

INTERMAGNET Meeting Minutes

Public Edition

07-09 September 2025

Instituto Português do Mar e da Atmosfera

Rua C do Aeroporto

1749-077 Lisboa

Portugal



Participants:

ExCon

David Boteler (DB), NRCan, Canada
Ellen Clarke (EC), BGS, UK
Gauthier Hulot (GH), IPGP, France
Andrew Lewis (AL), GA, Australia
Jürgen Matzka (JM), GFZ, Germany

Online

Kristen Lewis (KL), USGS, USA

OpsCom

Seiki Asari (SA), JMA, Kakioka Obs, Japan
Stephan Bracke (SB), IRM, Belgium
David Calp (DC), NRCan, Canada
András Csontos (AC), HUN-REN EPSS, Hungary
Simon Flower (SF), BGS, UK
Benoît Heumez (BH), IPGP, France
Shun Imajo (SI), KU, Japan
Roman Leonhardt (RL), Geosphere, Austria
Barbara Leichter (BL), Geosphere, Austria
Andrew Lewis (AL), GA, Australia
Jürgen Matzka (JM), GFZ, Germany
Tero Raita (TR), U. Oulu, Sodankylä Obs, Finland
Marcos Vinicius da Silva (MVS), GFZ, Germany
Chris Turbitt (CT), BGS, UK

Online

Kusumita Arora (KA) NGRI, India

Orsi Baillie (OB) BGS, UK
Charles Blais (CB), NRCan, Canada
Matthew Gard (MG), GA, Australia
Brendan Geels, (BG) USGS, USA
Manjula Lingala (ML) NGRI, India
Igor Mandić (IM) PMF U. Zagreb, Croatia
Virginie Maury (VM), IPGP, France
Emmanuel Nahayo (EN) SANSA, South Africa
Jan Reda, (JRD), IG PAS, Poland

Guests

Jorge Cruz, IPMA, Portugal
Sang Cheol Han, KSWC, South Korea
Cristiano Martins, UFPA, Brazil
Diogo Silva, IPMA, Portugal
Michael Vik, IGCAS
Wu CheolYun, Radar and Space Engineering Co,
South Korea

Institute Abbreviations

BCMT – Bureau Centrale de Magnétisme Terrestre, France

BGS – British Geological Survey

ESA – European Space Agency

GA – Geoscience Australia

GeoSphere – Bundesanstalt für Geologie, Geophysik, Klimatologie und Meteorologie, Austria

GFZ – GFZ Helmholtz Centre for Geosciences

HUN-REN EPSS – HUN-REN Institute of Earth Physics and Space Science, Hungary

IAGA – International Association of Geomagnetism and Aeronomy

IGCAS – Institute of Geophysics of the Czech Academy of Sciences

IoG PAS – Institute of Geophysics, Polish Academy of Science

IPGP – Institut de Physique du Globe de Paris, France

IPMA – Instituto Português do Mar e da Atmosfera, Portugal

IRM – Institut Royal Météorologique, Belgium

JMA – Japan Meteorological Agency

KSWC- Korean Space Weather Centre

KU – Kyoto University, Japan

NGRI – National Geophysical Research Institute, India

NRCan – Natural Resources Canada

SGO – Sodankylä Geophysical Observatory, Finland

PMF – Faculty of Science, University of Zagreb, Croatia

UFPA – Federal University of Pará, Instituto de Geociencias, Brazil

USGS – United States Geological Survey

Table of contents

1	Preliminaries.....	8
1.1	Meeting format	8
1.2	Welcome and Introductions	8
2	Committee structure and membership	8
2.1	Changes to membership.....	9
2.1.1	New Members.....	9
2.1.2	Resignations.....	9
2.1.3	Impending Retirements	9
2.1.4	Management Team and OpsCom membership status	9
2.1.4.1	Management team.....	9
2.1.4.2	OpsCom Members.....	9
2.2	Executive Council (ExCon).....	10
2.3	Operations Committee (OpsCom)	10
3	Agenda, minutes and guests	10
3.1	Agenda.....	10
3.2	Approval of minutes from November 2024 meeting in Rio de Janeiro	10
3.3	Presentation of guests and new members.....	11
4	Plenary discussions and presentations.....	11
4.1	Certificates of appreciation	11
4.1.1	Former chairs	11
4.1.2	Current and recent data checkers.....	11
4.2	ESA Scout NanoMagsat Mission and Beyond (GH).....	11
4.3	Realtime data (SF).....	12
4.4	Geomagnetic Activity Viewer (SF)	13
4.5	MARTAS and MQTT (RL).....	13

4.6	Data quality (MVS).....	13
4.7	Variometer data (DB).....	14
4.8	Expansion of OpsCom membership.....	15
4.9	IAGA Resolution (GH).....	16
4.10	Mailing Lists.....	16
5	Plenary action items from Rio De Janeiro meeting November 2024.....	16
5.1	Secretary correspondence.....	17
6	Next meeting.....	17
7	Closing.....	18
8	Plenary decisions and action items.....	18
8.1	Decisions.....	18
8.2	Action items.....	18
9	Executive Council.....	20
9.1	Meeting overview and participants.....	20
9.2	INTERMAGNET OpsCom membership.....	20
9.2.1	Communications.....	21
9.3	Update on USGS operations.....	21
9.4	DOI and INTERMAGNET datasets.....	21
9.5	Russian Federation Observatories.....	21
9.6	Variometers - current practices within INTERMAGNET institutes.....	22
9.7	Other business.....	23
9.8	ExCon decisions and action items.....	23
9.8.1	Decisions.....	23
9.8.2	Action items.....	23
10	Definitive Data sub-committee.....	24
10.1	Meeting overview.....	24

10.2	Participants (in situ and online).....	24
10.3	Agenda.....	24
10.4	2024 Action Items Review from Rio meeting	24
10.5	1-Minute Definitive Data Report.....	25
10.5.1	Data Checkers	26
10.6	1-Second Definitive Data Report	26
10.6.1	Data Submission and Processing Workflow	26
10.6.2	IMBOT Automatic Review System:.....	26
10.6.3	Software Support:	26
10.7	Data Checking and Quality Control.....	26
10.8	K Value Determination for IAF Files.....	27
10.9	Discussion on Updating Data Formats	27
10.10	Notifications, Certificates, and Official Correspondence.....	27
10.11	Definitive Data decisions and action items	28
10.11.1	Action Items	28
10.12	Core Concepts and Terminology.....	28
10.13	Conclusion	29
11	GINs Sub-committee	30
11.1	Participants	30
11.1.1	Others mentioned in this report.....	30
11.2	Agenda.....	30
11.3	Review of action items from previous meetings.....	30
11.3.1	Issues on GitHub.....	30
11.3.2	Actions from the INTERMAGNET Rio meeting (November 2024)	30
11.4	Progress with use of Seedlink for inter-GIN data transport (Canada, US)	31
11.4.1	Canadian GIN (CB)	31

11.4.2	US GIN (BG).....	31
11.5	Progress with use of MQTT for inter-GIN data transport (France, Japan)	32
11.5.1	French GIN (VM).....	32
11.5.2	Japanese GIN (SI).....	32
11.6	Use of MQTT for faster transport of data from observatories	32
11.7	Other discussions.....	32
11.7.1	The INTERMAGNET data portal.....	32
11.8	GINS decisions and action items	33
11.8.1	Action items.....	33
12	IMO Applications and Standards Sub-committee.....	34
12.1	Participants	34
12.2	Agenda.....	34
12.3	Sub-committee membership	34
12.4	IMO action Items from the November 2024 meeting	34
12.5	IMO Applications	35
12.5.1	REU (Reunion Island)	35
12.6	Prospective IMOs.....	35
12.7	Russian Federation Observatories.....	35
12.8	Ukrainian Observatories.....	35
12.9	IMOs currently listed as non-compliant.....	35
12.10	Other IMOs of concern	35
12.10.1	Status of USGS observatories.....	35
12.11	Resolved since last meeting	36
12.12	Referral of problematic IMOs from data checkers	36
12.13	Other Business	36
12.13.1	Geodetic Reference Datum	36

12.13.2	Update to IMO application form - BGS data policy	37
12.13.3	Review of IMO Subcommittee use of Git for meeting organisation	38
12.14	IMO decisions and action items.....	38
12.14.1	Decisions.....	38
12.14.2	IMO action items from the September 2025 meeting.....	38
13	Technical Manual Sub-committee	39
13.1	Participants	39
13.2	Agenda.....	39
13.3	Action items from November 2024 Rio meeting.....	39
13.4	Keeping different information sources in-sync.....	40
13.5	Define UVZ variometer orientation	40
13.6	Need for more info on how to produce INTERMAGNET 1 sec data	41
13.7	Reduce disk space usage of the www.intermagnet.org repository	42
13.8	Release Planning.....	42
13.9	Next Release: 5.3.0	42
13.10	Not handled during this meeting	42
13.11	TM decisions and action items	42
13.11.1	Action items	42
14	Appendix	44
14.1	Meeting agenda.....	44
14.1.1	Sunday 2025-09-07 (11:00 - 15:00 UT) (Members only).....	44
14.1.2	Monday 2025-09-08 (09:00 to 18:00 UT) (Members and Guests).....	44
14.1.3	Tuesday 2025-09-09 (09:00 to 16:00 UT) (Members and Guests).....	45

INTERMAGNET Meeting Minutes

Throughout these minutes, references to subcommittees and committee members are identified using the abbreviations shown in section 2 below and initials included in the list of participants.

This public edition of the minutes has been edited to remove some material relating to individuals, observatories or institutes.

1 Preliminaries

1.1 Meeting format

This was primarily a face-to-face meeting with some participants online. The meeting was held in the offices of the Instituto Português do Mar e da Atmosfera. IPMA provided three meeting rooms for plenary and sub-committee discussions as well as audio-visual, internet and online facilities. IPMA provided morning and afternoon teas. Lunches were arranged at the IPMA staff cafeteria. This meeting followed the IAGA/IASPEI Joint Scientific Meeting held at the Instituto Superior de Engenharia de Lisboa (ISEL), 31 August – 05 September in Lisbon.

Audio recordings of some sessions were made to assist in preparation of minutes. Some sub-committees have online issue tracking on GitHub to allow discussions to take place before and after the meeting.

<https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues>

<https://github.com/INTERMAGNET/wg-definitive-data/issues>

<https://github.com/INTERMAGNET/wg-tech-man/>

1.2 Welcome and Introductions

The meeting was officially opened by Maria Ana Martins, Deputy Director of IPMA who welcomed participants. DB thanked IPMA for hosting the meeting and congratulated IPMA on their geomagnetic monitoring program. Participants, online participants and guests introduced themselves. Guest and new member introductions are summarised in section 3.3

2 Committee structure and membership

The subcommittee structure has remained unchanged since the previous meeting. The Instrument and Data Acquisition subcommittee remains dormant for now but may be reconvened in the future in relation to ongoing discussion on variometer instrumentation and data.

