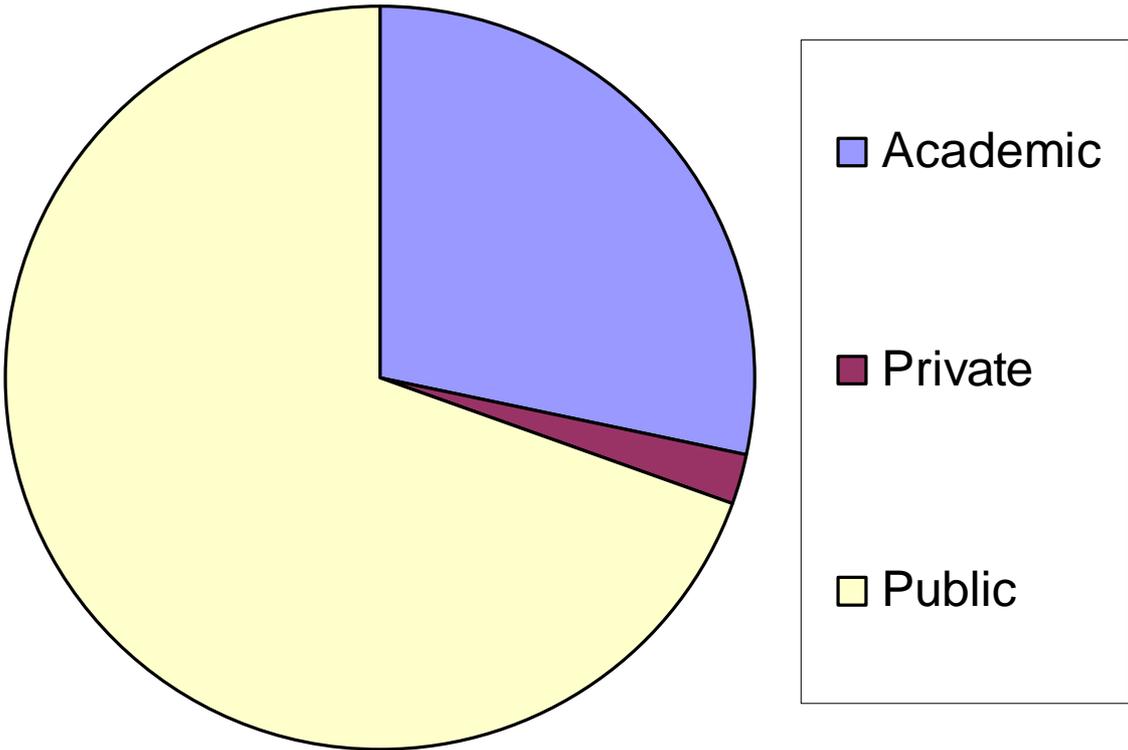


Figure 4 Distribution of catalogued resources by sector

5.5 Statistical analysis of ground-based measurement resources

The catalogue contains 95 items that represent ground-based measurements of space weather parameters. The figure below shows how these can be used to monitor various different space weather domains:

- ground effects (e.g. neutron monitoring, geomagnetic variations)
- ionosphere (e.g. critical frequencies, total electron content, convection velocities)
- magnetosphere (e.g. particle precipitation)
- solar wind (e.g. interplanetary scintillation)
- Sun (e.g. H-alpha, magnetographs, white light imagery)
- thermosphere (e.g. doppler measurements of neutral winds)

Note that some space weather measurements can monitor more than one domain. These are treated as multiple entries in the plot below.

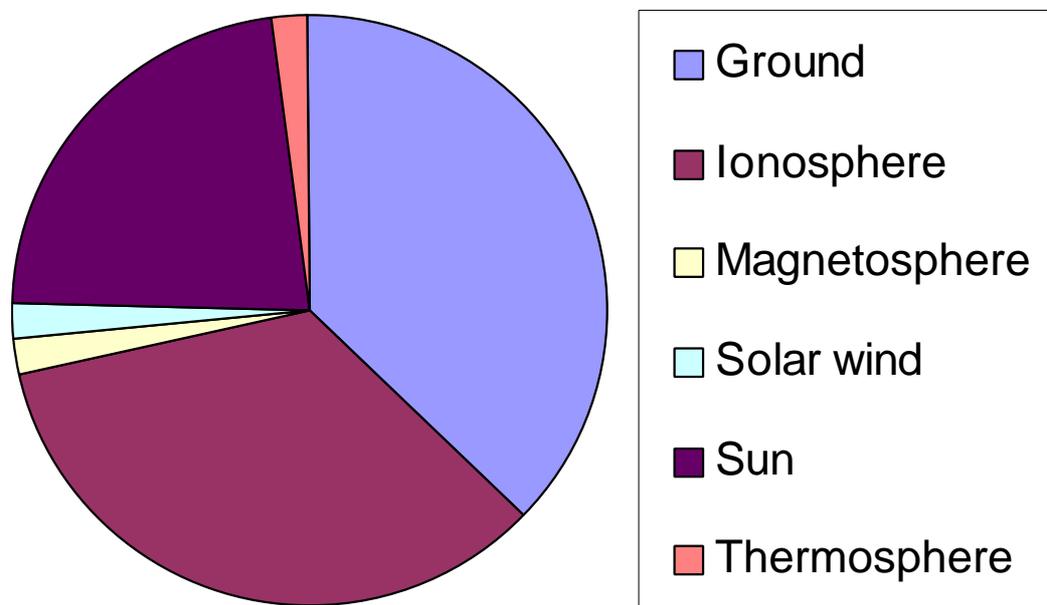


Figure 5 Distribution of ground-based measurements by space weather domain

You can see that ground-based measurements are primarily focussed on ground effects, the ionosphere and the Sun. The focus on ground effects is obvious as these can be measured directly. In contrast the measurements of the ionosphere and the Sun are remote sensing observations. The ionospheric measurements are primarily active measurements that monitor the effect of ionospheric conditions on the propagation of radio waves from dedicated sources (e.g. satellites, radars). The relative proximity of the ionosphere and its strong effects on radio propagation make this feasible. In contrast, solar observations are passive measurements that monitor the natural emissions from the Sun. It is the great power of those natural emissions that makes this feasible.

We have also looked at the distribution of ground-based measurements by country. The figure below shows this.

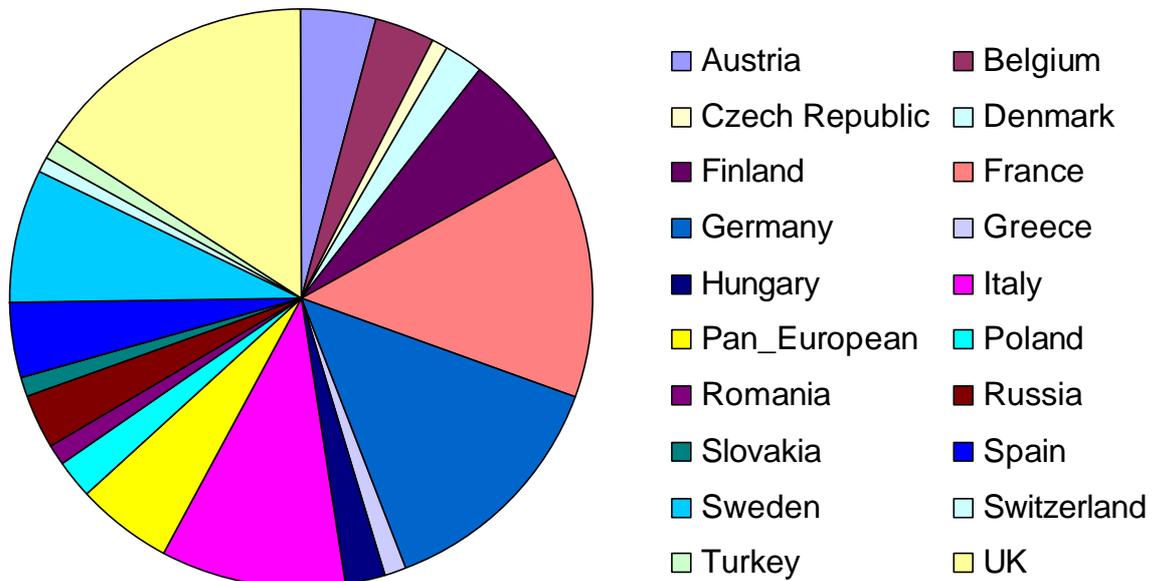


Figure 6 Distribution of ground-based measurements by country

The result is similar to that for all resources (Figure 2). There are strong contributions from France, Germany, Italy, Scandinavia and the UK – plus a significant Pan-European element.

