INTERMAGNET Meeting Minutes

**Public Edition**

**07-08 November 2024**
Observatório Nacional
Rua General José Cristino 77,
Sao Cristovao
Rio de Janeiro
Brazil

**09-10 November 2024**
Hotel IBIS Rio de Janeiro Botofogo
Rua Paulino Fernandes 39 Botafogo
Rio de Janeiro
Bazil

**Participants:**

**ExCon**
David Boteler (DB), NRCan, Canada
Kristen Lewis (KL), USGS, USA
Jurgen Matzka (JM), GFZ, Germany
Andrew Lewis (AL), GA, Australia
**On Line**
Gauthier Hulot (GH), IPGP, France
Ellen Clarke (EC), BGS, UK

**OpsCom**
Benoît Heumez (BH), IPGP, France
Chris Turbitt (CT), BGS, UK
David Calp (DC), NRCan, Canada
Jan Reda (JRD), IoG PAS, Poland
Kristina Rossavik (KR), USGS, USA
Marcos Vinicius da Silva (MVS), GFZ, Germany
Matthew Gard (MG), GA, Australia
Roman Leonhardt (RL), Geosphere, Austria
Seiki Asari (SA), JMA, Kakioka Obs, Japan
Stephan Bracke (SB), IRM, Belgium
Tero Raita (TR), U. Oulu, Sodankylä Obs, Finland
**On Line**
Brendan Geels, (BG) USGS, USA
Charles Blais (CB), NRCan, Canada
Maggie Pueringer (MP), USGS, USA
Simon Flower (SF), BGS, UK

Virginie Maury (VM), IPGP, France

**Not present during the meeting:**
Shun Imajo (SI), KU, Japan
András Csontos (AC), Hun-Ren EPSS, Hungary

**Guests**
André Weirman, ON, Brazil
Cristiano Martins, UFPA, Brazil
Cristoph Amtmann, OAW IWF, Austria
Hiroki Matsushita, JMA Kakioka Obs, Japan

**Institute Abbreviations**

BCMT – Bureau Centrale de Magnétisme Terrestre, France
BGS – British Geological Survey
GA – Geoscience Australia
GeoSphere – Bundesantalt für Geologie, Geophysik, Klimatologie und Metrotologie, Austria
GFZ – German Research Centre for Geosciences
GNS – Geological and Nuclear Science, New Zealand
Hun-REN EPSS – Hungarian Research Network, Institute for Earth Physics and Space Science
IAGA – International Association of Geomagnetism and Aeronomy
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
IRM – Institut Royal Météorologique, Belgium
JMA – Japan Meteorological Agency
NRCan – Natural Resources Canada
OAW IWF – Austrian Academy of Science, Space Research Institute
ON – Observatorio Nacional, Brazil
SGO – Sodankylä Geophysical Observatory, Finland
UFPA – Federal University of Pará, Intituto de Geociencias, Brazil
USGS – United States Geological Survey

# Table of contents

# INTERMAGNET Meeting Minutes

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

## 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 Observatório Nacional. ON provided a lecture room for plenary discussions, a smaller room for sub-committee discussions as well as audio-visual, internet and online facilities. ON also provided morning and afternoon tea. Lunches were arranged at near-by local restaurants. Additional optional discussions and group work were held at the Hotel IBIS Rio De Janeiro, Botofogo.
This meeting followed the XXth IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition and Processing (31 Oct – 06 Nov Vassouras, Brazil).

Audio recordings of most 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

DB welcomed and thanked participants and their institutes for attending the meeting and expressed thanks to André Wiermann and ON for hosting the meeting. JM explained the logistics of the meeting and presented the agenda (see appendix). There were no requests for any changes to the agenda. Sub-committee members and guests introduced themselves, guest introductions are summarised in section 3.3.

## 2 Committee structure and membership

There have been some important changes to the OpsCom sub-committee structure, responsibilities and membership since the last face-to-face meeting in Sopron in May 2023. These changes were discussed and approved during an online meeting of INTERMAGNET officers in October 2024, see section 4 for a summary from that meeting.