2.1 Changes to membership

2.1.1 New Members

All members of the data check team are now considered as OpsCom members. Barbara Leichter, Emmanuel Nahayo, Igor Mandić, Kusumita Arora, Manjula Lingala, András Csontos and Orsi Baillie participated in this meeting as members for the first time. Most were assigned subcommittee responsibilities which are included in section 2.3.

2.1.2 Resignations

Kristina Rossavik (USGS) and Margaret Pueringer (USGS) resigned from the committee before this meeting.

2.1.3 Impending Retirements

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

There are no immediate retirements to announce.

2.1.4 Management Team and OpsCom membership status

2.1.4.1 Management team

The management team was established during the previous meeting to facilitate day to day management and operations during meetings. The team consists of all chairs (of ExCon, OpsCom and sub committees) and secretaries and meets each day during INTERMAGNET meetings to review the progress of the meeting and adjust plans as required.

2.1.4.2 OpsCom Members

In August 2024, a letter was sent to all members of the data checking team to invite them to join in the new role of “OpsCom member”. OpsCom members can participate in INTERMAGNET meetings, access all documentation and are encouraged to contribute to activities. From August 2024, all data checkers have been considered as OpsCom members.

Following the announcement, there was some ambiguity in membership status and some data checkers expressed uncertainty on the new role. The definitive data subcommittee accepted most of the new data checker OpsCom members and all but two of the data checking team are now allocated to subcommittees. Barbara Leichter is still considering her involvement and Hiroaki Toh previously resigned from his subcommittee membership.

In August 2024 a letter was sent to INTERMAGNET institutes inviting nominations for new Opscom members. Three nominations were received and two have been accepted into the subcommittees. Previously, the term “INTERMAGNET officer” was used for members of the subcommittees. The term INTERMAGNET officer is now deprecated and the terms “chair” and “subcommittee member” are used for active members of the subcommittees. “OpsCom member” is used for the new class of member as described above.

Subcommittee chairs can continue to nominate new members of their subcommittee. All new subcommittee members require formal endorsement from ExCon.

Subcommittees can decide to hold private sessions during meetings (without guests) either as a single subcommittee or with other subcommittees.

Further discussions may be required to clarify roles and processes.

2.2 Executive Council (ExCon)

David Boteler*
Ellen Clarke
Gauthier Hulot
Kristen Lewis
Andrew Lewis
Jürgen Matzka

2.3 Operations Committee (OpsCom)

Chair Jürgen Matzka*
Secretary Andrew Lewis

Sub-committees (at the conclusion of the meeting)

Definitive Data (DD)	Geomagnetic Information Nodes (GINS)	IMO Applications and Standards (IMO)	Technical Manual (TM)	Instruments and Data Acquisition (IDA)
Jan Reda*	Simon Flower*	Chris Turbitt*	Stephan Bracke*	
Roman Leonhardt*	Brendan Geels	Andrew Lewis^	András Csontos	
Benoît Heumez^	Charles Blais	Benoît Heumez	Andrew Lewis	
Emmanuel Nahayo	Shun Imajo	David Calp	Chris Turbitt^	
Igor Mandić	Stephan Bracke	Jürgen Matzka	Seiki Asari	
Kusumita Arora	Virginie Maury	Matthew Gard		
Manjula Lingala		Tero Raita		
Marcos Vinicius da Silva				
Matthew Gard				
Orsi Baillie				
Simon Flower				
Tero Raita				

* Chair or Co-Chair of council/committee/sub-committee; ^ Deputy Chair of sub-committee

3 Agenda, minutes and guests

3.1 Agenda

The main agenda for the meeting was presented by JM during plenary and is available in section 14.1. There were no additional items suggested for the agenda. Sub-committee chairs presented agendas for their meetings. Details are included in sections 9 to 13.

3.2 Approval of minutes from November 2024 meeting in Rio de Janeiro

Minutes from the previous meeting held in November 2024 were published in June 2025. The process of publication included review and acceptance of those minutes by committee members so further approval was not required during this meeting.

3.3 Presentation of guests and new members

- Barbara Leichter, GeoSphere, Austria, data checker
- Cristiano Martins, UFPA, Instituto de Geociencias, Brazil, magnetic observatory data.
- Diogo Silva, IPMA, magnetic observatory support and support for this meeting
- Igor Mandić, PMF U. Zagreb Croatia, data preparation, data checker and member of DD
- Jorge Cruz. IPMA, magnetic observatory data preparation and support for this meeting
- Manjula Lingala, NGRI, Choutuppal observatory data processor and data checker
- Matthew Gard, GA, data checker and member of IMO and DD
- Michael Vik, IGCAS, Budkov observatory data acquisition systems and data preparation.
- Orsi Baillie, BGS, Data processor and data checker
- Sang Cheol Han, KSWC, Jeju magnetic observatory
- Wu Cheol Yun, Radar and Space Engineering Co., Jeju magnetic observatory

Not all guests and new members were present or online at the time .

4 Plenary discussions and presentations

4.1 Certificates of appreciation

DB presented certificates of appreciation to former subcommittee members, chairs, current and recent data checkers.

4.1.1 Former chairs

Simon Flower. Chair of OpsCom 2016 – 2024; Alan Thomson, Chair of ExCon 2014 – 2022; Benoit St-Louis, Chair of TM 1995 – 2023; Charles Blais, Chair of GWD 2017 – 2023

4.1.2 Current and recent data checkers

Tero Raita, 2013 - present ; Seiki Asari, 2019 - present ; Marcos Vinicius da Silva, 2025 - present ; Ellen Clarke, 2005 – 2020; Benoit Heumez, 2010 - present; BL 2025 - present ; Andrew Lewis, 2005 - present ; David Calp, 2011 - present ; Orsi Baillie, 2021 - present ; Matthew Gard, 2021 – present; Manjula Lingala 2025 - present; Kusumita Aurora 2018 - present; Jan Reda, 2005 - present; Igor Mandić 2023 - present; Emmanuel Nahayo 2022 - present

4.2 ESA Scout NanoMagsat Mission and Beyond (GH)

Details, plans and progress on the NanoMagSat mission and future directions
https://intermagnet.org/meetings/2025-Lisbon/Hulot_NanoMagSat_2025.pdf

ESA Scout NanoMagsat mission is a consortium led by Open Cosmos, a UK company, with the science and payload led by IPGP together with Danish Technical University, University of Grenoble and University of Oslo. ESA are not involved in planning but will effectively purchase data from the consortium, monitor and oversee operations.

Like magnetic observatories, monitoring the magnetic field from space requires continuous long-term monitoring to capture the full range of information from the core, lithosphere, oceans, ionosphere and magnetosphere with signals from thousands of nanoTesla down to fractions of nT on time scales from

years to sub-second. NanoMagSat mission planning commenced in 2020 and is designed to continue the work of the Swarm satellites which have been operating successfully since 2013.

The NanoMagSat mission is a constellation three 16U nanosatellites (200 x 200 x 400 mm), one in a polar orbit and two in 60-degree inclined orbits to provide global spatial and local time coverage every 30 days. Each satellite will have a 3-metre-long boom carrying two star cameras and an absolute scalar magnetometer capable of measuring the vector field using coils, a high frequency vector magnetometer, a Langmuir probe and two GNSS antennas. Launch is planned for 2027 and 2028.

Beyond the Swarm and NanoMagSat missions there is a need to coordinate satellite missions to ensure continued availability of data and IAGA approved a resolution during the recent Lisbon meeting to encourage cooperation and co-ordination for future missions.

4.3 Realtime data (SF)

Progress on data transmission protocols between GINs and IMOs

https://intermagnet.org/meetings/2025-Lisbon/Flower_RealTimeDataInIntermagnet.pptx

For many years, real time data deliveries to INTERMAGNET have used web services and email from IMOs to GINs and the rsync utility for data transfers between the GINs and the data archive.

In 2024 it was agreed to transition to two alternative transport protocols for data transfers between the GINs and the data archive in Edinburgh. SeedLink is already in use for transfers between IMOs and the Golden and Ottawa GIN and will be used for transfers between those GINs and the data archive.

Message Queue Telemetry Transport, MQTT, will be used for data transfers from Paris and Kyoto to the data archive. MQTT will also be available for transfers direct from IMOs to Paris, Kyoto and Edinburgh.

The Edinburgh GIN can now accept data via both seedLink and MQTT. The seedLink connection between the Ottawa GIN and Edinburgh is complete. There remains a small amount of work to implement seedLink at the Golden GIN. The Kyoto GIN is working to implement MQTT data transfer which may be complete before the end of 2025. There is a larger project to redesign and rebuild the Paris GIN which will take some time yet. Replacing rsync data transfers is on target for the end of 2026.

There are six IMOs delivering data to Edinburgh directly via MQTT.

Rapid data transfers are possible using seedLink and MQTT but IMOs must be encouraged to speed up their data transfers which may be possible even using their existing systems without adopting the new protocols.

Tools to monitor real time performance on the network have been developed at the Edinburgh GIN and are now available as a web service. Data lag is measured every minute for every IMO and collated in configurable bins from 1 minute to greater than three days. The data lag measurement may be improved in the future. Many observatories deliver data every hour. The INTERMAGNET requirement is for data to be delivered with a lag no greater than three days. The data lag statistics, as currently configured, do not distinguish between different data types. The data embargo periods required by some institutes are not included in the data lag statistics.

Moving data from the IMOs to the GINs and from the GINs to the data archive is important, but more important is providing data from the data archive to data users. Currently, users access the data via a web service but there are better ways that should be explored to allow INTERMAGNET to empower the user community to access and use data.

DB agreed the real-time statistics are a very useful tool.

TR noted there was a service break at the Edinburgh GIN in August 2025 which has influenced recent data lag time statistics.

GH commented that two factors affect data lag, the first are technical issues and the second is the INTERMAGNET policy and suggested a consideration of the INTERMAGNET policy requiring data deliveries within 3 days of data acquisition could have a strong influence on reducing data lag times.

4.4 Geomagnetic Activity Viewer (SF)

An example third party application using INTERMAGNET data

https://intermagnet.org/meetings/2025-Lisbon/Flower_GeomagneticActivityViewer.pptx

When the INTERMAGNET data archive was hosted in Ottawa, the Geomagnetic Activity Viewer application was a useful and popular tool for data users. That tool was not ported when the archive transferred from Ottawa to Edinburgh. A new tool has been developed by BGS which accesses data from both the INTERMAGNET archive and the Edinburgh World Data Centre. Both these data sources support the Heliospheric Data Application Programmer's Interface (HAPI) for data access, and the tool uses HAPI to access data.

The new tool was developed by BGS, not by INTERMAGNET, and is a good example of how third parties can develop systems which access INTERMAGNET data using new data access protocols.