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6 Options for extension of the catalogue

The statistical analysis suggests that the catalogue could be extended by acquisition of additional data. In particular:

- To collect more data on ground-station resources that could contribute to a space-based programme of measurements of space weather parameters.
- To collect more data on research knowledge that could be used to develop new technologies for space weather measurements and prediction techniques (concept, model).

Some types of resources could be resolved into further detail. For example one could classify models according to the technique used (neural network, magnetohydrodynamics, etc). The underlying space weather resources database can easily be adapted to store these lower level attributes. But it is important to identify priority areas for deeper analysis so that limited resources can be applied in the most useful manner.

Another important way in which the catalogue could be extended would be to add some judgement about the relative merits of different resources and thus overcoming the limitations discussed in section 4.1. Thus, for example, we could rate a major facility like a SuperDARN radar more highly than an isolated ionosonde measurement. This addition would allow us to obtain an improved assessment of the relative scale of space weather activities in different European countries

Catalogue of European Space Weather Resource

Annex A - Resource Summary

Issue 1.1
17 November 2001

INTRODUCTION

This summary was generated from an Access database of space weather resources using a report generator named "Resource Summary". In this case, the individual resources are summarised by type and by country (other summary formats can easily be prepared by creating a suitable report generator). For each resource, we provide the name of the resource, the name of its operator, a short description of the resource and, where available, a web address from which further information may be obtained.

For more information on the database fields see the main part of this document.

CAVEAT

This catalogue is based on information obtained in good faith from a variety of sources discussed in the main part of this document. Thus its accuracy and completeness reflect the accuracy and completeness of those sources. Thus we can accept no liability for any errors or omissions in the catalogue. But we greatly welcome any comments that correct existing catalogue entries or add new entries. Please send comments to Mike Hapgood (Email: M.Hapgood@rl.ac.uk).

Resource type: Concept

Germany

Name: ELF detection of energetic particle precipitation

Operator: Universität Frankfurt
Institut für Meteorologie und Geophysik

URL: <http://www.geophysik.uni-frankfurt.de/~fuellekr/eicr.html>

Description: Demonstrated use of ELF measurements to detect change in Schumann resonance parameters associated with solar energetic particle precipitation, e.g. JGR 104, p 10111 (1999)

Name: Use of ELF measurements to determine lower ionospheric parameters

Operator: Universität Frankfurt
Institut für Meteorologie und Geophysik

URL: <http://www.geophysik.uni-frankfurt.de/~fuellekr/eicr.html>

Description: ELF measurements combined with appropriate models can be used to determine ionospheric parameters. See M. Füllekrug, Physics Letters A, Oct 2000, in press.

Resource type: Data centre

Belgium

Name: Regional Warning Centre Brussels

Operator: Royal Observatory of Belgium
Solar Physics Department

URL: <http://sidc.oma.be/index.php3>

Description: ISES regional warning centre

Name: World Data Center for the Sunspot Index
Operator: Royal Observatory of Belgium
Solar Physics Department
URL: <http://sidc.oma.be/index.php3>
Description: The official source for the international Sunspot index

France

Name: BAse de données Solaires Sol 2000
Operator: CNRS
Institut National des Sciences de l'Univers
URL: <http://bass2000.bagn.obs-mip.fr/>
Description: New database of French solar "Ground" data - to standardise those data similar to SOHO data and provide new scientific tool from storage, distribution and exploitation of the solar data obtained on the ground.

-

Name: Centre de Données de la Physique des Plasmas
Operator: Centre d'Etude Spatiale des Rayonnements
URL: <http://cdpp.cesr.fr/>
Description: French national data centre for space plasma physics

Name: International Service of Geomagnetic Indices
Operator: Centre d'études des Environnements Terrestre et Planétaires
URL: <http://www.cetp.ipsl.fr/~isgi/homepag1.htm>
Description: Data base of geomagnetic indices based on the report of magnetic observatories distributed all over the planet

Name: Paris Geomagnetic Information Node for INTERMAGNET

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/INTERMAGNET/homepage.html>

Description: Collection and dissemination node for real-time data within INTERMAGNET.

Hungary

Name: Greenwich and Debrecen Photoheliographic Results

Operator: HELIOPHYSICAL OBSERVATORY, DEBRECEN,

URL: <http://fenyi.sci.klte.hu/activities.html>

Description: classical photospheric database, contains the positions and areas of sunspot groups for all days. Based on observations at former Royal Greenwich Observatory between 1878 and 1976 and on Debrecen observations since 1976.

Name: Historical Solar Image Database

Operator: HELIOPHYSICAL OBSERVATORY, DEBRECEN,

URL: <http://fenyi.sci.klte.hu/activities.html>

Description: Database of Hungarian solar images - taken at Kalocsa and Ógyalla between 1873 and 1920 - and at Debrecen between 1958 and 2000

Italy

Name: ARTHEMIS

Operator: Osservatorio Astronomico di Capodimonte
Solar Physics and Stellar Atmosphere Group

URL: <http://arthemis.na.astro.it/>

Description: ARTHEMIS is a new class of solar data archives based on modern relational database management systems.

Poland

Name: Helio-Geophysical Predictions Service

Operator: Polish Academy of Sciences
Space Research Centre

URL: <http://www.cbk.waw.pl/rwc/rwc.html>

Description: ISES Regional Warning Centre in Warsaw

Name: Ionospheric Dispatch Centre in Europe

Operator: Polish Academy of Sciences
Space Research Centre

URL: <http://www.cbk.waw.pl/rwc/idce.html>

Description: Provides access to some recent ionospheric data from vertical incidence sounders located mainly within European area as well as to data available in ISES network. Established as a result of COST251.

UK

Name: British Isles GPS archive Facility

Operator: University of Nottingham
IESSG

URL: <http://ukcogr.iessg.nottingham.ac.uk/~eosi>

Description: Archive of GPS data from a network of continuously operating GPS receivers in the UK. Funded for use on geodetic applications. TBD if useful for Space Weather.

Name: Edinburgh Geomagnetic Information Node for INTERMAGNET

Operator: British Geological Survey
Global Seismology and Geomagnetism Group

URL: <http://www.gsrp.nmh.ac.uk/intermagnet/>

Description: Collection and dissemination node for real-time data within INTERMAGNET.

Name: Geomagnetism Information and Forecast Service
Operator: British Geological Survey
Global Seismology and Geomagnetism Group
URL: http://www.nerc-murchison.ac.uk/gifs/on_line_gifs.html
Description: Service for use by the academic community and those engaged in bone-fide research. It is not for commercial use, or for use by those engaged in commercially funded projects.

Name: World Data Centre C1 for STP
Operator: Rutherford Appleton Laboratory
Space Science and Technology
URL: <http://www.wdc.rl.ac.uk>
Description: Part of the network of World Data Centres. It is one of several STP data centres in Europe.

Resource type: Ground-station

Germany

Name: DLR ground station Neustrelitz
Operator: Deutschen Zentrum für Luft- und Raumfahrt
URL: <http://www.nz.dlr.de/>
Description: Satellite ground station operated by DLR at Neustrelitz

UK

Name: RAL ground station

Operator: Rutherford Appleton Laboratory
Space Science and Technology

URL: <http://ssdwacs.bnsc.rl.ac.uk/>

Description: S band ground station at RAL. Currently used as one of the stations providing real-time downlink of solar wind data from ACE.

Name: West Freugh ground station

Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough

URL: http://www.dera.gov.uk/html/space/west_freugh_ground_station.htm

Description: Ground station at West Freugh in Scotland

Resource type: *Historical*

Germany

Name: Hainberg Solar Tower

Operator: Georg-August-Universität Göttingen
Universitäts-Sternwarte Göttingen

URL: <http://www.uni-sw.gwdg.de/geninf/hainberg/sonnenturm/esonnenturm.html>

Description: The solar tower was built with military funds during 1942-43. The then director convinced military officials that solar research could be used to predict solar storms and so the occurrence of radio disturbances

UK

Name: Operation Gearbox
Operator: Rutherford Appleton Laboratory
Space Science and Technology

URL:

Description: Ionosonde placed on Svalbard by UK military during 1942-43 to support HF comms - under Operations Gearbox and Locomotive. Some records held by RAL World Data Centre. See also (add reference)

Resource type: Information

Belgium

Name: TRapped Radiation ENvironment model Development
Operator: Belgian Institute for Space Aeronomy

URL: <http://www.magnet.oma.be/home/trend/trend.html>

Description: ESA-funded programme to develop improved (time-dependent) models of the radiation belts

ESA

Name: ESA Space Weather server
Operator: European Space Agency
Space Environments and Effects Analysis section

URL: <http://www.estec.esa.nl/wmwww/spweather/>

Description: Space Weather server at ESTEC

Name: Space Weather Euro-News
Operator: European Space Agency
Space Environments and Effects Analysis section
URL: <http://www.estec.esa.nl/wmwww/spweather/NEWSLETTER/newsletter.html>
Description: Electronic newsletter on space weather activities. Searchable database on <http://www.esrin.esa.it:8766/esa/> (include SWEN in list of keywords)

Finland

Name: Forecasts for auroral tourism
Operator: Finnish Meteorological Institute
Geophysical Research
URL:
Description:

Name: Freja Charging Database
Operator: Finnish Meteorological Institute
Geophysical Research
URL: http://www.geo.fmi.fi/spece/freja_light/Data_Tools/Freja/freja_for_spine.htm
Description: Database of information on spacecraft charging events identified during the operation of the Freja satellite

Name: Geomagnetically induced currents information
Operator: Finnish Meteorological Institute
Geophysical Research
URL: <http://www.geo.fmi.fi/MAGN/GIC/>
Description: General information of GIC research at FMI/GEO concerning power systems and pipelines. Includes measured data (co-operation with industrial companies).