The responsibilities of the former GINS, World Wide Web and Data Formats sub-committee (GWD) have been re-defined to concentrate on the work of the Geomagnetic Information Nodes, including all aspects of data flow, defining how the GINs work together to share data and how GINs collect data from IMOs. SF assumes the role of chair for the GINS sub-committee, but a new chair will be required in the next few years.
The Definitive Data sub-committee now has two co-chairs, JRD is co-chair responsible for one-minute definitive data preparation and publication of the INTERMAGNET Reference Data Set. RL is co-chair with responsibility for one-second definitive data and managing subcommittee meetings and reporting. Definitive Data sub-committee has also assumed responsibility for data formats, formerly manage by GWD.
Technical Manual sub-committee has taken on the additional responsibility for the maintenance and development of the web site from the former GWD subcommittee, though further discussion are required as the website is a distributed system on GitHub and with back-end services at BGS. Stephan Bracke is the new chair of TM.
Along with these changed sub-committee responsibilities there has also been changes and additions to membership of the sub-committees. During the previously INTERMAGNET meeting in Sopron (May 2023) the decision was made to admit all members of the data checking team as active members of sub-committees. Additionally, before this meeting a call was sent for nominations from the IMO community for new members of the INTERMAGNET committee.
Amongst the data checking team, MG, SA, KR, MP, DC attended this meeting and agreed to take up active roles on the sub-committees. MVS and András Csontos were nominated by IMOs and both were accepted as members during or immediately after this meeting.

Given there is significant overlap of membership of the IMO and DD sub-committees it is best to schedule GIN and IMO sub-committee meetings at the same time, in different meeting rooms and schedule DD and TM sub-committee meetings at the same time, in different locations to maximise availability for members to attend meetings.

## 2.1 Changes to membership

### 2.1.1 Resignations

Before this meeting Charles Blais stepped down from his role as chair of GWD but remains an active member of the restructured GINs sub-committee.

### 2.1.2 New Members

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institute.
Following the decision made during the previous INTERMAGNET meeting in Sopron (May 2023) to consider all members of the data check team as OpsCom members, Seiki Asari, David Calp, Matthew Gard, Maggie Pueringer and Kristina Rossavik accepted the offer and became OpsCom members during this meeting. Their sub-committee affiliations are listed in section 2.3
USGS GIN manager, Brendan Geels, was accepted as a member of OpsCom and joined the GINs sub-committee.
A call for nominations for new OpsCom members was sent to the IMO community on 2024-08-12.

### 2.1.3 In Memoriam - Achim Ohlert

JM announced that Achim Ohlert (nee Morschhauser) can no longer contribute to INTERMAGNET due to illness and later announced that Achim passed-away on Saturday 09 November 2024. Achim will be remember as a highly talented, very motivated and nice, lively person. He will be sadly missed by his friends and colleagues in the INTERMAGNET committee and the broader geomagnetic community.

## 2.2 Executive Council (ExCon)

| |
|---|
| David Boteler* |
| Ellen Clarke |
| Gauthier Hulot |
| Kristen Lewis |

## 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 | |
| Kristina Rossavik | Shun Imajo | David Calp | Chris Turbitt^ | |
| Maggie Pueringer | Stephan Bracke | Jürgen Matzka | Seiki Asari | |
| Marcos Vinicius da Silva | Virginie Maury | Maggie Pueringer | | |
| Matthew Gard | | Matthew Gard | | |
| Simon Flower | | Tero Raita | | |
| 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 during plenary and is available in section 15.1 There were no additional items suggested for the agenda. Sub-committee meeting agendas are included in the sections 10 to 14

## 3.2 Approval of minutes from May 2023 Sopron meeting

Minutes from the previous meeting held in May 2023 were published in October 2023. The process of publication included review and acceptance of those minutes by the committee so further approval was not required during this meeting.

## 3.3 Presentation of guests

JM described the sub-committee structure and responsibilities and described some changes to the subcommittees which have been presented above in section 2.

*Guests introduced themselves*

- André Weirman, Observatório Nacional, Brazil, is hosting the meeting and is responsible for the Brazilian magnetic observatories.
- Cristoph Amtmann works at the Austrian Academy of Science, Space Research Institute developing instruments for space missions and uses INTERMAGNET data to check instruments.
- Cristiano Martins from the Federal University of Pará, Instituto de Geociencias, Brazil, has an interest in magnetic observatory data.
- Hiroki Matsushita is a researcher at Kakioka observatory, Japan Meteorological Agency, with an interest in definitive data.