The tool uses minute-value data to calculate and display rate-of-change of the geomagnetic field. Data availability information is also available through the tool. This new application does not present the activity data as a map and is not yet available for external use.

DB suggested the map was particularly useful for space weather forecasting and should be re-developed as an INTERMAGNET product. As an internal INTERMAGNET product, the original Geomagnetic Activity Viewer had agreement to circumvent the data embargo agreements required by some institutes. Any third-party application will have the issue of data embargoes if the application requires real-time data. JM thanked SF and the work done by BGS hosting INTERMAGNET data and developing tools such as this new activity viewer.

4.5 MARTAS and MQTT (RL)

A versatile python data acquisition and MQTT transmission tool

<https://github.com/geomagpy/MARTAS>

In the Rio meeting there was some discussion on providing a simple tool to enable MQTT for every IMO. MARTAS is a data acquisition python software package which can run on many devices to simplify communication between sensors using serial communications and convert data to an MQTT data stream. MARTAS is currently used at Conrad observatory, variometer stations and commercial projects within the Austrian power grid.

MARTAS accesses data from a wide range of sensor and also files or databases and sends data via MQTT at regular intervals or when new data become available.

MARTAS is available on github and is currently under development.

4.6 Data quality (MVS)

Assessing long-term data quality by comparing measured secular variation against modelled data

https://intermagnet.org/meetings/2025-Lisbon/daSilva_ImprovedDataChecking.pptx

IMO secular variation is calculated from annual difference of monthly means which are corrected for modelled magnetospheric field contributions by removing the ring current contribution. These data are

compared against the core field calculated from the CHAOS model. Good data compares very well against the modelled data.

Data with problems is highlighted by differences or jumps when compared to the modelled data. It is important to confirm problem data against neighbouring observatories to identify if the cause of problems originates at IMO or in the modelled data.

JM commented that this is a powerful tool to check data quality and identify data within INTERMAGNET which do not meet user expectation.

GH emphasised the procedure is actually a data comparison rather than a data check and differences in results between the IMO data and the model could originate from problems in either the IMO or the model. The comparisons could be made more robust by using more than one model.

EN confirmed that external contributions are removed from the secular variation data.

4.7 Variometer data (DB)

Discussion during two plenary sessions on the merits and issues for INTERMAGNET to accept and distribute variometer data

Space weather studies require geomagnetic time-series data, but data calibrated to absolute values such as supplied by INTERMAGNET IMOs are not necessary, only variometer data are required. There are occasions when IMOs cannot provide absolute data, and those data are not currently accepted by INTERMAGNET. Additionally, some institutes already operating IMOs are also building variometer stations or variometer networks.

SuperMAG (<https://supermag.jhuapl.edu>) provides a variometer data repository but credit for data is sometimes attributed to SuperMAG rather than the institutes collecting the data. Apart from SuperMAG, there is no obvious place to deposit data from variometer stations where it can be easily discoverable. Perhaps INTERMAGNET could start accepting variometer data from existing INTERMAGNET institutes.

If INTERMAGNET were to provide variometer data, it would raise the profile amongst the space weather community.

Standards for data and instrumentation will be required and additional work needed to ensure data meet the standards. Additional work will also be needed to manage and distribute variometer data. EC noted that software within INTERMAGNET is designed for absolute data and it could be difficult to adapt for variometer data in terms of orientation conversion.

SF notes that all but 5 IMOs provide baseline corrected reported quality data.

JM says GFZ runs variometers and applies a pseudo-baseline to treat the data like an observatory.

GH suggested a starting point for INTERMAGNET to accept variometer data is to accept data only from existing IMO institutes already in INTERMAGNET.

There are a wide range of issues to be considered, including but not limited to:

- A variation station can range from observatory quality instruments down to lower quality instruments
- Temperature stability is desirable, should it be required and measured?
- Is it better to have many lower quality sites or a smaller number of higher quality sites
- Real-time data transmissions are required for space weather studies – should that be included in the variometer standard?
- Is a new naming convention required, perhaps a four-letter code?
- Are baselines necessary in the variation data?

A comprehensive matrix of science application and requirements for variometer data is required to identify issues and then define requirements and standards.

JM noted that Norway has good experience on running variometer stations and maintains a data portal for variometer data (<https://flux.phys.uit.no>). Some institutes establish variometer stations using observatory grade instrument and high-quality installations, while others are using lower grade instruments and installations. JM prefers a smaller number of high-quality variometers rather than a large number of low-quality stations.

RL noted that IAGA issue three-letter codes and JM called for a detailed technical discussion from the people who are involved on whether 3 or 4 letter codes are adopted.

AL noted four letter codes could cause issues with standard files names and meta-data.

CT asked about clearly delineating between variometer and observatory datasets because many data users do not appreciate the differences between an observatory and a variometer station. The INTERMAGNET data set currently comprises homogenous, high quality, peer-reviewed observatory data and mixing variometer data into that dataset will cause issues and complications, not least that INTERMAGNET's reputation for high quality observatory data could be devalued. One option would be to maintain and distribute variometer datasets as completely different and separate class of data. DB agreed that variometer data must be stored and distributed as a different data type and suggested there must be very clear distinction between variation and observatory data. Different station naming convention would assist with that and suggested we could have a separate portal for distributing variometer data.

SF suggested, and GH supported, a working group is the best way to examine all the issues and suggest a way forward, including needs, requirements, consequences and other issues. The group should aim to present findings at the next face to face meeting.

Volunteers for the working group included DB, BH, DC, JM. A chair for the group will be identified, and new members will be invited as required.

BH cited the example of data from Easter Island which is a good quality installation but only has absolute observations once every few months, hence it is no longer a member of INTERMAGNET and the data are not available. BH re-iterated the idea of a two-tier system, IMO and IMS (INTERMAGNET Magnetic Station). JM presented the similar example for Tristan de Cunha observatory where absolute observations were not available for 12 months. Definitive and quasi-definitive data were not submitted but reported data submissions were provided and there were no comments from INTERMAGNET.

CT noted there are multiple reasons for removing an IMO from INTERMAGNET and under current guidelines it takes several years. INTERMAGNET can allow for retention of IMOs in the network under special circumstances where there is a temporary hiatus in absolute observations with good intention of resuming regular observations in the near future.

JM believes a two-tier system is the way forward where observatory and variometer data are clearly delineated in the data set. INTERMAGNET should represent the interests of the observatories and the users. Removing good data does not make anyone happy. GFZ delivers variometer data to Tromsø Geophysical observatory data delivery portal.

4.8 Expansion of OpsCom membership

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

Institutes already contributing to INTERMAGNET are the best source of prospective new members for the subcommittees. INTERMAGNET will make direct person-to-person approaches, where possible, to gauge interest for membership to the committee.

4.9 IAGA Resolution (GH)

GH reported on the IAGA resolution which he proposed and was accepted at the recent IAGA joint scientific meeting in Lisbon, resolution No. 1 (2025) (<https://www.iaga-aiga.org/resolutions>). The resolution encourages co-ordination of geomagnetic operations in space, much as INTERMAGNET coordinates ground observatory operations. GH presented and explained the details to the committee. IAGA is the official representative of the international geomagnetic science community so resolutions are a valuable resource which can be cited as the official view of the community.

4.10 Mailing Lists

GFZ runs four INTERMAGNET mailing lists on behalf of INTERMAGNET. Two of those lists are working well, intermagnet_imocontact@listserv.dfn.de and intermagnet_worldobs@listserv.dfn.de, but intermagnet_opscom@listserv.dfn.de and intermagnet_excon@listserv.dfn.de have problems. A new mailing list tool is required.

RL suggested that BREVO is an effective email tool used within the GIC community. It is free and provides a large degree of protection of personal data. JM urged INTERMAGNET to adopt BREVO to manage the “excon” and “opscom” mailing lists. The “imocontact” and “worldobs” lists can remain unchanged for now as they are working. Everyone should give consideration to other suitable collaboration tools, noting the success of GitHub which is being used by the subcommittees. (However, at the time of writing, tests of the BREVO mailing list tool indicate that this might not be a suitable solution).

5 Plenary action items from Rio De Janeiro meeting November 2024

Action	Responsible	Description	Status
Rio24 P.A01	chairs/secretary	Complete sub-committee reports, decision logs and action item list by 6 weeks after completion of the meeting	Done
Rio24 P.A02	Chairs	Supply a report on sub-committee activities for inclusion in the “Report to IMOs” by 6 weeks after completion of the meeting	Done
Rio24 P.A03	OpsCom Secretary	Complete a report to IMOs and distribute to IMOContacts, WorldObs and the INTERMAGNET web site by 12 weeks after completion of the meeting	Done
Rio24 P.A04	OpsCom secretary	Complete draft minutes, including reports from sub-committees by 12 weeks after completion of the meeting	Done
Rio24 P.A05	committee members	Review the draft minutes within 14 weeks after meeting	Done
Rio24 P.A06	OpsCom secretary	Complete corrections and amendments to the minutes with 16 weeks	Done
Rio24 P.A07	OpsCom secretary /OpsCom chair	Review minutes for publication	Done
Rio24 P.A08	committee members	Review draft “public” minutes	Done

Rio24 P.A09	OpsCom secretary	Upload minutes to INTERMAGNET document archive, publish the “public” minutes on INTERMAGNET web site and notify IMO-Contacts before the next scheduled meeting or no later than 24 weeks after completion of the meeting.	Done
Rio24 P.A10	Chairs	As necessary, arrange an online sub-committee meeting or document meeting before the next face to face meeting	Done at chairs discretion
Rio24 P.A11	OpsCom chair	Request committee members for agenda items for inclusion at the next meeting and request chairs to create sub-committee agendas	Done
Rio24 P.A12	OpsCom chair	Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET’s communication with community	Done
Rio24 P.A13	OpsCom chair	Publish draft agendas 2 weeks before the next INTERMAGNET meeting	Done
Rio24 P.A14	JM	Investigate use of INTERMAGNET data in publication using DOI statistics	Done
Rio24 P.A15	AL	Include an item in the report to IMOs from this meeting to request IMOs submit 1-second QD data where possible	Done
Rio24 P.A16	ExCon	Discuss appropriate recognition for individual IMOs to acknowledge their contributions to INTERMAGNET (associated with DD letters for definitive data and acknowledgement in publications)	Done

5.1 Secretary correspondence

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

Throughout the period November 2024 to September 2025, correspondence received by the secretary on behalf of INTERMAGNET included:

- Two publications using INTERMAGNET data, as per the INTERMAGNET data conditions of use: Leonid F. Chernogor, Marya Yu. Holub, Geomagnetic effect of the solar eclipse of April 8, 2024, in the North American sector, [Advances in Space Research, Volume 75, Issue 3](#), 1 February 2025, Pages 3133–3149, <https://doi.org/10.1016/j.asr.2024.11.002>

New Late Cretaceous and CAMP Magmatic Sources off West Iberia, From High-Resolution Magnetic Surveys on the Continental Shelf
<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022TC007637>

6 Next meeting

The next face-to-face meeting will be in held during October 2026 at the Kyoto World Data Centre, Kyoto University, Japan over three days from Wednesday 21 to Friday 23 October with an option to

extend into Saturday 24 October. The XXI IAGA geomagnetism workshop at Kakioka will immediately follow the meeting.