Name: Space Weather Information Server

Operator: Finnish Meteorological Institute
Geophysical Research

URL: <http://sumppu.fmi.fi/spee>

Description: Searchable database of space weather resources. Search form available on http://sumppu.fmi.fi/spee/spee_search.html

France

Name: French Space Weather study

Operator: Centre National d'Etude Spatiale

URL:

Description: Report of French study group

Name: Report on key parameters for Space Weather studies

Operator: Laboratoire de Planétologie de Grenoble

URL: <ftp://ftp-lpg.obs.ujf-grenoble.fr/archives/Document-Atelier-Meteo.pdf>

Description: Report compiled following a November 1999 workshop on . In French

Italy

Name: Whole Sun Catalog

Operator: Osservatorio Astronomico di Capodimonte
Solar Physics and Stellar Atmosphere Group

URL: <http://arthemis.na.astro.it/wsc/wsc.html>

Description: Joint project of SOHO, BASS2000, and ARTHEMIS with goal of creating a central catalogue of all solar observations made around the world every day. will contain basic information on the observations, and information and/or links on how to get the data

UK

Name: AuroraWatch UK

Operator: University of York
Magnetospheric Physics Group

URL: <http://www.aurorawatch.york.ac.uk/>

Description: This web site allows you to monitor geomagnetic activity in real time, and will let you know when aurora may be visible from the UK.

Resource type: Instrument

Austria

Name: Magnetometer expertise

Operator: Institut fuer Weltraumforschung

URL:

Description: Expertise in space magnetometers

Belgium

Name: Expertise in space-based solar imaging

Operator: Royal Observatory of Belgium
Solar Physics Department

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to EIT on SOHO and SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Centre Spatiale de Liège

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to EIT on SOHO and SECCHI on STEREO

Canada

Name: Space-based dosimetry

Operator: Thomson & Nielsen Electronics Ltd

URL:

Description: Construction of simple instruments for dosimetry measurements in space (as well as on the ground)

ESA

Name: CLUSTER

Operator: European Space Agency
Science Programme

URL: <http://sci.esa.int>

Description: ESA science mission to study the Earth's magnetosphere and its interaction with the solar wind. 4 identical spacecraft will allow full resolution of space plasma phenomena in time and all three spatial dimensions.

Name: Expertise in measurement of electric fields

Operator: European Space Agency
Space Science Department

URL:

Description: Expertise in instruments to measure electric fields in space, e.g. EFW on Cluster

Name: Expertise in space measurements of high energy particles

Operator: European Space Agency
Space Science Department

URL:

Description: Expertise in instruments to measure high energy particles in space, e.g. IMPACT on STEREO

Name: Space expertise in high energy particle detectors

Operator: European Space Agency
Space Environments and Effects Analysis section

URL:

Description: Expertise in simple high energy particle detectors for radiation monitoring in space

France

Name: Expertise in space measurements of energetic particles

Operator: Centre d'Etude Spatiale des Rayonnements

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. IMPACT on STEREO, radiation detector on Newton-XMM, CIS on Cluster

Name: Expertise in space measurements of energetic particles

Operator: Observatoire de Paris
Département d'Astronomie Solaire

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. IMPACT on STEREO

Name: Expertise in space measurements of energetic particles

Operator: Office National d'Etudes et de Recherches Aéronautiques
Département Environnement Spatial

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. SPICA

Name: Expertise in space-based radio wave detectors

Operator: Observatoire de Paris
Département d'Astronomie Solaire

URL:

Description: Expertise in space-based radio detectors, e.g. contributions to SWAVES on STEREO, also experiments on WIND

Name: Expertise in space-based solar imaging

Operator: Observatoire de Paris
Département d'Astronomie Solaire

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Institut d'Optique Théorique et Appliquée

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to EIT on SOHO and SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Laboratoire d'Astronomie Spatiale

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to EIT on SOHO and SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Institut d'Astrophysique Spatiale

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to EIT on SOHO and SECCHI on STEREO

Name: SPICA-ICARE

Operator: Centre National d'Etude Spatiale

URL:

Description: Electron and ion detector for radiation belt energies

Name: Système Compact d'Investigation de Propagation IONosphérique

Operator: École Nationale Supérieure des Télécommunications de Bretagne
Groupe Ionosphère

URL: <http://www-iono.enst-bretagne.fr/scipion.html>

Description: new state of the art digital sounder for ionospheric monitoring and research.

Germany

Name: Expertise in measurement of electric fields

Operator: Max-Planck-Institut für Extraterrestrische Physik

URL:

Description: Expertise in instruments to measure electric fields in space, e.g. EDI on Cluster

Name: Expertise in space magnetometry

Operator: Technische Universität Braunschweig

URL:

Description: Expertise in space-based magnetometry, e.g. involvement in FGM on Cluster

Name: Expertise in space measurements of energetic particles

Operator: Max-Planck-Institut für Aeronomie

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. IMPACT on STEREO, CELIAS on SOHO and RAPID on Cluster

Name: Expertise in space measurements of energetic particles

Operator: Technische Universität Braunschweig

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. CELIAS on SOHO and CIS on Cluster

Name: Expertise in space measurements of energetic particles

Operator: University of Kiel

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. IMPACT on STEREO, COSTEP on SOHO

Name: Expertise in space measurements of energetic particles

Operator: Max-Planck-Insitut für Extraterrestrische Physik

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. PLASTIC on STEREO, CELIAS on SOHO and CIS on Cluster

Name: Expertise in space-based solar imaging

Operator: University of Kiel

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Max-Planck-Insitut für Aeronomie

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to LASCO on SOHO and SECCHI on STEREO

Name: Global TEC & vertical electron density profiles

Operator: Deutschen Zentrum für Luft- und Raumfahrt

URL: <http://www.kn.nz.dlr.de>

Description: Use of satellite-borne GPS (e.g. CHAMP) to derive TEC on global scale. In particular radio occultation measurements shall be used to deduce vertical electron density profiles on global scale (100..200 profiles per day). Prototype phase, operational 2001

Hungary

Name: DEBRECEN photoheliograph

Operator: HELIOPHYSICAL OBSERVATORY, DEBRECEN,

URL: <http://fenyi.sci.klte.hu/activities.html>

Description: observes the full disc of the Sun in the continuous visible light, Chromospheric observations with H-alpha monochromator

Name: Expertise in space magnetometry

Operator: KFKI Research Institute for Particle and Nuclear Physics

URL:

Description: Expertise in space-based magnetometry, e.g. involvement in FGM on Cluster

Italy

Name: Expertise in space measurements of energetic particles

Operator: Istituto di Fisica dello Spazio Interplanetario

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. CIS on Cluster

Norway

Name: Expertise in space measurements of energetic particles

Operator: Norwegian Defence Research Establishment

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. PEACE on Cluster

Name: Expertise in space measurements of energetic particles

Operator: University Bergen

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. RAPID on Cluster

Sweden

Name: Expertise in measurement of electric fields

Operator: Royal Institute of Technology

URL:

Description: Expertise in instruments to measure electric fields in space, e.g. EFW on Cluster

Name: Expertise in measurement of electric fields

Operator: Swedish Institute of Space Physics
Uppsala Division

URL:

Description: Expertise in instruments to measure electric fields in space, e.g. EFW on Cluster

Name: Expertise in space measurements of energetic particles

Operator: University of Bern

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. CELIAS on SOHO, PLASTIC on STEREO, CIS on Cluster

Switzerland

Name: Radiation Environment Monitor

Operator: Paul Scherrer Institut
Laboratory for Astrophysics

URL: http://www1.psi.ch/www_lap_hn/astr_rem/astr_rem.html

Description: Instrument to measure the charged massive particles encountered by satellites in space