# 4 Summary of online meeting from 17 October 2024

An online meeting was held on 17 October 2024. The meeting was the first opportunity for JM, as new OPSCOM chair, to present and discuss ideas and directions for INTERMAGNET. The major discussion points from the meeting were:

- Refocusing INTERMAGNET on the perspective of data users.
- Publishing data faster.
- Increasing efficiency, especially for one minute and one-second data checking which currently has delays.
- Making INTERMAGNET's work easier, both for the IMOs and the committee members. For example, allow data checkers to make corrections for file formats or other minor errors with the approval of IMOs to speed up finalisation of definite data.
- Take a more robust approach to under-performing IMOs.
- Managing work better by distributing workloads more evenly throughout the year via online meetings and synchronising concentrated periods of work between committee members.
- Restructuring of the sub-committees (details included in section 2).

Some of these points formed the basis for further discussion throughout this meeting.

# 5 Plenary discussions and presentations

## 5.1 General OpsCom membership

A decision made during the Sopron meeting from May 2023 opened-up membership of the Operations Committee more widely and created a new role of OpsCom member. Additionally, all members of the data checking team would be considered as OpsCom members. A call for nominations for new OpsCom members was distributed to the IMO community, and notification sent to the data checking team in August 2024.
JM noted that the response from the IMO community, three nominations, had been small and more promotion work is required. The subject was discussed at the IAGA meeting which included many representatives from South American IMOs, further discussion can be held at the next IAGA workshop in Kakioka which should have good representation from amongst Asian IMOs.
DB explain the motivation for the new class of INTERMAGNET office was, in part, to get more engagement from the IMO community and bring-in more people to the sub-committees to replace retiring officers. EC added that it was also an opportunity to provide data checkers with more status and recognition for the work they do.
Both DB and JM agreed that the expectation is that most nominations received from the IMO institutes will be accepted, but INTERMAGNET will do a final check and acceptance.

## 5.2 Real-time data

Review of INTERMAGNET data transfer and future architecture. SMF
https://intermagnet.org/meetings/2024-Rio/Flower_IntermagnetRealTime.pptx

Data are currently transferred between the Golden (USA), Ottawa (Canada), Kyoto (Japan) and Paris (France) GINs to the Edinburgh (UK) GIN and BGS data archive using the rsync utility.
The US and Canadian GINs manage only IMOs from their own institutes and make their own arrangements to receive data from their IMOs. The Kyoto and Paris GINs accept data from international IMOs via email. The Edinburgh GIN accepts data from international IMOs via email and web service.
There is latency in the system due to the nature of the rsync and email transfers protocols and complexity within the Edinburgh GIN to service the data transfers.
Two new data transfer protocols are under consideration - Seedlink and MQTT trials commenced after the Sopron meeting last year. Both Seedlink and MQTT offer transfer of data packets rather than whole day files, low latency, security and easier implementation than rsync.
It is suggested that the US and Canadian GINs will update their data transfers to the Edinburgh GIN to use Seedlink, the French and Japanese GINs will add the MQTT protocol to both accept data from IMOs and transfer data to the Edinburgh GIN. Edinburgh will add Seedlink and MQTT to the existing email and web service protocols to accept data from IMOs
Already three observatories are sending data to Edinburgh via MQTT and two via Seedlink.
Perhaps the Golden and Ottawa GINs are ready to convert from Rsync to Seedlink transfers to Edinburgh? Further work is required to update the Kyoto and Paris GINs to MQTT including setting-up an MQTT broker (possibly in a Docker container) and developing software to forward data (delivered via the existing email or curl protocols) into the MQTT broker for on-forwarding to Edinburgh.
IMOs should also be encouraged to send data via the new protocols to decrease latency.
DB commented that demands for real-time data have evolved over the years, and this is a great starting point for this work within INTERMAGNET.