7 Closing

DB thanked IPMA for hosting the meeting and JM for organising and chairing the meeting.

8 Plenary decisions and action items

8.1 Decisions

Number	Description
Lisbon25 P.D01	All IMO data submitted to INTERMAGNET should be baseline corrected
Lisbon25 P.D02	The next meeting will be held at Kyoto University, Japan 21-23 October 2026

8.2 Action items

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

Some action Items considered in plenary sessions have been captured within the council and sub-committee action items in the sections below. Those actions items not fully included in the council and sub-committees lists are included here.

Action	Responsible	Description
Lisbon25 P.A01	Chairs/secretary	Complete sub-committee reports, decision logs and action item list by 6 weeks after completion of the meeting
Lisbon25 P.A02	Chairs	Supply a report on sub-committee activities for inclusion in the “Report to IMOs” by 6 weeks after completion of the meeting
Lisbon25 P.A03	OpsCom Secretary	Complete a report to IMOs and distribute to IMOContacts, WorldObs and the INTERMAGNET web site by 12 weeks after completion of the meeting
Lisbon25 P.A04	OpsCom secretary	Complete draft minutes, including reports from sub-committees by 12 weeks after completion of the meeting
Lisbon25 P.A05	committee members	Review the draft minutes within 14 weeks after meeting
Lisbon25 P.A06	OpsCom secretary	Complete corrections and amendments to the minutes with 16 weeks
Lisbon25 P.A07	OpsCom secretary /OpsCom chair	Review minutes for publication
Lisbon25 P.A08	committee members	Review draft “public” minutes
Lisbon25 P.A09	OpsCom secretary	Upload minutes to INTERMAGNET document archive, publish the “public” minutes on INTERMAGNET web site and notify IMO-Contacts before the next scheduled meeting or no later than 24 weeks after completion of the meeting.

Lisbon25 P.A10	Chairs	As necessary, arrange an online sub-committee meeting or document meeting before the next face to face meeting
Lisbon25 P.A11	OpsCom chair	Request committee members for agenda items for inclusion at the next meeting and request chairs to create sub-committee agendas
Lisbon25 P.A12	OpsCom chair	Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET’s communication with community
Lisbon25 P.A13	OpsCom chair	Publish draft agendas 2 weeks before the next INTERMAGNET meeting
Lisbon25 P.A14	AL	Include an item in the report to IMOs from this meeting to request all IMOs submit “adjusted” quality baseline corrected data to the GINs
Lisbon25 P.A15	DB, JM, BH, DC	Establish a working group on variometer data, select a chair and other members. Report findings at the next face-to-face meeting
Lisbon25 P.A16		
Lisbon25 P.A17		
Lisbon25 P.A18		
Lisbon25 P.A19		
Lisbon25 P.A20		
Lisbon25 P.A21		
Lisbon25 P.A22		

9 Executive Council

9.1 Meeting overview and participants

Two ExCon meetings were held in person, one on 09 September and one on 10 September. David Boteler (Chair), Ellen Clarke, Gauthier Hulot, Kristen Lewis (online), Jürgen Matzka, Andrew Lewis.

9.2 INTERMAGNET OpsCom membership

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

The changes and expansion of OpsCom memberships have developed well since the last meeting and now all members of the data checker team have the automatic option to become OpsCom members but there is no obligation on data checkers to contribute to OpsCom.

EC noted the need for clarification on the expectations and obligations for new members and suggested these should be recorded in writing.

It is important that ExCon continues to be included in all decisions on membership and ExCon provides final approval on all membership decisions. This has always been the case in the past but should be reiterated to remove any recent confusion. In the last year, when data checkers were first admitted to OpsCom they were accepted into sub-committees at the request of sub-committee chairs without explicit ExCon approval. Subcommittee chairs should continue to suggest and actively approach data checkers for membership to their committees, but ExCon retains the right of final approval. ExCon approval for membership changes is normally almost automatic but there have been rare examples in the past where proposals for new member have been rejected by ExCon.

Action: Prepare a written statement to communicate that all memberships, including data checkers and OpsCom nominations require ExCon approval.

DB recalled there were only two responses to the call for new OpsCom members which was distributed in August 2024 . These applications were accepted during the Rio meeting. But DB asked if there was a need for formal acceptance to the nominating institute.

Action: DB to prepare acceptance letters.

The invitation for new OpsCom members is an open invitation and rather than re-sending the invitation, a reminder should be included in the report to IMOs from this meeting.

Action: AL to include reminder about membership in report to IMOs

DB suggested a wider distribution to capture IMO institutes which do not have particularly close contact with INTERMAGNET, or making direct contact with the head or director of institutes rather than simply using the “IMO_contacts” mailing list. EC noted it would be difficult to identify the correct people and may be better to target a small number of good quality, well resourced institutes which may already be running IMOs but not otherwise contributing actively to INTERMAGNET. EC did approach specific people from two such institutes after the Rio meeting, both expressed reluctance to commit.

AL suggests the commercial instrument manufacturers as a source of new members, but it was generally considered they don't have suitable observatory experience, and their presence may raise conflict of interest issues.

DB suggested internships at well established institutes for observatory operational staff would be valuable. GH says IPGP does this already for observatories they are involved in, as does GFZ.

9.2.1 Communications

DB raised the topic of official letters of acknowledgement to institutes when definitive data are accepted. AL noted that DD are working on an automatic system to send such letters. JM noted communications are available via the mailing list to IMOs and INTERMAGNET presents at IAGA workshops and conferences.

9.3 Update on USGS operations

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

KL reported that USGS have recently lost a number of experience geomagnetism staff.

The observatory network should continue to function unchanged. The focus is now on real-time data operations with production of definitive data on hold. It will be possible to post-process definitive data once staffing levels have been restored, although it is expected there will be some ramp-up time required to train new staff. The delay in definitive data from USGS observatories may impact the Dst index but other global indices should be able to continue.

9.4 DOI and INTERMAGNET datasets

GH noted that quasi-definitive data is now the most used and sought-after data by many sections of the community and yet there is no official means to reference those data with a Digital Object Identifier.

BGS creates AUX_OBS data using quasi-definitive data for the European Space Agency. Definitive data are used primarily for the International Geomagnetic Reference Field model.

EC noted that DOIs are also required for the real-time data and GH added that any data released requires a DOI, but there are difficulties issuing DOIs for changing datasets. It is possible to have a DOI which references a web page rather than a permanent data set but this does serve the purpose for referencing and acknowledgment and does not necessarily preserve reproducibility of data and traceability of their use in publications.

The understanding of DOIs within INTERMAGNET continues to evolve with time and technology.

EC noted that BGS has not yet used DOIs for their data.

The annual INTERMAGNET definitive data does get a DOI.

DD subcommittee is best placed to provide detailed information on how INTERMAGNET works with DOIs. In future INTERMAGNET may use one DOI for a continuously expanding definitive data set. This is also done for DOIs associated with the GFZ KP index. A DOI can be minted before it is published.

A wider discussion on DOIs for additional datasets within INTERMAGNET is necessary.

9.5 Russian Federation Observatories

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

INTERMAGNET currently has no contact with any observatories in the Russian Federation, but observatory operations continue and data are being collected and made available from the Russian Academy of Sciences data centre.

9.6 Variometers - current practices within INTERMAGNET institutes

KL reported that USGS is working to establish a low-cost magnetic variometer network in collaboration with the USGS seismic network using Bartington MAG690 fluxgate magnetometers monitoring 10 Hz data aligned in the geographic reference frame.

The initial purpose was to monitor magnetic noise in the Global Seismic Network stations at high latitudes. Since then, variometers have been installed at lower latitude Advanced National Seismic System stations. At this time there are about 40 variometers on the continental United States. The installation teams work closely with the USGS geomagnetism team and ensure consistent installation standards. A publication will be forthcoming (and is published at the time of writing:

<https://doi.org/10.1785/0220250185>).

There are no specific arrangements to minimise temperature variations apart from those already available to the seismic system. In general, the variometer systems are usually in the same building as the seismometer.

The official data repository for the variometer data is EarthScope/IRIS. Data are available in real-time on the USGS website at <https://geomag.usgs.gov/plots/variometer>

DB reported that NRCAN is planning to do similar work at the Canadian seismic network and is applying for funding.

JM noted that GFZ use observatory grade instruments (FGE, LEMI, Geomag) which are installed with temperature stability in mind. Generally, GFZ do a preliminary variometer installation at sites where an observatory is proposed as a suitability test for the site. Instruments are installed in DHZ orientation, with zero bias on the east sensor. Sensors are not rotated during the lifetime of the station. Total field is not necessarily measured at the variometer stations, but temperature is stabilised where possible and measured.

AL reported that Geoscience Australia is running one variometer station on the southern coast of Australia to fill a gap in the observatory network. The site uses observatory grade instruments (FGE and GSM90) located in an underground vault. In many respects the installation is the same as an observatory except there are no regular absolute observations and there is no official IAGA three-letter code.

Temperature is monitored but not actively stabilised. Data were calibrated with an initial set of absolute observations and observations will be made on an opportunity basis, perhaps once every year or so.

The Australian space weather organisation also runs a network of magnetic variometers in addition to taking data from the GA observatory network.

EC described the three variometer stations established by the BGS for space weather monitoring which have been running for a few years. The sites were set up as low-cost installations using a LEMI magnetotelluric variometer aligned relative to the magnetic field as DHZ. The sites do record temperature.

GH reports IPGP runs a variometer network with the purpose of complementing the observatory network. The stations were established for external field studies and to augment the repeat station network. The issue of station identifications codes requires further consideration and perhaps all variometer stations should have four letters in their code.

DB suggested it is necessary to define data quality and standards to ensure variometer data are fit for purpose and GH re-iterated the importance of formally defining goals and requirements for INTERMAGNET variometer data.

EC raised the proposal of limiting INTERMAGNET variometer data to those IMO's which are no longer meeting the standards of absolute control and data quality. Real-time data availability is also very important.

JM expressed his view that an observatory must be capable of measuring secular variation and also external fields to a high accuracy while a variometer station must do all the same things as an observatory *except* measuring secular variation.

Land access, ownership and physical security is also an important consideration for permanent installations.

9.7 Other business

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

The decision was made that data checkers must be associated with an INTERMAGNET institute.

As a general principle, part-time work does not preclude an experienced committee member from continuing to contribute to INTERMAGNET.

GH suggest that meeting minutes would benefit from an executive summary.

