

INTERMAGNET

(International Real-time Magnetic Observatory Network)

Website

<http://www.intermagnet.org>

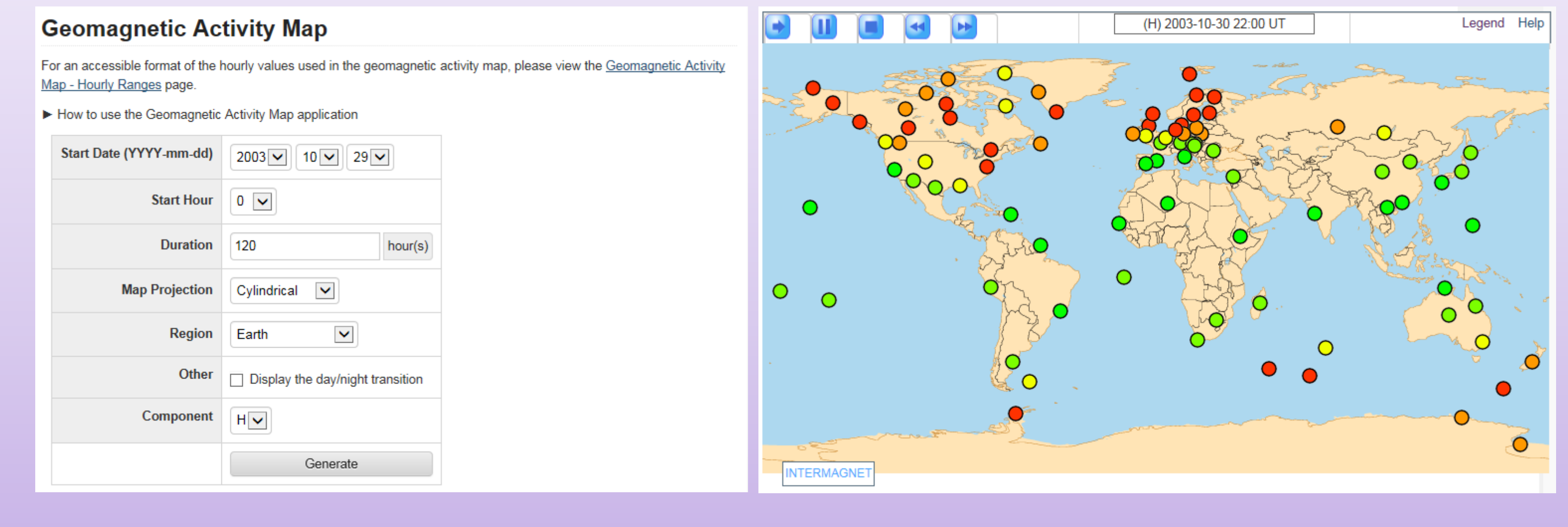
Contact INTERMAGNET

<http://www.intermagnet.org/contact-eng.php>

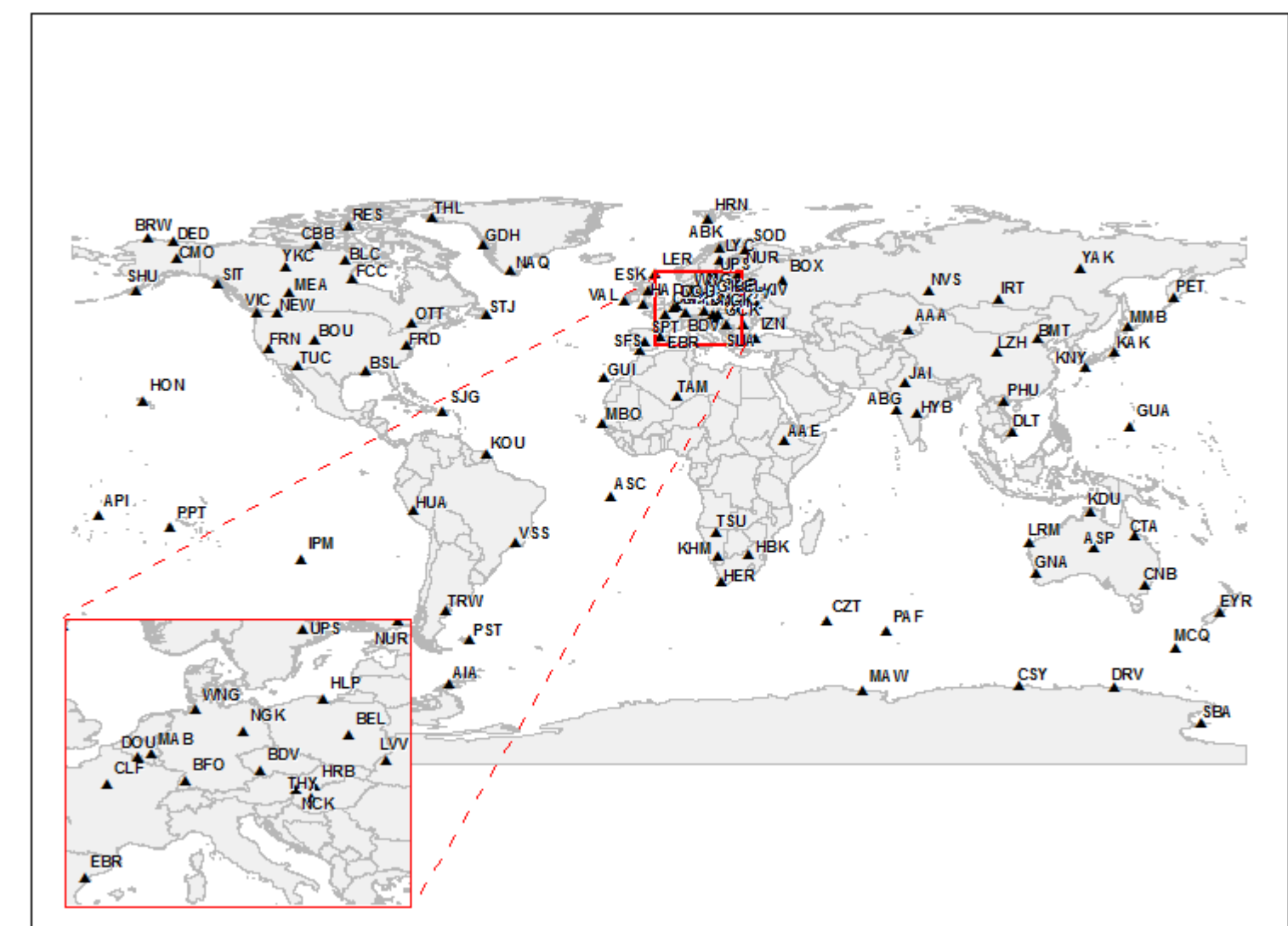
General Information

As of 2015, INTERMAGNET has 59 participating institutes in 41 countries who collectively operate 143 geomagnetic observatories, over three quarters of all observatories known to be operating around the world (see <http://www.intermagnet.org/institutes-eng.php>). Data collection is continuous and is managed by regional Geomagnetic Information Nodes in 5 countries. Data are forwarded from these nodes to the INTERMAGNET web site in Canada for distribution to users. INTERMAGNET supplied 0.91 million data files to users in 2013 and 1.37 million in 2014 (each file contains either one day or one month of data from a single observatory - the vast majority of requests are for 'day' files). Annual DVDs of 'definitive' data are published and available for free when processing is complete.

Single-frame snapshot from the Geomagnetic Activity Map: a movie showing H-component activity during the 2003 Halloween geomagnetic storm. See <http://www.intermagnet.org/activitymap/activitymap-eng.php>



143 observatories world-wide, operated by 59 scientific institutions



Successes and Challenges

Successes

Training Efforts: "INTERMAGNET-Compatible Digital Geomagnetic Observatory" (INDIGO)

The objective of the INDIGO project is to increase the number of INTERMAGNET-quality digital observatories around the world. As well as providing equipment and offering remote support, INTERMAGNET recently ran a training course for two observers from the Argentinian Servicio Meteorológico Nacion at the British Geological Survey's offices in Edinburgh. The Royal Observatory of Belgium also provides support to the INDIGO project.

Engagement with ICSU and/or WDS Research: "Uniting and Networking the Magnetic Community in the Northern Indian Ocean Region" (MAGNIO)

The MAGNIO project is an ICSU funded project, with the International Union of Geodesy and Geophysics (IUGG) as lead applicant. INTERMAGNET members are involved in setting this up. MAGNIO aims to establish coordination and common standards between high-quality magnetic observatories in the North Indian Ocean region and promote regional studies of geomagnetic phenomena. Much of the focus of INTERMAGNET's work is in engaging with Space Weather researchers and making data products that are useful in this community, which is relevant to the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP). INTERMAGNET has an arrangement to supply data in real-time to support the work of the International Service for Geomagnetic Indices (ISGI).