UK

Name: Auroral imager

Operator: University of Leicester
Radio and Space Plasma Physics Group

URL:

Description: Development of a space-qualified auroral imager

Name: Cosmic Radiation Effects and Dosimetry

Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough

URL:

Description: radiation experiments designed and manufactured by DERA

Name: Expertise in space magnetometry

Operator: Imperial College London
Space and Atmospheric Physics Group

URL:

Description: Expertise in space-based magnetometry, e.g. leadership of FGM on Cluster and Ulysses

Name: Expertise in space measurements of energetic particles

Operator: Rutherford Appleton Laboratory
Space Science and Technology

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. PEACE and RAPID on Cluster

Name: Expertise in space measurements of energetic particles

Operator: Mullard Space Science Laboratory

URL:

Description: Expertise in instruments to measure energetic particles in space, e.g. PEACE on Cluster

Name: Expertise in space-based solar imaging

Operator: University of Birmingham

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to LASCO on SOHO and to SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Mullard Space Science Laboratory

URL:

Description: Expertise in space-based solar imaging, e.g. contributions to SECCHI on STEREO

Name: Expertise in space-based solar imaging

Operator: Rutherford Appleton Laboratory
Space Science and Technology

URL:

Description: Expertise in space-based solar spectroscopic imaging, e.g. contributions to CDS on SOHO, also contributions to SECHHI on STEREO

Name: Radiation monitor

Operator: Mullard Space Science Laboratory

URL: http://www.mssl.ucl.ac.uk/www_plasma/research/spaceweather_research.html

Description: Development of a "black box" detector to be carried by future commercial satellites, part-funded by the satellite insurance industry. This will add much needed data to what are currently sparse records of the radiation environment near the Earth.

Resource type: *Measurement*

Austria

Name: Kanzelhöhe Vacuum-Telescope

Operator: Karl-Franzens-Universität, Graz
Kanzelhöhe Solar Observatory

URL: http://www.solobskh.ac.at/docs/gen_frame_en.html

Description: high resolution vacuum-spectrograph

Name: Magneto-Optical Filter

Operator: Karl-Franzens-Universität, Graz
Kanzelhöhe Solar Observatory

URL:

Description: allows bidimensional Doppler and magnetic measurements to be carried out simultaneously in the Na (or K) lines with high spectral stability & high time cadence. developed at University of Rome, in cooperation with Trieste Astronomical Observatory

Name: Photometric Solar Telescope

Operator: Karl-Franzens-Universität, Graz
Institute of Astronomy

URL: <http://www.kfunigraz.ac.at/astwww/mst/project.html>

Description: small multi-band imaging system for full-disk observations of the Sun in various wavelengths.

Name: Überwachungsinstrument

Operator: Karl-Franzens-Universität, Graz
Kanzelhöhe Solar Observatory

URL: http://www.solobskh.ac.at/docs/gen_frame_en.html

Description: Set of four refractors used for patrol monitoring of the Sun - to observe sunspots, in green light, in H-alpha and take magnetograms

Belgium

Name: Belgian ionosonde

Operator: Royal Meteorological Institute of Belgium

URL: http://www.meteo.oma.be/IRM-KMI/rmi_tree/geopdesc.html

Description: Ionosonde operated by RMI - at Dourbes?

Name: Belgian magnetometers
Operator: Royal Meteorological Institute of Belgium

URL: http://www.meteo.oma.be/IRM-KMI/rmi_tree/geopdesc.html

Description: Two magnetometers operated by RMI - one at Dourbes and one at ?

Name: Belgian neutron monitor
Operator: Royal Meteorological Institute of Belgium

URL: http://www.meteo.oma.be/IRM-KMI/rmi_tree/geopdesc.html

Description: Neutron monitor operated by RMI

Czech Republic

Name: Budkov Geomagnetic Observatory
Operator: Academy of Sciences of the Czech Republic
Geophysical Institute

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imobdv_e.html

Description: Magnetometer at Budkov in the Czech Republic (49.1N, 14.0E)

Denmark

Name: Brorfelde Geomagnetic Observatory
Operator: Danish Meteorological Institute
Solar-Terrestrial Physics Division

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imobfe_e.html

Description: Magnetometer at Brorfelde in Denmark (55.6N, 11.7E)

Name: Greenland magnetometer chain
Operator: Danish Meteorological Institute
Solar-Terrestrial Physics Division
URL: <http://web.dmi.dk/projects/chain/>
Description: Magnetometer chain in Greenland . Main chain is 17 sites on west and east coasts, operated by DMI. Also linked with 5 inland sites (MAGIC = Magnetometer Array on the Greenland Ice Cap) run by Space Physics Research Laboratory, University of Michigan.

ESA

Name: SOLAR AND HELIOSPHERIC OBSERVATORY
Operator: European Space Agency
Science Programme
URL: <http://sohowww.estec.esa.nl/>
Description: Solar Observatory at L1 point.

Name: Solar orbiter
Operator: European Space Agency
Science Programme
URL: <http://sci.esa.int>
Description: New science mission to study the Sun at unprecedented resolution - by injection into an orbit which allows the spacecraft to co-rotate with the Sun at perihelion

Name: Ulysses
Operator: European Space Agency
Science Programme
URL: <http://sci.esa.int/home/ulysses/index.cfm>
Description: Heliospheric spacecraft exploring regions away from ecliptic plane

Finland

Name: IMAGE

Operator: Finnish Meteorological Institute
Geophysical Research

URL: <http://www.geo.fmi.fi/image/>

Description: Magnetometer network in Fennoscandia and Svalbard

Name: Magnetometers - Ionospheric Radars- Allsky Cameras Large Experiment

Operator: Finnish Meteorological Institute
Geophysical Research

URL: <http://www.geo.fmi.fi/MIRACLE/>

Description: Multi-instrument ground-based network in Fennoscandia and Svalbard consisting of magnetometers (IMAGE), radars (STARE, CUTLASS) and all-sky cameras

Name: Metsähovi Radio Observatory

Operator: Helsinki University of Technology
Metsähovi Radio Observatory

URL: <http://kurp-www.hut.fi/>

Description: 14 m diameter radio telescope used at frequencies 10-100 GHz. Used for solar radio mapping at 22.2 GHz or at 36.8 GHz. Operates in a campaign mode (I.e. not continuously) especially in summer.

Name: Oulu Cosmic Ray station

Operator: University of Oulu
Space Research Group

URL: <http://spaceweb.oulu.fi/projects/crs/>

Description: Cosmic ray monitor at 65.05°N, 25.47°E. Counts of the neutron monitor are accumulated over 1-minute and 1-hour intervals. Data collection with 10 seconds recording time is also available. Data sent to WDCs.

Name: Sodankylä ionosonde
Operator: Sodankylä Geophysical Observatory

URL: <http://space.sgo.fi/htmls/ionosonde.html>

Description: Ionosonde at Sodankylä in northern Finland

Name: Sodankylä riometer network
Operator: Sodankylä Geophysical Observatory

URL: <http://space.sgo.fi/htmls/riometer.html>

Description: Riometer network with five sites in Finland, 1 in Sweden, 1 in Svalbard and 1 on Iceland. A number of other sites exist but are not currently operational.

France

Name: Détermination d'Orbite et Radiopositionnement Intégrés par Satellite
Operator: Centre National d'Etude Spatiale

URL: <http://www.ign.fr/fr/PI/activites/geodesie/DORIS/>

Description: Radio-electrical system for high accuracy orbit determination and station positioning. Also provides data on global ionospheric behaviour - see <http://www.ign.fr/fr/PI/activites/geodesie/DORIS/#ionosphere>.

Name: H-Alpha Coronagraph
Operator: Observatoire du Pic du Midi

URL: <http://www.omp.obs-mip.fr/omp/pic/coroseng.htm>

Description: SURVEY PROGRAM relative to dynamic phenomena of solar corona's cold area, observed in the H-Alpha hydrogen line.

Name: Iceland West (Stokkseyri) radar

Operator: Laboratoire de Physique et Chimie de l'Environnement

URL: http://web.cnrs-orleans.fr/~web/pce/recherche/plasmas_spatiaux/ventsolaire/ventsolair

Description: HF radar based at Stokkseyri, Iceland to measure ionospheric convection.

Name: Kerguelen cosmic ray monitor

Operator: Institut Français pour la Recherche et la Technologie Polaires

URL: <http://www.ifremer.fr/ifrtp/pages/progge.html>

Description: Kerguelen cosmic ray monitor. Responsible scientist is P.Lantos at Meudon.

Name: Nancy Radioheliograph

Operator: Observatoire de Paris
Département d'Astronomie Solaire

URL: http://www.obs-nancy.fr/html_fr/rh_new.htm

Description: The Nancy Radioheliograph (NRH; located at 47 N 02 E) provides since the TWO dimensional images of the radio brightness of the Sun with second time resolution.