9.8 ExCon decisions and action items

9.8.1 Decisions

Number	Description
Lisbon25 EXC-D01	All new members of OpsCom and data checkers require ExCon approval
Lisbon25 EXC-D02	Members of the data checking team must be a member of an INTERMAGNET institute

9.8.2 Action items

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

Action	Responsible	Description
Lisbon25 EXC-A01	ExCon	Prepare a written statement to communicate that all committee membership arrangements, including data checkers and OpsCom nominations, require ExCon approval.
Lisbon25 EXC-A02	DB	Prepare acceptance letters for the two nominated OpsCom members
Lisbon25 EXC-A03	AL	Include a reminder about membership nominations in the report to IMOs for this meeting.
Lisbon25 EXC-A04		
Lisbon25 EXC-A05		
Lisbon25 EXC-A06		
Lisbon25 EXC-A07		
Lisbon25 EXC-A08	ExCon	Facilitate further discussion on DOIs for additional INTERMAGNET datasets

10 Definitive Data sub-committee

10.1 Meeting overview

This document provides a comprehensive overview of the INTERMAGNET DD Subcommittee meeting scheduled for Lisbon 2025. The content covers agenda items, action item follow-ups from 2024, detailed reports on 1-minute and 1-second definitive geomagnetic data processing, data checking protocols, challenges faced by changes in the data checking team, technical discussions on data formats, and administrative matters related to notifications and certification.

10.2 Participants (in situ and online)

Andrew Lewis (AL), Benoit Heumez (BH), Charles Blais (CB), David Calp (DC), Igor Mandic (IM), Jan Reda (JRD), Jürgen Matzka (JM), Marcos Vinicius da Silva (MVS), Matthew Gard (MG), Roman Leonhardt (RL), Simon Flower (SF), Shun Imajo (SI), Stephan Bracke (SB), Tero Raita (TR), Virginie Maury (VM)

10.3 Agenda

- Approval of meeting agenda and review of outstanding action items from November 2024
- Reports on the status and progress of 1-minute and 1-second definitive geomagnetic data collection and publication
- Data checking challenges and guidelines, including a “cookbook” for data checkers.
- Issues arising from the halt of USGS definitive data production/data checking, with discussion on consequences and mitigation strategies.
- Technical discussions on:
 - K value determination methods for IAF files
 - Potential updates or creation of a new IBFV 3.00 baseline file format suitable for automatic DI measurements
 - Possible change of the 1-minute definitive data format from IAF to ImagCDF
- Matters related to official notifications, certificates, and communication following publication of definitive data
- Summary of subcommittee action items following the 2025 meeting and any other relevant business

10.4 2024 Action Items Review from Rio meeting

Number	Responsible	Description	Status
Rio24DD.A01	JRD	Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2024 by end of January 2025	Done -sent Feb 5, 2025
Rio24DD. A02	RL	Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2023 by the end of February 2025	Done -sent Feb 28, 2025
Rio24DD. A03	All, JM	Change of DOI handling: Create DOI as growing repositories for both 1min and 1sec definitive data. To be hosted at GFZ. Automatic transfer and publication time stamping. To be started as soon as possible including 2021 onwards	Ongoing
Rio24DD. A04	RL, SF, SB	Migration of 1-min definitive data from IAF to CDF formats. This is a long ongoing process to	Ongoing

		start after software to deal with CDF are available (2026?)	
Rio24DD. A05	MVS, DataCheckers	Incorrect jump signs in year mean files. Not to be corrected by IM. Asking IMOs to correct in latest file and add note in comments.	Done. Communicated?
Rio24DD. A06	DataCheckers, BH, TR	Clarify permission for data checkers to modify files, to be added into the data checkers guidelines. No changes to be made on existing files in step1. Give 4 weeks to IMOs to make change before it is made automatic	Done. The document can be added to the Manual appendices and/or sent to the Definitive data checkers along with the call for data.
Rio24DD. A07	TR, BH	Frequency of absolute S measures. Data checkers to add this parameter on check list. And communicate with IMOs to either report missing values or start performing regular measures. Only for recent data.	Ongoing. TR volunteered to make a script to detect gaps or lack of pillar measurements
Rio24DD. A08	BH,JRD, RL,EXCON	Official letter to IMOs (for def data acceptance). Manually by email for 2020. Later years made automatic using IMBOT. To be signed by Excon.	Ongoing. A template exists; an Automatic routine is being prepared
Rio24DD. A09	Excon	Certificate for Data Checkers	Done. Presented during Lisbon meeting
Rio24DD.A10		Update Technical Manual - Data checking 1-minute	Ongoing. Requires the publication of the IMBOT article and 1-min cookbook (both items will be presented)
Rio24DD.A11	MG, RL, SB	Development of a new version IBFV base line format to account for manual and automatic measurements	Ongoing. Suggestions on IBFV will be presented and discussed

10.5 1-Minute Definitive Data Report

- Current focus on archival completeness and migration to GFZ architecture (at the time of writing, the migration to GFZ is canceled and instead a solution is implemented at Paris GIN).
- Consideration of processing steps and necessity of current workflows.
- Replacement of the existing FTP connection at Paris GIN with more secure protocols (SFTP).
- Communication issues between step 2 and step 3 of data processing under review.

10.5.1 Data Checkers

Observer	Observatories Covered
Andrew Lewis	BRD, EBR, FUR, JCO, MAB, NGK, PIL, PST, SUA, VAL, VSS
Matthew Gard	GCK, IRT, KIV, KMH, PAG, PEG, PPT, SBL, SJG
Benoit Heumez	BOU, BRW, BSL, CMO, DED, FRD, FRN, GUA, IQA, NEW, SFS, SHU
David Calp	API, ASP, CSY, CTA, EYR, GDH, KDU, LRM, MAW, TDC, THL
Kusumita Arora	ESK, FCC, HAD, KHB, MMB, SPG, TSU
Emmanuel Nahayo	ARS, CKI, CPL, HUA, KEP, TAM, VOS, YAK
Igor Mandic	AIA, BEL, GUI, HLP, LVV, STT, WIC
Orsi Baillie	HBK, TUC, SIT, VIC
Claudia Rossavik	CLF, DLT, KAK, KOU, MCQ, NAQ, SHE, WNG
Marcos Vinicius da Silva	ABG, BDV, GNG, NCK, SBA
Hiroaki Toh	BMT, HER, HYB, LON, LYC, MGD, NVS, VNA
Seiki Asari	ABK, ASC, BLC, BOX, CBB, HRN, NUR, PET, SOD, TTB
Barbara Leichter	HON, KIR, PHU
Jan Reda	BFO, DOU, DUR, HRB, IZN, MEA, OTT, RES, SPT, STJ, THY
Tero Raita	CNB, CYG, GAN, JAI, KNY, LER, ORC, UPS, YKC

10.6 1-Second Definitive Data Report

10.6.1 Data Submission and Processing Workflow

Step	Description
Step 1	Data providers submit data to Paris GIN; IMBOT reviews data automatically, converts to ImagCDF 1.3/1.3.1, assigns quality levels (0-2).
Step 2	Data checker manually reviews Step 1 accepted data (levels 1 and 2), provides summary reports and acceptance decisions.
Step 3	Final editorial check by DD 1-sec chair; approved data published with DOI by BGS/GFZ.

10.6.2 IMBOT Automatic Review System:

- Identifies new or modified data.
- Converts data to ImagCDF format.
- Assigns quality levels: 0 (poor) to 2 (best).
- Requests data provider review if quality < 2.
- Assigns manual data checker for level 2 quality data.

10.6.3 Software Support:

- Two INTERMAGNET public software packages updated for 1-second data preparation and checking.
- IMCDView is among the notable tools supporting processing and visualization.

10.7 Data Checking and Quality Control

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

- Cookbook for data checkers reviewed to ensure consistency and clarity in procedures.
- Focused discussion on the halt of USGS definitive data production and data checking:
 - USGS currently on hold; this impacts production and quality control.
 - Consequences include inability to produce:
 - Nowcast Kp index without calibrated variometer data from FRD and SIT.
 - Definitive Kp values without USGS K values from FRD and SIT.
 - Mitigation depends on whether USGS continues providing variometer data and shares software/algorithms for K value calculation.
 - Impact on Dst index production is *Not specified/Uncertain*.

10.8 K Value Determination for IAF Files

- Methods, differences in approaches, and the DKA data format are under review.
- Data checking processes related to K values are being refined to ensure accuracy and consistency.

10.9 Discussion on Updating Data Formats

Topic	Discussion Points	Proposed Solutions / Considerations
Updating IBFV Baseline Files	Current IBFV 2.00 format unsuitable for automatic DI measurements due to limited temporal resolution.	<ul style="list-style-type: none"> - Allow multiple records per day. - Add instrument indicator (manual vs automatic). - Use numeric key:value coding. - Switch to ISO 8601 date format. - Include D, I, F data from DI measurement. - Introduce new IBFV 3.00 format alongside IBFV 2.00 to ensure backward compatibility. - Gradual software package updates to support new format.
Changing 1-Minute Data Format	Consideration of switching from IAF to ImagCDF format for 1-minute definitive data.	<ul style="list-style-type: none"> - Assess necessity and impact on software/checking routines. - Include K values within the data. - Add extensive README/meta-information fields. - Address inclusion of auxiliary data like BLV. - Evaluate overall benefits and implementation challenges.

10.10 Notifications, Certificates, and Official Correspondence

- Discussion on automating notifications regarding publication status of definitive data.
- Issuance of certificates for data checkers to acknowledge their contribution.
- Consideration of additional official letters for data providers or checkers to formalize processes and maintain transparency.

10.11 Definitive Data decisions and action items

- Compilation and assignment of new and ongoing action items to ensure progress on data collection, processing, format updates, and quality assurance.
- Focus on addressing technology upgrades, data flow improvements, and procedural clarifications.
- Enhancement of documentation and communication with stakeholders.

10.11.1 Action Items

Number	Responsible	Description	Status
Lisbon25 DD.A01	JRD	Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2025 by end of January 2026	
Lisbon25 DD. A02	RL	Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2024 and 2025 by the end of February 2026	
Lisbon25 DD. A03	MVS, JRD	Communication of incomplete/wrong jump signs in yearmean and request for updates in 2026 submission	
Lisbon25 DD. A04	RL	Reminder for review if not completed within 2 months after data submission, message to chair -include into IMBOT	included in IMBOT2.0.2 (2025-09-12)
Lisbon25 DD. A05	DC	DKA format description for Technical Manual - check Jankowski 1991	
Lisbon25 DD. A06	RL	K indices, methods and citations	
Lisbon25 DD. A07	MG, SB, RL	Produce a template of IBFV 3.00 file	
Lisbon25 DD. A08	TR, BH, all data checkers	Updating/reviewing the cookbook and make it ready for TM	
Lisbon25 DD. A09	IM	Add the data checking template to the cookbook	
Lisbon25 DD.A10	RL	Include 1-sec checklist to the cookbook	
Lisbon25 DD.A11	DC, BH, MVS	Organizing a data checking course at IAGA WS Kakioka	
Lisbon25 DD.A12	MVS	Yearly data quality report	
Lisbon25 DD.A13	TR	Site difference analysis	
Lisbon25 DD.A14	All, JM	Change of DOI handling: Create DOI as growing repositories for both 1min and 1sec definitive data.	
Lisbon25 DD.A15	RL	Thank you message with option to obtain updated certificate by Excon.	included in IMBOT2.0.2 (2025-09-12)

10.12 Core Concepts and Terminology

Term	Definition / Description
Definitive Data (DD)	High-quality, finalized geomagnetic data used for scientific and operational purposes.