JM clarified that IMOs will have the option to deliver data via the MQTT protocol directly into the Edinburgh GIN or via the Paris and Kyoto GINs. SF noted it is desirable to continue the data reception function at the GINs as they offer a service to their IMOs and develop a good relationship with the IMOs.
CB questioned if the Golden and Ottawa GINs will require a system to translate from Seedlink to MQTT data transfers and SF explained this is not the case as the Seedlink transfers into the Edinburgh GIN are functional now and are handled by a simple piece of software at the GIN.
GH noted BCMT manages the French-controlled observatories and should be retained for political reasons.
VM explained that data transfers to the Paris GIN are made by Curl, not email and was concerned that the IMOs may not have resources to change their systems. BCMT is important in the French system as it also handles many non-INTERMAGNET observatories.
SF noted there will be no additional work for IMOs if they choose not to use MQTT as the traditional protocols into the Paris GIN can remain in place.
DB suggested some instructions and software could be prepared by INTERMAGNET and provided to the IMOs.
CB made the point, for seismic systems, the instrument makers provide data transfer protocols within their instruments. JM noted this is not generally the case in the geomagnetism community, but it should be possible in the MinGeo MagRec system. RL already has MQTT software that could be adapted for the required INTERMAGNET payload.
BG mentioned the USGS Golden GIN is close to providing Seedlink and is currently experimenting with MQTT. CB noted Canada has fully implemented Seedlink at all their observatories.
AL asked if it was possible to deliver data in the new protocols as test streams into the BGS system and SF confirmed there are test servers available at the Edinburgh GIN.
JM says GFZ would be interested to use Seedlink. SB says it is easy to implement MQTT at an observatory and RL confirmed MQTT software is available on GitHub which could be run on, for example, a Raspberry Pi machine at an observatory for very low cost.

## 5.3 Variometer data

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

*Discussion on the merits and issues for INTERMAGNET to accept and distribute variometer data*

Variometer data quality can vary greatly based on:

- Temperature stability,
- Control of sensor orientation,
- Baseline drift rate,
- Full field, close to absolute measurements or arbitrary zero level
- Scalar data availability
- Data processing and cleaning
- Permanent or temporary station

An easy entry point is for INTERMAGNET to consider variometer data that is observatory-quality in all other respects except for regular absolute observation control from existing INTERMAGNET institutes. There are a number of examples where observations cannot be completed at an observatory.
BH commented that observatories which have limited periods without absolute control could, almost automatically, be accepted as variometer stations, perhaps as a different classification “IMS”

(INTERMAGNET Magnetic Stations) rather than IMO. IPGP are installing variation stations (including scalar magnetometer) but noted there are some issues requiring consideration if variation data were to be handled by INTERMAGNET.

- There are no agreed data quality or instrumentation standards for variometer stations
- There is no centrally controlled list of variation station names which opens the risk of duplicate names
- There is no global data repository for variation data.

KL agreed that some guidelines would be helpful and noted USGS has deployed about 15 variometers (using Bartington magnetometers sampling at 10 Hz without scalar magnetometer at existing US seismic stations) and plans to install more. Stations were installed to research geomagnetic interference affecting seismic data and to augment the observatory real-time data available for space weather and GIC studies in a more cost-effective way, noting that space weather applications do not require definitive data. USGS has been submitting the magnetic variometer data to the Incorporated Research Institutions for Seismology (IRIS). BG added that the USGS variometer are using 4 letter Federation of Digital Seismic Networks (FDSN) codes as station names, not IAGA codes.
DC has some experience with Bartington magnetometers and suggested suspended magnetometers with temperature control can be maintained to good tolerances.
GH suggested it is important to first understand the scientific motivation for installing new variometer stations, then it is possible to define standards, data quality and instrumentation requirements. It would be helpful to develop a matrix of data applications versus data requirements as a first step to assist in the decision process.
JM noted that studying global secular variation required about 100 high quality observatories around the world, whereas studying external fields in high latitudes requires a station spacing of 200 km, or 500 km at mid latitudes. Denmark and Norway operate large variometer networks and smaller observatory networks, and these groups have good knowledge to operate variometer stations. The IMAGE network is also a good example of a variometer network.
TR commented that the IMAGE network could be extended further south but more work will be required to manage stations and data.
DB noted, from his perspective as a data user, there is demand for variation data for GIC and space weather studies. GIC studies simply require the time-rate-of-change of the magnetic field so there are no issues with temperature or baseline stabilities. Space weather studies require real-time data but have little need for absolute values. INTERMAGNET is working towards real-time streamed data and he encourages INTERMAGNET to embrace provision of variometer data for these types of studies.
CT suggested if INTERMAGNET accepts variometer data then care will be needed to clarify and distinguish the difference between observatory and variometer data for the data user community and noted that any new INTERMAGNET standards for variometer data will require checking and monitoring which will introduce a significant new workload given the likely number of new variometer stations.
JM is in favour of bringing variometer data and knowledge into INTERMAGNET but starting slowly, bearing in mind the additional work that will be required.
SF commented that if variometer data are distributed using INTERMAGNET existing systems then work is required to adapt the system, if variometer data are distributed using a new platform, then work is required to develop that platform.