Name: Observatoire Magnétique de Chambon la Forêt

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/clf.html>

Description: Magnetometer at Chambon la Forêt near Paris

Name: Observatoire Magnétique de Dumont d'Urville

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/drv.html>

Description: Magnetometer at Terre Adélie, Antarctica (66.6S, 140.0E)

Name: Observatoire Magnétique de Kourou

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/kou.html>

Description: Magnetoemeter at Kourou in French Guiana (2.2 N, 307.3 E)

Name: Observatoire Magnétique de Martin de Viviers

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/ams.html>

Description: Magnetometer on Amsterdam Island in the Indian Ocean (37.8S, 77.6E)

Name: Observatoire Magnétique de Pamataï

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/ppt.html>

Description: Magnetometer on Tahiti in the Pacific Ocean (17.6 S, 210.4 E)

Name: Observatoire Magnétique de Port Alfred

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/czt.html>

Description: Magnetometer at Possession Island in the Crozet Islands in the southern Indian Ocean (46.4S, 51.9E)

Name: Observatoire Magnétique de Port aux Français

Operator: Institut de Physique du Globe de Paris

URL: <http://obsmag.ipgp.jussieu.fr/Obs/paf.html>

Description: Magnetometer on Kerguelen in the southern Indian Ocean (49.4 S, 70.3 E)

Name: SuperDARN Kerguelen

Operator: Laboratoire de Physique et Chimie de l'Environnement

URL: <http://www.ifremer.fr/ifrtp/pages/progge.html>

Description: Kerguelen station of SuperDARN. Responsible scientist is J.P. Villain at LPCE Orleans

Name: Terre Adélie cosmic ray monitor

Operator: Institut Français pour la Recherche et la Technologie Polaires

URL: <http://www.ifremer.fr/ifrtp/pages/progge.html>

Description: Terre Adélie cosmic ray monitor. Responsible scientist is P.Lantos at Meudon.

Germany

Name: Furstenfeldbruck Geomagnetic Observatory

Operator: Ludwig-Maximilians-Universität München

URL: http://www.gsrg.nmh.ac.uk/intermagnet/english/imos/imofur_e.html

Description: Geomagnetic observatory at Furstenfeldbruck near Munich

Name: GPS and GNSS monitoring

Operator: Deutschen Zentrum für Luft- und Raumfahrt

URL: <http://www.dlr.de/KN/KN-NL>

Description: GPS and GNSS monitoring at DLR Oberpfaffenhofen

Name: GPS Derived TEC Maps

Operator: Deutschen Zentrum für Luft- und Raumfahrt

URL: <http://www.kn.nz.dlr.de/>

Description: TEC maps over Europe derived from GPS monitoring. Work of Institute for Communication and Navigation, External research team Neustrelitz

Name: GREGOR

Operator: Kiepenheuer-Institut für Sonnenphysik

URL: <http://www.kis.uni-freiburg.de/GREGOR/>

Description: New 1.5m telescope with a 1.5m aperture and an alt-azimuthal mounting - to be installed at the Observatorio del Teide, Tenerife. equipped with adaptive optics and a polarimetry system. Replaces Gregory-Coude Telescope (GCT). Operational in 2004.

Name: Gregory-Coude Telescope

Operator: Georg-August-Universität Göttingen
Universitäts-Sternwarte Göttingen

URL: <http://www.uni-sw.gwdg.de/>

Description: 45 cm telescope at Observatorio del Teide, Tenerife. Has an effective focal length of 25 m. It feeds a horizontal Echelle spectrograph. To be replaced by larger telescope GREGOR.

Name: Juliusruh Ionosonde

Operator: Universität Rostock
Leibniz-Institut für Atmosphärenphysik

URL: http://www.iap-kborn.de/radar/Technik/Ionosonde/index_eng.htm

Description: Ionosonde at Juliusruh, Germany

Name: Niemegek Geomagnetic Observatory

Operator: GeoForschungsZentrum Potsdam

URL: http://www.gsrg.nmh.ac.uk/intermagnet/english/imos/imongk_e.html

Description: Geomagnetic observatory at Niemegek near Potsdam

Name: Scandinavian Twin Auroral Radar

Operator: Max-Planck-Institut für Aeronomie

URL: <http://www.linmpi.mpg.de/english/projekte/stare/>

Description: VHF(?) backscatter radar

Name: SOLAR RADIO ASTRONOMY

Operator: Astrophysikalisches Institut Potsdam

URL: <http://www.aip.de/groups/osra/>

Description: Radio spectral observations are carried out at in Tremsdorf 15 km SE of Potsdam. 4 sweep spectrographs (10 sweeps per second in the ranges 40-90 MHz; 100-170 MHz; 200-400 MHz and 400-800 MHz).

Name: Sonnenobservatorium Einsteinturm

Operator: Astrophysikalisches Institut Potsdam

URL: <http://aipsoe.aip.de/descr/soe-overview-e.html>

Description: equipped with a double spectrograph and two photoelectric polarization analyzers which allow to determine the spatial distribution of the magnetic field vector and its gradient

Name: Vacuum Newton Telescope

Operator: Kiepenheuer-Institut für Sonnenphysik

URL: <http://www.kis.uni-freiburg.de>

Description: 40cm telescope at Observatorio del Teide, Tenerife. 35m focal length, evacuated.

Name: Vacuum Tower Telescope

Operator: Kiepenheuer-Institut für Sonnenphysik

URL: <http://www.kis.uni-freiburg.de>

Description: 70cm telescope at Observatorio del Teide, Tenerife. 45m focal length, evacuated, spectrograph and additional instruments.

Name: Wingst Geomagnetic Observatory

Operator: GeoForschungsZentrum Potsdam

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imowng_e.html

Description: Geomagnetic observatory at Wingst near Hamburg

Greece

Name: Athens Ionosonde

Operator: National Observatory of Athens

URL: <http://www.iono.noa.gr>

Description: Digisonde

Hungary

Name: Nagycenk Geomagnetic Observatory

Operator: Hungarian Academy of Sciences
Geodetic and Geophysical Institute

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imonck_e.html

Description: Magnetometer at Sopron in west of Hungary (47.6N, 16.7E)

Name: Tihany Geomagnetic Observatory

Operator: Hungarian Geological Survey
Eötvös Loránd Geophysical Institute

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imothy_e.html

Description: Magnetometer on Tihany Peninsula on the shore of Lake Balaton

Italy

Name: Castello Tesino GEOMAGNETIC OBSERVATORY

Operator: Istituto Nazionale di Geofisica

URL: <http://www.ingrm.it/geomag/ictesino.htm>

Description: Geomagnetic observatory at Castello Tesino in northern Italy. Part of Italian national programme (<http://www.ingrm.it/geomag/iosserva.htm>)

Name: Gibilmanna Ionosonde

Operator: Istituto Nazionale di Geofisica

URL: <http://io.ingrm.it/aeronomi/eniongb.htm>

Description: Digisonde at Gibilmanna, near Palermo in Sicily. Part of the Italian national ionospheric service (<http://io.ingrm.it/aeronomi/ensin.htm>). Southern-most ionosonde in Europe.

Name: H-alpha observations of the Sun

Operator: Osservatorio Astrofisico di Catania
Ricerche di fisica del Sole

URL: <http://w3c.ct.astro.it/cd-oac-web/oss-sistematica.html>

Description: H-alpha observations of the Sun. See <http://www.ct.astro.it/sunoacc.html> for images.

Name: L'AQUILA GEOMAGNETIC OBSERVATORY

Operator: Istituto Nazionale di Geofisica

URL: <http://www.ingrm.it/geomag/ilaquila.htm>

Description: Geomagnetic observatory at L'Aquila in central Italy. Part of Italian national programme (<http://www.ingrm.it/geomag/iosserva.htm>)

Name: Precision Solar Photometric Telescope

Operator: Osservatorio Astronomico di Roma

URL: <http://www.rm.astro.it/rise/pspt.html>

Description: Measures CaK line as a good proxy of solar magnetic activity and of ultraviolet emissions

Name: Rome Ionosonde

Operator: Istituto Nazionale di Geofisica

URL: <http://io.ingrm.it/aeronomi/enionrm.html>

Description: Digisonde at Rome. Part of the Italian national ionospheric service (<http://io.ingrm.it/aeronomi/ensin.htm>). Real-time data available via <http://dps-roma.ingrm.it/>

Name: Terra Nova Bay Ionosonde

Operator: Istituto Nazionale di Geofisica

URL: <http://io.ingrm.it/aeronomi/eniontn.html>

Description: Ionosonde at Terra Nova Bay, Antarctica. Part of the Italian national ionospheric service (<http://io.ingrm.it/aeronomi/ensin.htm>).