IAF Format	INTERMAGNET ASCII format used for definitive data storage.
ImagCDF Format	NetCDF-based format supporting complex metadata and multidimensional data structures, increasingly used in INTERMAGNET data.
IBFV	INTERMAGNET Baseline File Version, used to store variometer baselines determined from absolute measurements.
DI Measurements	Absolute measurements of the geomagnetic field components D (declination) and I (inclination) usually accompanied by absolute measurements of F (field intensity).
Kp Index	Planetary geomagnetic activity index derived from sub-auroral observatory data.
Dst Index	Disturbance Storm Time index measuring the ring current intensity using low-latitude observatory data.
IMBOT	Automated data review system used to process and check 1-second definitive data.
Data Checker	Designated person responsible for manual review and quality control of submitted data.

10.13 Conclusion

The INTERMAGNET DD Subcommittee meeting in Lisbon 2025 is focused on advancing the collection, quality assurance, and publication of definitive geomagnetic data, especially for 1-minute and 1-second resolutions. Key challenges include mitigating the impact of USGS's halted data production, updating legacy data formats to accommodate modern automatic measurements, and ensuring robust data checking protocols supported by updated software tools. The committee emphasizes clear communication, enhanced data security, and procedural transparency through official notifications and certifications.

11 GINS Sub-committee

11.1 Participants

Charles Blais (CB), Simon Flower (SF), Brendan Geels (BG), Shun Imajo (SI), Virginie Maury (VM)

11.1.1 Others mentioned in this report

Stephan Bracke (SB), Roman Leonhardt (RL), Jürgen Matzka (JM), Chris Turbitt (CT)

11.2 Agenda

- Review of action items from previous meetings and open issues on GitHub <https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues>
- Progress on using Seedlink
- Progress on using MQTT
- Other Business
- Action Items

11.3 Review of action items from previous meetings

11.3.1 Issues on GitHub

See GitHub issues here <https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues>

- Issue #14 has been closed, as it has been superseded by a program of work that is being discussed at this meeting.
- Issue #13 has been closed, as it has been superseded by a program of work that is being discussed at this meeting.
- Issue #12 has been closed, as it has been completed and written up here: <https://github.com/INTERMAGNET/wg-www-gins-data-formats/tree/master/ImagMQTT>.
- Issue #11 has been closed, as we were unsure what actions were being proposed.
- Issue #10 has been closed, as we believe there is nothing further to add.
- Issue #8 has been closed, as the work has been completed.
- Issue #5 has been closed, as the CDF files distributed by INTERMAGNET now have correct leap seconds. The only remaining part of the issue was to set up an automated check for CDF leap second updates, but we have not been able to resolve this with the current software.

11.3.2 Actions from the INTERMAGNET Rio meeting (November 2024)

See the actions here: https://github.com/INTERMAGNET/wg-www-gins-data-formats/blob/master/Meeting_2024-11/GINSubcommitteeMeetingMinutes.md

Number	Responsible	Description	Progress
Rio24 GIN.A01	SF	discuss MQTT implementation at the Kyoto GIN with SI	superseded by a program of work that is being discussed at this meeting.
Rio24 GIN.A02	VM	investigate new ways of transferring data to the Edinburgh GIN	superseded by a program of work that is being discussed at this meeting

Rio24 GIN.A03	SF	update the MQTT documentation with changes to the topic and payload	Updates have been made to the MQTT documentation
Rio24 GIN.A04	SF	update BGS MQTT software and notify existing MQTT users of topic and payload changes.	Updates have been made to the software and users notified
Rio24 GIN.A05	RL	add support for IMPF in MagPy	MagPy and MARTAS have been updated to include support for MQTT and its data formats
Rio24 GIN.A06	SF	rationalise MQTT and Seedlink documentation	superseded by a program of work that is being discussed at this meeting
Rio24 GIN.A07	CB	investigate new ways of transferring data to the Edinburgh GIN	superseded by a program of work that is being discussed at this meeting.
Rio24 GIN.A08	BG	investigate new ways of transferring data to the Edinburgh GIN	superseded by a program of work that is being discussed at this meeting.
Rio24 GIN.A09	SF, CB, BG, VM	review GitHub issues	All GitHub issues were reviewed
Rio24 GIN.A10	SF	organise regular online meetings of the sub-committee	An online meeting was held in March 2025

11.4 Progress with use of Seedlink for inter-GIN data transport (Canada, US)

It should be possible to complete the replacement of rsync transfers from Canada and the US to the UK by the end of 2025.

11.4.1 Canadian GIN (CB)

Work to transfer data between the Canadian and Edinburgh GINs using Seedlink is complete. All provisional data, except quasi-definitive data, is now being transferred using Seedlink. NRCAN are not yet sending quasi-definitive data, but plan to do so using the Edinburgh GIN data submission web service. NRCAN are looking into a technology called nats.io, in particular the jetstream module, which will allow them to use MQTT. They may think about moving from Seedlink to MQTT in the future. They are thinking ahead about how to distribute data to clients in real-time and MQTT is one option for this. Potential clients for this service include those with an interest in GIC.

11.4.2 US GIN (BG)

The US currently have just a few observatories available via Seedlink but will soon be able to send all observatories (when the Seedlink ring size is increased). We should be able to start test Seedlink transfers between the US and Edinburgh GINs after this meeting. Data compression and the requirement to fill a fixed length buffer mean that data can be delayed - they are looking at ways around this.

USGS are investigating MQTT for internal data transport. This work will require a new database. The work is partly motivated by network restrictions.

11.5 Progress with use of MQTT for inter-GIN data transport (France, Japan)

It should be possible to complete the replacement of rsync transfers from France and Japan to the UK by the end of 2026.

11.5.1 French GIN (VM)

The French GIN requires a full upgrade, including moving from ftp to sftp. This is a major piece of work that has yet to be started. Enabling MQTT data transfer will be part of this upgrade. The work done by RL to support MQTT in MagPy and MARTAS may be useful here.

11.5.2 Japanese GIN (SI)

A report on progress was provided and can be seen here:

https://github.com/INTERMAGNET/wg-www-gins-data-formats/blob/master/Meeting_2025-09/mqtt_report_kyoto_20250907.pdf

11.6 Use of MQTT for faster transport of data from observatories

Six observatories are using MQTT to send data to the Edinburgh GIN. They are: BEL, DOU, HLP, HRN, MAB, VAL.

11.7 Other discussions

CB talked about the need to enable the user community to create their own tools to work with our data. SF discussed the need to encourage observatories to send data in real-time - providing the technology for real-time transfer will not realise any benefits until observatories start using it.

11.7.1 The INTERMAGNET data portal

There were discussions during the plenary meeting about issues relating to the data portal:

- Users would like to see an information "(i)" icon on all labels on all pages to make it clearer that help information is available.
- JM sent email to SF (19/08/2025) describing problems downloading data, whereby the downloaded data contained an incorrect scalar F value: When selecting "calculated components X Y Z F(scalar)" we get recorded F. For example, peg20250802vsec.sec where we get calculated F and not recorded F in the IAGA-2002 downloaded file (and I would expect recorded F as I selected recorded components). Investigate this issue and fix any associated problems.
- There is confusion about the view/download button - it doesn't download! Find a better way to lay out this page.
- SB requested that we add acknowledgement text to data download scripts (in the same way that it is currently added to IAGA-2002 and CDF data files).

There was also discussion about whether all data in the portal should be full-field data. The conclusion was that it should be, so the current restriction whereby only recorded components are provided for reported data through the HAPI interface can be removed.

SF had a list of observatories that appear to be sending reported data without a baseline.

11.8 GINS decisions and action items

11.8.1 Action items

Number	Responsible	Description
Lisbon25 GIN A01	BG, SF:	Complete implementation of Seedlink data transfer from Golden to the Edinburgh GIN
Lisbon25 GIN A02	SI, SF:	Complete implementation of MQTT data transfer from Kyoto to the Edinburgh GIN
Lisbon25 GIN A03	VM:	Redesign Paris GIN
Lisbon25 GIN A04	VM, SF:	Implement MQTT data transfer from Paris to the Edinburgh GIN
Lisbon25 GIN A05	SF:	Implement the changes that were discussed to the INTERMAGNET data portal
Lisbon25 GIN A06	SF:	Send list of observatories transmitting variometer data to CT
Lisbon25 GIN A07	SF:	Organise an online GIN managers meeting

12 IMO Applications and Standards Sub-committee

12.1 Participants

Subcommittee Officers: Chris Turbitt (chair), Dave Calp, Mathew Gard*, Benoit Heumez*, Andrew Lewis*, Jürgen Matzka* & Tero Raita*

* attended part sessions

12.2 Agenda

- Subcommittee membership
- Action Items for November 2024 meeting
- IMO Applications
- Russian Federation observatories
- Ukrainian observatories
- IMOs currently listed as non-compliant
- Other IMOs of concern
- Other Business
- Action Items from 2025 meeting

12.3 Sub-committee membership

No change

12.4 IMO action Items from the November 2024 meeting

Number	Responsible	Description	Status
Rio24 IMO.A1	JM	JM to update the IMO Subcommittee on the status of the VAL 2019-2022 data for a decision on whether IMO status should be withdrawn	Completed
Rio24 IMO.A2	CT	Communicate the Subcommittee's decision on the REU application to BH	Completed
Rio24 IMO.A3	CT	Follow up AAA IMO application with Alexey Andreyev	Completed
Rio24 IMO.A4	CT	Make a recommendation to Anna Willer to submit NAQ 2020 definitive data where there are absolutes and again from start of observations in 2022	Completed
Rio24 IMO.A5	KL	Look for existing USGS-MNRE (Samoa) MoU, make contact with Katie Pogi to identify a relevant MNRE contact, ask whether observations can be resumed and what would be required from other institutes to support API in the long-term	Completed
Rio24 IMO.A6	TR, CT	TR to send summary of CYG problems to CT. CT to notify IMO which years are going to be accepted and which years are not acceptable	Ongoing
Rio24 IMO.A7	BH	Accept DED 2018 definitive data and assist IMO to process and submit 2019 data with a designated step	Completed

Rio24 IMO.A8	CT	Send a letter to IPGP designating DLT & PHU as non-compliant IMOs	Completed
Rio24 IMO.A9	CT	Communicate Subcommittee decision on publication of 2020 & 2021 NAQ data to Anna Willer	Completed

12.5 IMO Applications

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.5.1 REU (Reunion Island)

REU application has been accepted by the Subcommittee with the following recommendations:

- the applied baseline fit to the observed baselines could be improved during some periods of the year to minimise the residuals
- the cause of the large gradients in the baselines during 2024 (>1nT/day at times) should be investigated as this may be related to the diurnal signal in the G-component

IMO.A3 Notify REU Observatory that IMO application has been accepted and inform EXCON (CT)

12.6 Prospective IMOs

This section has been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.7 Russian Federation Observatories

This section has been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.8 Ukrainian Observatories

This section has been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.9 IMOs currently listed as non-compliant

This section has been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.10 Other IMOs of concern

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.10.1 Status of USGS observatories

USGS communicated on the 14 July 2025 that definitive data delivery will be temporarily paused across the network from July 2025 due to staffing issues.