Ongoing Scientific and Technological Developments

- High-resolution 1-second data: INTERMAGNET is close to the launch of a new high-resolution data product. This has included creating and publishing a standard for 1-second data, preparing the infrastructure to support the new data (including a new CDF data format) and developing processes for receiving and checking the data quality. INTERMAGNET has been involved in developing specifications for instrumentation that will meet user requirements in this area.
- INTERMAGNET has encouraged its participating observatories to submit 1-second data even though they may not yet conform to the new 1-second data standard. This is to support our users who work in Space Weather hazards. One of the beneficiaries of this work is the National Aeronautics and Space Administration (NASA) THEMIS satellite mission.
- Quasi-definitive data: INTERMAGNET has defined a data product called quasi-definitive data that is designed to allow users early access to data of high quality, but before it has been corrected to final standards. Quasi-definitive data can be available within days or weeks of acquisition, whereas "final" definitive data may take a year or more to complete. One of the beneficiaries of this work is the European Space Agency (ESA) SWARM satellite mission.
- INTERMAGNET has designed an interactive geomagnetic activity map, available on its website: <http://www.intermagnet.org/activitymap/activitymap-eng.php>

Challenges

Data Types and Distribution

- 1-second definitive data: At present, INTERMAGNET regularly produces 1-minute definitive data. We expect to make substantial progress towards regular production of 1-second definitive data, taking account of technological developments that enable instrumentation and data acquisition.
- Real-time data distribution: INTERMAGNET expects to continue progress towards its goal of collecting and distributing real-time data to users. Our present infrastructure allows data to be distributed, at best, within 20 minutes of recording. We hope to improve this to 2 minutes (for 1-minute resolution data) and 30 seconds (for 1-second data).
- Additional customers: INTERMAGNET is in active discussion with the European Plate Observing System (EPOS) and expects to be making geomagnetic data available through EPOS by the conclusion of the EPOS implementation phase. EPOS is an integrated earth sciences research infrastructure approved by the European Strategy Forum on Research Infrastructures (ESFRI).

Data Standards and Management

- Design of standards: In discussion of data standards, there is often difficulty in separating idealized aspirational standards and pragmatic achievable standards. As the result of previous work on standards, INTERMAGNET expects to be able to confidently document what are achievable standards, as opposed to aspirational standards, in the future.
- DOIs: At present, INTERMAGNET data does not use persistent identifiers such as Digital Object Identifiers (DOIs). We expect to begin attaching DOIs to some of our published data within the next two years.
- Metadata: INTERMAGNET needs to do a great deal of work on how it organizes, stores and presents metadata. With funding from the EPOS project, INTERMAGNET is coordinating the creation of a metadata service for the geomagnetic community. A first version of the metadata schema has been completed and is available for comments. Work is proceeding to ensure compliance with international standards such as ISO19115.

Best Practices

General requirements

Relevant experts, active communication, open access to data

- INTERMAGNET actively seeks and includes expertise in observatory operations and data products from the members of its participating institutions, from members of related industries (e.g., instrument manufacturers), and from data customers within the scientific community.
- INTERMAGNET works closely with the International Association of Geomagnetism and Aeronomy (IAGA) and other organizations concerned with magnetic observatory operations. Whenever possible, annual INTERMAGNET meetings are held in conjunction with IAGA meetings to maximize exchange of information.
- Prior to drafting standards for new data products, the scientific community is consulted via discussion and formal surveys as to their needs and wishes, e.g., overall usefulness, allowable noise levels and timestamp accuracy.
- The INTERMAGNET website provides free distribution of all data provided by the member observatories, with the minimum delay that each participating institution is able to support.

Organizational framework

Long-term planning, oversight, formal periodic assessment

- INTERMAGNET communicates regularly with data users to promote use of INTERMAGNET data and to understand their requirements, feeding this information into the definitions of operating standards.
- INTERMAGNET holds annual 3-day meetings for review and planning, attended by an executive committee, an operations committee, and guests from the scientific community and related industries (e.g., instrument manufacturers). A report of the meeting's discussions, decisions and highlights is distributed to all member observatories.

Management of data, products, and services

Data integrity and authenticity, defined criteria for collection and evaluation

- INTERMAGNET sets mandatory standards for data measurement, processing, recording formats and transmission which must be satisfied before an observatory becomes a member of the observatory network. INTERMAGNET supports observatory operators in achieving the standards by providing technical assistance. The standards are documented and publicly available in the INTERMAGNET technical manual: <http://www.intermagnet.org/publication-software/technicalsoft-eng.php>
- The quality of processed definitive data is extensively checked and verified before release. An established series of checks are performed by the reporting institution; these checks are then repeated by one or more INTERMAGNET members not associated with the reporting institution.