Name: Trieste Solar Radio System

Operator: Osservatorio Astronomico di Trieste
Solar Astrophysics Group

URL: <http://radiosun.ts.astro.it>

Description: Two solar multichannel radio polarimeter which operate at 6 fixed frequencies - 237, 327, 408, 610, 1420 and 2695 MHz on a routine daily basis

Name: White light observations of Sun
Operator: Osservatorio Astrofisico di Catania
Ricerche di fisica del Sole
URL: <http://w3c.ct.astro.it/cd-oac-web/oss-sistematica.html>
Description: White light observations of Sun. See <http://www.ct.astro.it/sunoacf.html> for sunspot data

Name: White light solar observations at Rome
Operator: Osservatorio Astronomico di Roma
URL: <http://www.rm.astro.it/bollettini/boll.html>
Description: white light observations are carried out routinely to describe sunspot regions properties (O.A.R. bulletin "Solar Phenomena")

Pan_European

Name: Dynasonde at Tromsø
Operator: EISCAT Scientific Association
URL: <http://seldon.eiscat.uit.no/dynasond.html>
Description: digital HF sounder covering ca. 1-30 MHz. It is sometimes referred to as a frequency agile sounder, or Advanced Ionospheric Sounder. can be run like an ionosonde or in other modes such as fixed frequency soundings

Name: EISCAT Svalbard radar
Operator: EISCAT Scientific Association
URL: <http://www.esr.eiscat.no/>
Description: Two beam incoherent scatter radar on the island of Svalbard. Can measure density, temperature, velocity and composition of ionospheric plasma

Name: European Incoherent Scatter radar

Operator: EISCAT Scientific Association

URL: <http://seldon.eiscat.uit.no/instrumentation.html>

Description: Tri-static radar in Northern Scandinavia. Can measure density, temperature, velocity and composition of ionospheric plasma. Can also be used for interplanetary scintillation studies.

Name: Ionospheric Heating facility

Operator: EISCAT Scientific Association

URL: <http://seldon.eiscat.uit.no/heater.html>

Description: Ionospheric heating facility

Name: Télescope Héliographique pour l'Étude du Magnétisme et des Instabilités Solaires

Operator: THEMIS S.L.

URL: <http://www.themis.iac.es/>

Description: new generation solar telescope to obtain very precise measurements of the solar magnetic field vector from simultaneous observations in a number of different polarized spectral lines. Located on Tenerife (28.3N, 16.5W, 2456m). Also funded by CNR Italy

Poland

Name: Belsk Geomagnetic Observatory

Operator: Polish Academy of Sciences
Institute of Geophysics

URL: <http://www.igf.edu.pl/belsk/belsk.htm>

Description: Magnetometer at Belsk, Poland (51.8N, 20.8E) - near Warsaw

Name: Hel Geomagnetic Observatory
Operator: Polish Academy of Sciences
Institute of Geophysics
URL: http://www.igf.edu.pl/hel/index_e.htm
Description: Magnetometer at Hel, Poland (54.6N, 18.8E) - on Baltic coast

Romania

Name: Surlari Geomagnetic Observatory
Operator: Geological Survey of Romania
URL: http://www.gsrn.nmh.ac.uk/intermagnet/english/imos/imosua_e.html
Description: Magnetometer at Surlari, Romania (45.3N, 26.3E)

Russia

Name: Moscow magnetometer
Operator: IZMIRAN
Magnetism
URL: http://www.izmiran.rssi.ru/magnetism/mos_data.htm
Description: Magnetometer near Moscow

Name: Moscow neutron monitor
Operator: IZMIRAN
Magnetism
URL: <http://helios.izmiran.troitsk.ru/cosray/main.htm>
Description: Neutron monitor at 55.47 N 37.32 E

Name: Vasil'sursk radio facility

Operator: NIRFI

URL: <http://esapub.esrin.esa.it/pff/pffv5n4/kloov5n4.htm>

Description: Facility at latitude 56N07, longitude 46E00, 140km east of Nizhny Novgorod. Can operate below 10 MHz in both radar mode and receive only mode. In radar mode acts as an ionospheric heating facility. Effective power is 19.2 MW at 9.05 and 9.31 MHz.

Slovakia

Name: Hurbanovo Geomagnetic Observatory

Operator: Slovak Academy of Sciences
Geophysical Institute

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/countrys/cy_svk_e.html

Description: Magnetometer at Hurbanovo in Slovakia

Spain

Name: El Arenosillo absorption data

Operator: Instituto Nacional de Técnica Aeroespacial

URL:

Description: Measures D-region absorption at 2.83 MHz on path from Madrid

Name: El Arenosillo ionosonde

Operator: Instituto Nacional de Técnica Aeroespacial

URL:

Description: Digisonde 256 at 37.1 N, 6.7 W

Name: Guimar - Tenerife Geomagnetic Observatory

Operator: INSTITUTO GEOGRAFICO NACIONAL

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imogui_e.html

Description: Magnetometer at Guimar on Tenerife (28.3N, 343.6E)

Name: San Pablo- Toledo Geomagnetic Observatory

Operator: INSTITUTO GEOGRAFICO NACIONAL

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imospt_e.html

Description: Magnetometer at San Pablo de los Montes in mainland Spain (39.5N, 355.6E)

Sweden

Name: Abisko Geomagnetic Observatory

Operator: Geological Survey of Sweden

URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imoabk_e.html

Description: Magnetometer at Abisko in northern Sweden (68.4 N, 18.8E)

Name: Auroral Large Imaging System

Operator: Swedish Institute of Space Physics
Kiruna Division

URL: <http://alis.irf.se/alis/>

Description: System of unmanned ground-based auroral imaging stations located in a grid of about 50x50 km in Northern Sweden. Each station is equipped with a high-resolution CCD detector.

Name: Kiruna Ionosonde
Operator: Swedish Institute of Space Physics
Kiruna Division
URL: <http://www.irf.se/~ionogram/>
Description: Ionosonde at Kiruna, Sweden (67.8N, 20.4E)

Name: Lovo Geomagnetic Observatory
Operator: Geological Survey of Sweden
URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imolov_e.html
Description: Magnetometer at Lovo near Stockholm (59.3 N, 17.8E)

Name: Lycksele Ionosonde
Operator: Swedish Institute of Space Physics
Kiruna Division
URL: <http://www.irf.se/~ionogram/>
Description: Ionosonde at Lycksele, Sweden

Name: New Swedish Solar Telescope
Operator: Stockholm Observatory
URL: <http://www.astro.su.se/groups/solar/solar.html>
Description: The New Swedish Solar Telescope will have twice as large aperture as its predecessor. This telescope will be installed at La Palma and should start operation during 2001.

Name: Uppsala Ionosonde
Operator: Swedish Institute of Space Physics
Kiruna Division

URL: <http://www.irf.se/~ionogram/>

Description: Ionosonde at Uppsala, Sweden

Switzerland

Name: PHOENIX-2
Operator: ETH ZURICH
Radio Astronomy and Plasma Physics group

URL: <http://www.astro.phys.ethz.ch/rapp/>

Description: broadband radio spectrometer to register the flare emission of the full sun. In the frequency range of operation, 0.1 to 4.0 GHz, both modes of circular polarization are recorded continuously.

Turkey

Name: Kandilli Geomagnetic Observatory
Operator: Bogazici University
Kandilli Observatory and Earthquake Research Institute

URL: <http://www.koeri.boun.edu.tr/geomagnt/MAGENG/Main.htm>

Description: Magnetometer at Istanbul (41.1N, 29.1E)

UK

Name: BAS magnetometer network

Operator: British Antarctic Survey
Upper Atmosphere Science Division

URL: <http://www.nerc-bas.ac.uk/public/uasd/instrums/magnet/intro.html>

Description: Magnetometers located at Halley, Antarctica and at three automated geophysical observatories on the ice cap.

Name: BAS VLF Receivers

Operator: British Antarctic Survey
Upper Atmosphere Science Division

URL: <http://www.nerc-bas.ac.uk/public/uasd/instrums/vlf/intro.html>

Description: ELF/VLF receiving systems designed to monitor the electromagnetic spectrum in the ELF (0.3-3.0 kHz) and VLF (3-30 kHz) frequency bands. Located at Halley, Antarctica and at three automated geophysical observatories on the ice cap.

Name: Chilton ionosonde

Operator: Rutherford Appleton Laboratory
Space Science and Technology

URL: <http://www.wdc.rl.ac.uk/ionosondes/ralsite.html>

Description: Digital ionosonde located at the RAL site. Successor to Slough ionosonde. Together with Slough forms the longest sequence of ionosonde data in the world.