The pause will include 2024 and 2025 definitive data review, processing, and delivery to INTERMAGNET and definitive data review and checking for non-USGS INTERMAGNET observatories. As the situation across the USGS network is temporary, data checking will be placed on hold, and no further action is to be taken. This will be reviewed at the next meeting.

12.11 Resolved since last meeting

This section has been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.12 Referral of problematic IMO's from data checkers

The Subcommittee held a discussion during both sessions (the second in plenary) on the process of tracking IMO's of concern and support for data checkers tasked with reviewing problematic definitive data. This followed a question from BH on best process to resolve issues encountered by data checkers. During these discussions:

- CT noted that the IMO Subcommittee has communicated to the DD Subcommittee that problematic data sets can be referred to the IMO Subcommittee for a second opinion
- It was noted that the DD Subcommittee has been holding similar discussions on improving the support for data checkers and the homogeneity of data checking through better communication
- IM asked whether INTERMAGNET's data checking rules could be relaxed to allow data checkers to assist IMO's in the preparation of data i.e. extending the agreement to allow data checkers to fix minor formatting problems
- RL stated that the DD Subcommittee had discussed establishing a support team for data processing that data checkers can refer to
- RL also suggested running a training course for data checkers at the 2026 IAGA Workshop
- BH & TR noted that the data checking 'cookbook' is now available for review

One suggestion was to establish a GitHub group for data checkers to:

- establish a forum between data checkers
- improve tracking through improved distribution of status information on data checking
- provide assistance with issues raised in the data checking process
- hold a library of data checking case studies and solutions

The Git facility to raise issues could be used to flag data checking problems, however the repository would need to be private rather than public due to the nature of the discussions.

The conclusions were therefore:

- Notify data checkers that they can refer problematic data sets to the IMO Subcommittee for review
- Establish a community platform for data checkers (e.g GitHub)
- Establish a data processing support team within the DD Subcommittee

DC is to work with the DD Subcommittee on behalf of the IMO Subcommittee on developing these ideas.

IMO.A5 Prepare a proposal for improving communication of IMO issues and tracking the data checking process (DC)

12.13 Other Business

12.13.1 Geodetic Reference Datum

Standardisation of geodetic reference datum for observatory positioning and azimuth bearing.

Plenary discussion on whether the geodetic reference datum used for GNSS measurement of observatory position and fixed mark azimuth should be standardised and/or documented in the observatory metadata. This discussion came about as a result of recent fixed mark measurements by BGS using differential GNSS in Northern Alberta, Canada.

- positional differences between the WGS84 and the NAD27 reference datum can be hundreds of meters
- rotational difference between the WGS84 and NAD27 geoids measured at 10' in northern Alberta in 2025, which directly affects azimuth bearing
- geodetic reference datum can vary over time and can comprise of multiple revisions, so providing reference to the datum revision and epoch of the GNSS measurement could be considered
- reference datum differences do not significantly affect fixed mark azimuths derived by sun observations or north-seeking gyro measurements

Notes on the discussion:

Which geoids are commonly used by observatories?

- AL: Australian Geodetic Datum 1984 (AGD84) has a similar offset to WGS84 as does NAD27. I suspect locations for older Australian observatories are measured on AGD84. A few hundred metres in absolute location is probably not so significant for location information. I am not sure if there is any rotational difference between WGS84 and AGD84 - Australia uses azimuths derived from astronomical (solar) observations, which use location in the calculation.

Should the reference geoid be specified as part of the INTERMAGNET IMO standard in the Technical Manual?

- WGS84 is already specified for locations in the IYFV (yearmean file) and in IAF format
- RL: IMOs should specify the datum & coordinate reference system used to determine observatory position by including the EPSG code of the datum in the observatory metadata (e.g. README file). The EPSG code is provided whenever using a GNSS device and this can change with time and from device to device
- There was agreement in the discussion that the ellipsoid needs to be specified in metadata for observatory positioning and altitude and that this should be the WGS84 datum
- CT is to draft a paragraph for the Technical Manual specifying that WGS84 should be used for observatory positioning
- Further discussion is required on the inclusion of EPSG codes in the observatory metadata

IMO.A14 Draft a paragraph specifying best practice in determining observatory position and altitude and use of geodetic datum. Also include in the IMO application form (CT)

12.13.2 Update to IMO application form - BGS data policy

- BGS data policy text was distributed to all INTERMAGNET members prior to the meeting
- CT is to distribute the text of the BGS data policy to the DD Subcommittee for inclusion in the calls for data
- SA queried whether the use of explicit email addresses on the INTERMAGNET web site was necessary as this could be a source of spam
- JM noted that it was appropriate to have a point of contact listed on the web site while INTERMAGNET's data use policy points commercial users to the IMO.

IMO.A15 Add data policy to IMO application form and send text to DD Subcommittee for inclusion with call for data (CT)

12.13.3 Review of IMO Subcommittee use of Git for meeting organisation

Subcommittee discussion on the effectiveness of Git for discussion and information exchange. CT is to consult other chairs on best practice for organising subcommittee meetings using Git. MG noted that he did not have the permissions required in Git to contribute to discussions in the repository.

IMO.A6 Discuss protocols used by other committee chairs for collaborative discussions in GitHub (CT)

IMO.A7 Check GitHub wg-imo-applications permissions for IMO Subcommittee members (CT)

12.14 IMO decisions and action items

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institutes.

12.14.1 Decisions

Number	Decision
Lisbon25 IMO.D01	Reunion (REU) IMO application accepted
Lisbon25 IMO.D02	

12.14.2 IMO action items from the September 2025 meeting

Number	Responsible	Description
Lisbon25 IMO.A01		
Lisbon25 IMO.A02		
Lisbon25 IMO.A03	CT	Notify REU Observatory that IMO application has been accepted and inform EXCON
Lisbon25 IMO.A04		
Lisbon25 IMO.A05	DC	Prepare a proposal for improving communication of IMO issues and tracking the data checking process
Lisbon25 IMO.A06	CT	Discuss protocols used by other committee chairs for collaborative discussions in GitHub
Lisbon25 IMO.A07	CT	Check GitHub wg-imo-applications permissions for IMO Subcommittee members
Lisbon25 IMO.A08		
Lisbon25 IMO.A09		
Lisbon25 IMO.A10		
Lisbon25 IMO.A11		
Lisbon25 IMO.A12		
Lisbon25 IMO.A13		
Lisbon25 IMO.A14	CT	Draft a paragraph specifying best practice in determining observatory position and altitude and use of geodetic datum. Also include in the IMO application form
Lisbon25 IMO.A15	CT	Add data policy to IMO application form and send text to DD Subcommittee for inclusion with call for data

13 Technical Manual Sub-committee

13.1 Participants

Sub-committee Members: Stephan Bracke (SB), András Csontos (AC), Seiki Asari (SA), Andrew Lewis (AL), Chris Turbitt (CT)

13.2 Agenda

- Welcome to new members
- Review of November 2024 action items
- Keep WEB and TM in sync (member lists)
- Technical Manual:
 - Plan content of next release with DOI
 - Discussion on release planning
 - New items for future release
- Web:
 - review of open issues
 - work with links to the Technical Manual
 - reduce space usages by replacing year books with links to the World Data Center
 - FAQ maintenance
- Real time data update with mqtt and seedlink

13.3 Action items from November 2024 Rio meeting

Number	Responsible	Description	Status
Rio24 TM.A01	AL	Include Data Checkers in acknowledgment	Done
Rio24 TM.A02	AL	Add the definition of IYFV 1.03	Not started
Rio24 TM.A03	AL	Add conditions of use CC-BY-NC 4.0	Done
Rio24 TM.A04	CT	Production of QD-Data; incorporate JM’s proposal from the updated FAQ (June 2020) into the Technical Manual or a combination of the essentials and some references to the FAQ.	Ongoing
Rio24 TM.A05	CT	Appendix A-1: Many of the definitions are specific to either IMFV1.22 or satellite transmission data formats e.g. “time stamp” and “flags”. Add general terminology definitions.	Done
Rio24 TM.A06	JM	Appendix C-1: G represents ΔF (see description below) but description hard to find	Not started
Rio24 TM.A07	JM	Appendix C-1: Orientation of “UVZ” has no definition in Section 6.1.3 Generate a table of the various orientations for the Technical Manual.	Not started
Rio24 TM.A08	JM/SB	Generate a DOI for the current release V-5.1.0 (SB send PDF)	Done
Rio24 TM.A09	SB	Appendix C-4: Delete section on CD-ROM Software	Done
Rio24 TM.A10	SB	Add links to previous version via DOI on the website publications	Done

Rio24 TM.A11	SB	transform documentation made to contribute into MD locally and remote	Not started
Rio24 TM.A12	SB	update organizational structure in TM	Done
Rio24 TM.A13	SB	organize intermediate video conferences	Done
Rio24 TM.A14	DD sub-committee	Provide text for the TM on the use of flags as a separate metadata field (ref. DD31) (also in CDF)	Not started
Rio24 TM.A15	DD sub-committee	Add a section on Auto D&I and AutoDIF Baseline.	Not started
Rio24 TM.A16	GIN sub-committee	flagging of data could be available in MQTT and CDF	Ongoing
Rio24 TM.A17	GIN sub-committee	Validate the following information: “1-second data: Available to users within 30 seconds” != (6.2.3 page 31) at the end “IMO may not make more than 1440 uploads per day”	Not started
Rio24 TM.A18	GIN sub-committee	Provide input for a chapter on MQTT	Ongoing
Rio24 TM.A19	TM sub-committee	review web site and suggest needed corrections and better integration with TM	Ongoing
Rio24 TM.A20	SF	Add information of usage and download possibility of definitive data via the DOIs and specify the differences	Done
Rio24 TM.A21	SF	Minor update to CDF format	Done
Rio24 TM.A22	AL	Update contact info in appendices	Done

13.4 Keeping different information sources in-sync

Currently there are three places which have an overlap of certain items:

- git repository www.intermagnet.org
- git repository tech-man.intermagnet.org
- document archive at BGS

To limit the duplications, we will try to maximise the work with links.