## 5.4 1-second data availability and usage statistics

*A discussion to explore 1-second quasi-definitive data and usage in publications*

BH noted that producing 1-second QD data is a lot of work and asks if the work required to create the data are justified by the data downloads and usage by the user community. Should IPGP continue to produce 1-sec QD data or concentrate on producing only 1-minute QD data.
JM encourages all IMOs to produce 1-second QD data where possible and suggests if one-second reported data are available then producing QD and definitive 1-second data should follow. GFZ will be able to submit 1-second QD data without too much effort and intends to start soon.
AL agreed that producing 1-second QD data is not a significant additional workload.
SF confirmed there are 22 IMOs contributing 1-second QD data during 2024.
The QD data set is primarily available for users who do not require definitive data but do require clean data with good baselines within a few months, rather than definitive data that takes more than a year for publication.
RL re-iterated the important difference between data flagging and data cleaning as there are different users with different understandings and requirements of signal and noise in a data set.
SF noted download statistics for 1-second data are available from the INTERMAGNET data archive but not for QD data specifically, though it would be possible to make some alterations to provide this information. The web-site statistics represent the number of days of data downloaded on the specified day (or month). Larger download numbers could be related to automatic downloads.
DB noted that tracking data usage in published papers is not done routinely and there is an issue with authors referencing the source of data, such as SuperMag or World Data Centre, rather than specific observatories or institutes. This is analogous to referencing a library from where information was sourced rather than the information itself. INTERMAGNET differs from other data repositories in that we are a collective of observatory operations, so a reference to INTERMAGNET reflects on all IMOs, but better recognition for individual IMOs may be required and this is an issue that ExCon can consider.
JM noted that DOIs theoretically make it possible to monitor data usage via scoping web sites which monitor DOI references. He has investigated these in the past and will do again.
JM commented that thanks to INTERMAGNET's strong reputation he is able to cite his IMOs association with INTERMAGNET to justify budgets and satisfy requirements in terms of data management and discoverability within GFZ.

## 5.5 *In camera* discussion on membership

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

INTERMAGNET officers voted unanimously to accepts Brendan Geels from USGS into OpsCom as a member of the GIN sub-committee.
INTERMAGNET officers voted unanimously to accept Maggie Pueringer from USGS, who is already a data checker, into OpsCom as a member of the Definitive Data sub-committee.
DB raised a question if SB should be included in the GIN but it was noted that SB is heavily committed as TM chair. SB already works closely with SF and was included in the GIN sub-committee.
GH suggested we should be mindful of the global distribution of INTERMAGNET officers and JM agreed the distribution needs to be improved. Prospective members for Latin-American countries were approached during the recently completed IAGA workshop at Vassouras but there was poor representation at that meeting from some other areas, such as Asian countries.
Sub-committee chairs can provide suggestions for membership of sub-committees. TM and IMO will require more members.

There will be a clash between the DD and IMO meetings this afternoon and IMO will not be able to complete its agenda today as many members need to attend the DD and ExCon meetings. IMO meeting will be held on the weekend.