Name: Co-operative UK Twin Located Auroral Sounding System

Operator: University of Leicester
Radio and Space Plasma Physics Group

URL: <http://ion.le.ac.uk/cutlass/cutlass.html>

Description: Two HF radars located in Iceland and Finland, both looking north into a volume over the Svalbard archipelago. Use of two radars enables the ionospheric convection velocity vector perpendicular to the Earth's magnetic field to be resolved.

Name: DERA Tromsø Ionosonde
Operator: Qinetiq (former Defence Evaluation and Research Agency)
Radio Science and Propagation Group, Malvern
URL: <http://digisonde.phys.uit.no/>
Description: Ionosonde in Tromsø, Norway, measuring electron density and convection. See also <http://rasp.dera.gov.uk/ifs/ionosonde.htm>

Name: Eskdalemuir magnetometer
Operator: British Geological Survey
Global Seismology and Geomagnetism Group
URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imoesk_e.html
Description: Magnetometer at Eskdalemuir in southern Scotland. Kp station

Name: Halley dynasonde
Operator: British Antarctic Survey
Upper Atmosphere Science Division
URL: <http://www.nerc-bas.ac.uk/public/uasd/instrums/dyna/intro.html>
Description: The dynasonde at Halley remotely senses the structure and motion of plasma 60-500 km up in the ionosphere and within a horizontal radius of about 500 km.

Name: Hartland magnetometer
Operator: British Geological Survey
Global Seismology and Geomagnetism Group
URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imohad_e.html
Description: Magnetometer at Hartland Point in Devon in the south-west of England. Successor to earlier magnetometers in south of England at Greenwich and Abinger. Northern station for the aa index, is a Kp station.

Name: Imaging Riometer for Ionospheric Studies
Operator: University of Lancaster
Department of Communication Sciences
URL: <http://www.dcs.lancs.ac.uk/iono/iris/>
Description: Imaging Riometer sited at Kilpisjärvi in northern Finland

Name: Lerwick magnetometer
Operator: British Geological Survey
Global Seismology and Geomagnetism Group
URL: http://www.gsrq.nmh.ac.uk/intermagnet/english/imos/imoler_e.html
Description: Magnetometer at Lerwick in the Shetland Islands. Kp station.

Name: Measurements of thermospheric winds
Operator: University College London
Atmospheric Physics Laboratory
URL: http://cat.apg.ph.ucl.ac.uk/FPI_Intro.html
Description: Fabry-Perot measurements of thermospheric winds at Kiruna, Sweden (67.8N, 20.4E), Kilpisjarvi, Finland (69.1N, 20.8E), Longyearbyen (78.2N, 15.6E) and Bear Lake, Utah (41.9N, 111.4W).

Name: Port Stanley ionosonde
Operator: Rutherford Appleton Laboratory
Space Science and Technology
URL: <http://www.wdc.rl.ac.uk/ionosondes/falsite.html>
Description: Ionosonde based on Falkland Islands. Provides a near-continuous sequence of ionospheric soundings from 1945 to the present day.

Name: Southern Hemisphere Auroral Radar Experiment

Operator: British Antarctic Survey
Upper Atmosphere Science Division

URL: <http://www.nerc-bas.ac.uk/public/uasd/instrums/share/intro.html>

Description: Radar at Halley, Antarctica - remotely senses ionospheric convection, started operation in Jan1988 under the acronym PACE. Now part of tripartite experiment, other elements provided by Johns Hopkins University and University of Natal. Part of SuperDARN

Name: Space Plasma Explorationby Active Radar

Operator: University of Leicester
Radio and Space Plasma Physics Group

URL: <http://ion.le.ac.uk/~jaq/speardoc.html>

Description: A new active HF space plasma sounder for Svalbard

Name: UK Sub-Auroral Magnetometer Network

Operator: University of York
Magnetospheric Physics Group

URL: <http://samsun.york.ac.uk/>

Description: Network of 9 stations equipped with fluxgate magnetometers which continuously record natural variations in the Earth's magnetic field - in sub-auroral regions in the UK, the Faroe Islands, Sweden, Norway , Finland, Iceland and Russia.

Resource type: *Model*

Belgium

Name: Statistical ELF and VLF Environment Models

Operator: Belgian Institute for Space Aeronomy

URL: <http://www.magnet.oma.be/sevem/>

Description: To make statistical maps of the VLF, ELF and plasma wave distribution in the magnetosphere, and to develop empirical and statistical models of the 3-dimensional distribution of wave parameters such as amplitude, polarization and frequency.

Name: UNIRAD

Operator: Belgian Institute for Space Aeronomy

URL: <http://www.magnet.oma.be/home/unirad/unirad.html>

Description: UNIRAD is a software package developed by and for ESA for evaluation of the radiation fluences and doses expected in a spacecraft for a mission defined by given orbital characteristics.

Denmark

Name: Linear Modeling of Ionospheric Electrodynamics

Operator: Danish Meteorological Institute
Solar-Terrestrial Physics Division

URL: <http://dmiweb.dmi.dk/fsweb/projects/spw/spw.html>

Description: Specification and forecast of ionospheric parameters (field-aligned currents and electric potentials) based on solar wind data (e.g. ACE)

Name: Real-time prediction of geomagnetic storms
Operator: Danish Meteorological Institute
Solar-Terrestrial Physics Division
URL: <http://dmiweb.dmi.dk/fsweb/solar-terrestrial/staff/wu/spwrtpdst.html>
Description: Real-time prediction of geomagnetic storms using solar wind parameters B, Bs, N and V, e.g. from ACE.

Finland

Name: Grand Unified Ionosphere-Magnetosphere Coupling Simulation
Operator: Finnish Meteorological Institute
Geophysical Research
URL: <http://www.geo.fmi.fi/~pjanhune/gumics3/>
Description: Simulation of ionosphere-magnetosphere coupling. It is a global MHD simulation coupled with a comprehensive ionospheric model.

France

Name: Collecte Localisation Services
Operator: Collecte Localisation Services
URL: <http://www.cls.fr/previsol/>
Description: Daily forecasts of solar flares, protons & magnetic activity & previous day's solar & mag indices are available free of charge, 3 day ahead forecasts via limited access. Outreach material to be added by end 2000.

Name: NEURAL NETWORK FORECAST OF THE SOLAR CYCLE
Operator: Observatoire de Paris
Département d'Astronomie Solaire
URL: <http://previ.obspm.fr/previ/eneurweb.htm>
Description: NEURAL NETWORK FORECAST OF THE SOLAR CYCLE

Name: SALAMMBO
Operator: Office National d'Etudes et de Recherches Aéronautiques
Département Environnement Spatial

URL: <http://www.onera.fr/desp-en/envvehspa/index.html>

Description: Model of radiation belt

Name: SIEVERT
Operator: Observatoire de Paris
Département d'Astronomie Solaire

URL:

Description: Provides radiation dose calculations for airline flights. Uses neutron data from Terre Adélie and Kerguelen together with energetic particle transport model. Operated in conjunction with Direction Générale de l'Aviation Civile.

Sweden

Name: AI Methods in Spacecraft Anomaly Predictions
Operator: Swedish Institute of Space Physics
Lund Division

URL: <http://www.irfl.lu.se/saaps/>

Description: The aim of this project is to develop tools for the analysis and prediction of spacecraft anomalies. The main methods will be the use of artificial intelligence (AI) such as neural networks and fuzzy systems.

UK

Name: COUPLED THERMOSPHERE-IONOSPHERE MODEL

Operator: University College London
Atmospheric Physics Laboratory

URL: <http://cat.apg.ph.ucl.ac.uk/model1.html>

Description: Self-consistent model of upper atmosphere temperature, density and composition

Name: DERA Internal Charging Threat Assessment Tool

Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough

URL: <http://www.space.dera.gov.uk/idc/index.html>

Description: tool for assessing the threat from internal charging.