Where the team members lists are concerned, we need to monitor and whenever inconsistency are seen all sources must be updated. The problem comes when someone updates the table directly on the master branch to the website. We will not be warned of these changes. SB will try to monitor this more closely. So we will be able to synchronise it almost immediately with the technical manual. AL will update the member table in the technical manual **TM.08**.

The document archive is a private archive and only maintainable by CT. CT will see if there are items we can move to GIT so everybody can maintain this content. Related to this issue SB will restructure the FAQ section and reformat it into plain markdown. It will make it simple to maximize answers to the FAQ with links to the technical manual instead of introducing the same content twice.

13.5 Define UVZ variometer orientation

Currently in the TM there is mention of UVZ orientation but this orientation is not documented in the TM. It is mentioned 12 times in the appendices in INTERMAGNET format definitions for IBF and IAF. AC found an article on the internet <https://onlinelibrary.wiley.com/doi/10.1155/2018/1804092>. It mentions a sensor oriented as “UVZ” which means the two horizontal axes are oriented $\pm 45^\circ$ from the local magnetic meridian. JM thinks that older WNG data have been measured in the $\pm 45^\circ$ configuration

and this configuration was called UVZ. AC will search for further information. During the discussion Jean Rasyon was mentioned and SB will try to find out if he has a definition. CT sent an almost complete table of all components used with their standardized indication.

Code	Description
X	North Component. The strength of the magnetic field vector in the geographic north direction (southerly values are --ve).
Y	East component. The strength of the magnetic field vector in the geographic east direction (westerly values are –ve).
Z	Vertical intensity. The strength of the magnetic field vector in the vertical direction. Z is upward positive downwards and hence negative in the southern hemisphere.
H	Horizontal intensity. The strength of the magnetic field vector in the horizontal plane along the magnetic meridian.
D	Declination or variation. The angle between the magnetic vector and true north positive east.
I	Inclination. The angle between the magnetic vector and the horizontal plane, in degrees of arc, positive above the horizontal.
F	Total field intensity. The geomagnetic field strength, calculated from and consistent with XYZ or HDZ field elements.
S	Scalar field intensity. The geomagnetic field strength, measured using an instrument that is independent from that used to measure the vector field values.
G	Delta-F. Delta-F is defined as F(vector)--S(scalar) in nT. When calculating values for the G element, if F(vector) is missing, G is set to --S (scalar)
E	A field strength in the horizontal plane perpendicular to 'H'. 'E' is only valid for data that is not baseline corrected.
V	The field strength along the direction of the inclination.
A	NW component.
B	NE component, 'B' is perpendicular to 'A'.

XYZHDIF are mentioned and shown with a drawing in section 6.1.3 of the TM, the other ones are derived or slight variants but should also be included and defined in the TM.

For UVZ we will have a problem because V will end up with two different meanings. No clear decision was made during this meeting but AC and SB will try to go into more detail and find out how to integrate it in the TM. During investigation SB discovered there is an overlap with chapter 6.4 and appendix C, hence action item **TM.25** that requires assignment to someone during the next online meeting. JM noted that he has not heard of “V” as defined here, but Tromso has used this direction for fluxgates, but not sure how they were labelled.

13.6 Need for more info on how to produce INTERMAGNET 1 sec data

SA noted there is no definition on how to produce 1 sec data in the TM that applies to the INTERMAGNET 1 second data standard. He refers to the appendix F.2 that has the title "Filter Coefficients to Produce One Second Value" but the coefficients are not included. CT explained there is a lot more to that than a simple list of filter coefficients. CT noted there are some documents that explain it more in detail, but it can be specific for the type of variometer. As action point, we should at least delete this F.2 appendix title. Additionally, we can make references to all other existing documents that define these specifications. CT will provide a DOI or link, if possible, to these documents.

13.7 Reduce disk space usage of the www.intermagnet.org repository

Current used space is 1.5 GB. Guidelines of git repository to not exceed 5 GB. This item has been discussed in github issue 92 (<https://github.com/INTERMAGNET/intermagnet.github.io/issues/92>). If year books are referenced via links to the Edinburgh WDC site and removed from the repository then data volume in the repository will be reduced by 503MB which is 33 % of current usage. For the moment these links are not available, but CT will follow this up (**TM.23**). This action will be sufficient reduction in space for now but other solutions (such as public document archive) to further reduce the disk space should be investigated (**TM.24**)

13.8 Release Planning

As discussed previously, we will go for a yearly official release with DOI around the time of the next meeting. Version numbers will be treated as followed major.minor.cor:

- Major Release : a new subject is introduced into the manual
 - example : MQTT for near real time data
- Minor Release : a significant change to the content without introducing new concepts or the yearly release with a specific DOI
 - example : new version of an already existing standard
- Corrections (cor) :
 - Typically language errors , errors in formula, etc

13.9 Next Release: 5.3.0

Next release will be done shortly after the 2026 meeting in Japan.

- Action items from Rio TM01, TM03, TM05, TM22, TM09 see section above
- Corrected formula remarked by MVS (6.5) issue #14 (<https://github.com/INTERMAGNET/imag-tech-man/issues/14>)
- Updated members table TM.08

13.10 Not handled during this meeting

- Extra administrators for readthedocs
- New items for future release :
 - Action item Rio DD.11: Development a new version IBFV base line format to account for manual and automatic measurements
 - Action item Rio DD.10: Update Technical Manual - Data checking 1-minute

13.11 TM decisions and action items

13.11.1 Action items

Item	Responsible	Description
Lisbon25 TM.01	AL/SB	Add the definition of IYFV 1.03 to the TM
Lisbon25 TM.02	CT	Production of QD-Data; incorporate JM's proposal from the updated FAQ (June 2020) into the Technical Manual or a combination of the essentials and some references to the FAQ.

Lisbon25 TM.03	SB	Appendix C-1: G represents ΔF (see description below) but description hard to find
Lisbon25 TM.04	SB/AC	Appendix C-1: Orientation of "UVZ" has no definition in Section 6.1.3 Generate a table of the various orientations for the Technical Manual.
Lisbon25 TM.05	JM/SB	Generate a DOI for the current release V-5.3.0 (SB send PDF)
Lisbon25 TM.06	SB	Add links to previous version via DOI on the website publications
Lisbon25 TM.07	SB	transform documentation made to contribute into MD locally and remote
Lisbon25 TM.08	AL	update organisational structure in TM to align with website
Lisbon25 TM.09	SB	organise video intermediate videoconferences
Lisbon25 TM.10	DD	Provide text for the TM on the use of flags as a separate metadata field (ref. DD31) (also in CDF)
Lisbon25 TM.11	DD	Add a section on Auto D&I and Auto Baseline.
Lisbon25 TM.12	GIN	Provide input for a chapter on MQTT
Lisbon25 TM.13	TM	review web site and suggest needed corrections and better integration with TM
Lisbon25 TM.14	AL	Update contact info in appendices
Lisbon25 TM.15	AC	Update his name
Lisbon25 TM.16	AL	Check for broken links on website
Lisbon25 TM.17	SB/CT	Update the FAQ
Lisbon25 TM.18	SA/SB/CT	Add DOI to document explaining the need for correct 1 sec data, delete appendix F1
Lisbon25 TM.19	CT	Talk to Ashley Smith to see what to do with VirES request
Lisbon25 TM.20	SF	When bulk data download is done include the data condition of use to it
Lisbon25 TM.21	CT	Integrate links to the WDC for yearbooks
Lisbon25 TM.22	SB	Permanently delete yearbooks on intermagnet site
Lisbon25 TM.23	TM	Investigate other existing solutions to store docs, pdfs, photos etc on the internet
Lisbon25 TM.24	TM	Investigate how to maximise use of git compared to document archive
Lisbon25 TM.25	SA/CT	Amend appendix F.2 and include references to more information on filter coefficients (refer to section 13.6 above)

14 Appendix

14.1 Meeting agenda

14.1.1 Sunday 2025-09-07 (11:00 - 15:00 UT) (Members only)

Time	ITEM
11:00	Preliminary catering and payment arrangements Introductions to attendees and IPMA staff Discussion on upcoming agenda Demonstration and discussion on INTERMAGNET data service website (JM and SF)
11:30	Co-working sessions: Introduction to INTERMAGNET resources (Presented by CT and SB) <ul style="list-style-type: none">- Web page- Document archive- Github One-to-one discussions on technical issues (MQTT, seedLink) Printing certificates Establishing and testing AV and on-line facilities
12:30	Lunch
13:00	Plenary discussions and arrangements for meeting rooms, on-line meetings and dinner arrangements
13:30	Management Team meeting to finalise agenda arrangements
15:00	IMO subcommittee preliminary discussion on new IMO applications

14.1.2 Monday 2025-09-08 (09:00 to 18:00 UT) (Members and Guests)

Time	Item
09:00	Welcome from IPMA Approval/changes to agenda Presentation of Subcommittees and their agendas Presentation of attendees Presentations on <ul style="list-style-type: none">- The new Management Team (incl. discussion)- OpsCom Membership status (incl. discussion) Plenary action items from last meeting
10:20	Coffee break (coffee in the middle room)
10:40	Subcommittee meetings DD (big room), IMO (small room), ExCon (middle room)
12:20	Lunch, self-paying at IPMA canteen
13:15	Management Team meeting
13:30	Subcommittee meetings TM (small room), DD (big room)
15:00	Coffee break (from 15:20 GIN online meeting)

15:30	Subcommittee meetings IMO (small room), 15:20 GIN online meeting
17:00	Coffee break
17:20	Reports from subcommittees
18:00	Public transport or uber to INTERMAGNET dinner
19:00	INTERMAGNET dinner at Mãe-Restaurante, Rua Dona Estefania, 92B costs 45 € incl drinks, self-paying walking distance to Praca Duque de Saldanha

14.1.3 Tuesday 2025-09-09 (09:00 to 16:00 UT) (Members and Guests)

Time	Item
09:00	Plenary session - talk by Gauthier on Nanomagsat (15') - talk by Simon on real-time data (15') - talk by Simon on viewing geomagnetic activity (15') - variometer discussion
10:20	Coffee break
10:40	Subcommittee meetings TM (small room), DD (big room), Excon (middle room)
12:20	Lunch, self-paying
13:15	Management Team meeting
13:30	Reports, decisions and action item lists
15:00	Plenary Session - talk by Marcos Vinicius on data quality checking - Options for new OpsCom members - INTERMAGNET mailing lists - Next Meeting
16:00	Coffee and end of meeting