Name: ESABASE

Operator: ALSTOM Energy Technology Centre

URL: <http://www.technology.energy.alstom.com/ebas.htm>

Description: Software environment for space system analysis. Includes applications to analyse problems related to debris impact and charged-particle radiation

Name: European Ionospheric Forecast and Mapping software

Operator: Rutherford Appleton Laboratory
Radio Communications Research Unit

URL:

Description: Windows-based software to forecast foF2, M3000F2, MUF3000F2 and TEC over Europe

Name: Geant4 Collaboration
Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough
URL: http://www.space.dera.gov.uk/space_env/geant_mn.html
Description: Development of a new generation of radiation shielding tools for civil space applications -in collaboration with CERN other members of the Geant4 collaboration. See <http://wwwinfo.cern.ch/asd/geant4/geant4.html>

Name: IF2 prediction
Operator: Rutherford Appleton Laboratory
Space Science and Technology
URL: <http://www.wdc.rl.ac.uk/wdcc1/data.html>
Description: Prediction of ionosphericly effective sunspot numbers IF2 and IG - as approved by CCIR

Name: Integrated Debris Evolution Suite
Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough
URL:
Description: Software for debris impact risks, platform optimisation and protection measures

Name: Ionospheric Forecasting
Operator: Rutherford Appleton Laboratory
Radio Communications Research Unit
URL: <http://www.rcru.rl.ac.uk/iono/maps.htm>
Description: foF2, MUF(3000)F2 and TEC forecasts across Europe for up to 24 hours ahead

Name: Ionospheric Forecasting Demonstrator
Operator: Qinetiq (former Defence Evaluation and Research Agency)
Radio Science and Propagation Group, Malvern
URL: <http://rasp.dera.gov.uk/ifs/ifs.html>
Description: forecasting electron density in UK 24 hours ahead using radial basis function neural networks

Name: Predictor of Geoeffective Solar Wind Structures
Operator: Imperial College London
Space and Atmospheric Physics Group
URL: <http://www.sp.ph.ic.ac.uk/~cargill/spw.html>
Description: algorithm to feed out a continual prediction of whether the solar wind at any given time is going to be "geoeffective".

Name: Space Environment Database and Analysis Tools
Operator: Rutherford Appleton Laboratory
Space Science and Technology
URL: <http://www.wdc.rl.ac.uk/sedat/>
Description: Database of charged particle flux data developed under ESA contract

Resource type: *Network*

ESA

Name: Spacecraft Plasma Interactions Network in Europe
Operator: European Space Agency
Space Environments and Effects Analysis section
URL: <http://www.estec.esa.nl/wmwww/Spine/>
Description: Network to share resources and to co-ordinate efforts in all domains related to the interaction of Spacecraft with the space plasma.

Finland

Name: Space Weather in the Antares Programme

Operator: Academy of Finland

URL: <http://akseli.tekes.fi/Resource.phx/tivi/antares/en/swape.htx>

Description: Finnish national programme for a omprehensive study of physics of space weather. Consists of basic space research and new instrument development.

France

Name: Programme National Soleil-Terre

Operator: CNRS
Institut National des Sciences de l'Univers

URL: <http://www.medoc-ias.u-psud.fr/pnst/pnst1.htm>

Description: French national programme - includes spaxce weather as one of four themes within the programme

Global

Name: INTERMAGNET

Operator: INTERMAGNET

URL: <http://www.gserg.nmh.ac.uk/intermagnet/>

Description: INTERMAGNET is a global network of cooperating digital magnetic observatories, using modern standard specifications for measuring and recording equipment, to facilitate data exchanges and the production of geomagnetic products in close to real time.

Name: Ionosonde Network Advisory Group

Operator: Ionosonde Network Advisory Group

URL: <http://www.ips.gov.au/INAG/>

Description: INAG is Working Group 1 of URSI Commission G. It is responsible for: collecting together information on analysis of ionograms, maintaining conventions for reduction of ionograms, a forum for people interested in obtaining reliable data from ionograms

Name: SuperDARN

Operator: SuperDARN

URL: <http://superdarn.jhuapl.edu/>

Description: SuperDARN is a global network of high-frequency radars used to study the Earth's ionosphere in the two auroral zones. There are 9 radars in the north (3 run by European groups) north and 6 in the south (2 run by European groups).

Italy

Name: Area of Astrogeophysics Research

Operator: Area of Astrogeophysics Research

URL: <http://astrogeofisica.univaq.it/en/meteo.asp>

Description: Consortium of institutes from the Abruzzo Region to pursue scientific activities in astronomy and geophysics. Has Space Weather as a major theme.

Pan_European

Name: COST 271 - Effects of upper atmosphere on terrestrial and Earth-space comms

Operator: European Union

URL:

Description: New COST action to study the effects of the upper atmosphere on terrestrial and Earth-space communications. Starts autumn 2000

Name: COST251 - IMPROVED QUALITY OF SERVICE IN IONOSPHERIC TELECO

Operator: European Union

URL: <http://www-cost251.rcru.rl.ac.uk/>

Description: Collaboration to demonstrate the practical improvement to terrestrial and Earth-space radio systems of COST 238 derived ionospheric models, and to promote their use & to further refine these models and to widen their geographical area of applicability

Name: European Solar Magnetometry Network

Operator: European Solar Magnetometry Network

URL: <http://www.phys.uu.nl/~rutten/tmr/>

Description: collaboration of eight European solar physics research groups. funded by a grant from the EU TMR programme for 4 years from May 1, 1998. integrates development and usage of European solar telescopes with space observation, data interpretation and theory

Name: Joint Organization for Solar Observations

Operator: Joint Organization for Solar Observations

URL: <http://joso.oat.ts.astro.it/>

Description: Group set up in 1968/60 to search for an "ideal" observatory site, construct a "Joint European Solar Observatory", a "Large European Solar Telescope" and stimulate more effective solar research in Europe. Led to current facilities at Tenerife & La Palma

Name: Space Processes and Electrical Changes Influencing Atmospheric Layers

Operator: European Science Foundation

URL: <http://www.sgo.fi/SPECIAL/>

Description: ESF Network to generate global, regional & local models to relate electrical changes in ionosphere to distribution of galactic, solar & magnetospheric charged particles, to quantify the relationship between these & the distribution of cloud and rainfall.

UK

Name: UK SOLAR-TERRESTRIAL PHYSICS NATIONAL FACILITIES

Operator: Particle Physics & Astronomy Research Council

URL: <http://ion.le.ac.uk/~jaq/tbj.html>

Description: Set of UK national facilities including radars (UK part of EISCAT + Cutlass), ionosondes, imaging riometer (IRIS), magnetometer network (SAMNET) and World Data Centre c1 for STP. See separate entries for these resources.

Resource type: Platform

Denmark

Name: The Ørsted satellite

Operator: TERMA Elektronik AS

URL: <http://web.dmi.dk/projects/oersted/homepage.html>

Description: 62 kg microsatellite for geomagnetic measurements.

France

Name: Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions

Operator: Centre National d'Etude Spatiale

URL: <http://sads.cnes.fr:8060/DEMETER/Fr/Welcome.html>

Description: First CNES micro-satellite mission. Will measure selectromagnetic signals generated by seismic or volcanic events. Due fo launch in mid-2001. About 100 kg mass.

Name: PICARD

Operator: Centre National d'Etude Spatiale

URL: <http://sads.cnes.fr:8060/PICARD/Fr/Welcome.html>

Description: Second CNES micro-satellite mission. Will measure solar diameter and irradiance. Due for launch in 2002-2003. Spacecraft mass of about 100 kg including 40 kg payload.

Spain

Name: MINISAT

Operator: Instituto Nacional de Técnica Aeroespacial

URL: <http://www.inta.es/areas/progra/minisat/peque.html>

Description: Minisatellite programme which seeks to give the Spanish aerospace industry the proper capability to design, produce, integrate and operate a complete space system. Mass up to 500 kg.

Sweden

Name: ASTRID-2

Operator: Swedish Space Corporation

URL: <http://www.ssc.se/ssd/msat/astrid2.html>

Description: 30 kg microsatellite for space plasma research

Name: Munin satellite

Operator: Swedish Institute of Space Physics
Kiruna Division

URL: <http://munin.irf.se/>

Description: 6kg nano-satellite carrying science instruments for auroral research

Name: The ASTRID satellite

Operator: Swedish Space Corporation

URL: <http://www.ssc.se/ssd/msat/astrid.html>

Description: 27 kg microsatellite for space plasma research

Name: The FREJA satellite
Operator: Swedish Space Corporation

URL: <http://www.ssc.se/ssd/ssat/freja.html>

Description: 214 kg small satellite for space plasma research

UK

Name: Space Technology Research Vehicle
Operator: Qinetiq (former Defence Evaluation and Research Agency)
Space Department, Farnborough

URL: <http://www.dera.gov.uk/html/space/strv/over.htm>

Description: Series of microsatellites (about 100 kg) developed by DERA - carrying a variety of scientific and technological payloads - including measurements of energetic charged particles

Name: SSTL enhanced microsatellites
Operator: Surrey Satellite Technology

URL: http://www.sstl.co.uk/services/subpage_services.html

Description: For missions between 50 and 100 kg, SSTL has a flight proven modular microsatellite core

Name: SSTL nanosatellites
Operator: Surrey Satellite Technology

URL: http://www.sstl.co.uk/services/subpage_services.html

Description: tiny (<10 kg) nanosatellites with significant capabilities can be constructed in very short periods of time and at extremely low cost, Surrey's first nanosatellite, SNAP-1, is a 6.5 kg spacecraft