### 5.6 Independent data checking and the INTERMAGNET web site

MacMillan and Olsen published (DOI 10.5047/eps.2013.07.011) results of data quality checking for the global observatory network (data from INTERMAGNET and world data centres). The paper presents plots which highlight data gaps, level changes and other inconsistencies which span long periods and represent additional information on data quality that is not available through the internal annual data checks done by INTERMAGNET. Such long-term data checking would be a valuable tool for INTERMAGNET that could identify problematic observatories in the network.
An analysis of the INTERMAGNET web site show FTP data access on the INTERMAGNET web seems to be a problem. SB noted that references to FTP must be removed from the Technical Manual and the ftp link on the web should also be removed. SF says that ftp is currently working on the INTERMAGNET archive, but it is difficult to support, and access will be halted soon. Removing FTP access does not remove access to any data.
The data portal only holds 1-minute and 1 second time-series data – it does not store metadata nor related data such as K index, baselines or ISO images for published CDs or DVDs. The IRDS held at GFZ includes the complete set of data and meta data from 1991.
There are no definitive 1-second data available on the data portal.

## 6 Plenary action items from Sopron meeting May 2023

| Action | Responsible | Description | Status |
|---|---|---|---|
| P.A01 | chairs/AL | Complete sub-committee reports, decision logs and action item list by 6 weeks after completion of the meeting | **Done** |
| 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** |
| P.A03 | SF | Complete a report to IMOs and distribute to IMOContacts, WorldObs and the INTERMAGNET web site by 12 weeks after completion of the meeting | **Done** |
| P.A04 | AL | Complete draft minutes, including reports from sub-committees by 12 weeks after completion of the meeting | **Done** |
| P.A05 | committee members | Review the draft minutes within 14 weeks after meeting | **Done** |
| P.A06 | AL | Complete corrections and amendments to the minutes with 16 weeks | **Done** |
| P.A07 | AL/OpsCom chair | Review minutes for publication | **Done** |
| P.A08 | committee members | Review draft "public" minutes | **Done** |
| P.A09 | AL | Upload minutes to INTERMAGNET document archive, publish the "public" minutes on INTERMAGNET web site and notify IMO-Contacts before the next | **Done** |

| | | | |
|---|---|---|---|
| | | scheduled meeting or no later than 24 weeks after completion of the meeting. | |
| P.A10 | chairs | As necessary, arrange an online subcommittee meeting or document meeting before the next face to face meeting | **Done** at chairs discretion |
| 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** |
| P.A12 | OpsCom chair | Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET's communication with community | **Done** |
| P.A13 | OpsCom chair | Publish draft agendas 2 weeks before the next INTERMAGNET meeting | **Done** |
| P.A14 | OpsCom chair | Decide on format and dates for next meeting | **Done** |
| P.A15 | ExCon and SF | Make arrangements to elect new chair for OpsCom | **Done** |
| P.A16 | DB/SF | Provide a letter of appreciation to the local organisers (SF to provide a list of people involved) | **Done** |
| P.A17 | CT | Contact Yuri Sumaruk and acknowledge the presentation made during the meeting on behalf of Kiev observatory | **Done** |
| P.A18 | BH | Investigate how "step 3" one-minute data were transferred to the NRCan data archive and how best to proceed migrate that process to the BGS archive to allow preparation of future IRDS data sets | **Done** |

## 6.1 Outstanding items from previous meetings

| Action | Responsible | Description | Status |
|---|---|---|---|
| P.A15 | AL | OpsCom requests ExCon to consider the idea of "emeritus" INTERMAGNET officers. There may be some retired INTERMAGNET officers who have much experience and possibly time available to contribute to aspects of INTERMAGNET business | ExCon to discuss further during this meeting |
| P.A21 | SF | Generate metadata reports and provide via email to IMOs (in WDC call-for-data) asking for correction and feedback | In progress, should be included in the next WDC call-for-data |

## 6.2 Secretary correspondence

Throughout the period May 2023 – November 2024 a small amount of email correspondence was received by the secretary on behalf of INTERMAGNET, including queries on the details of the Digital Object Identifier for the INTERMAGNET Reference Data set; the impact of electronic devices on the global electro-magnetic field and a query on filter coefficients to convert higher sample rate data to 1-second data. All correspondence was answered by appropriate INTERMAGNET officers.

# 7 Next meeting

Lisbon (IPMA), Edinburgh (BGS) and Niemegk (GFZ) were presented as candidate locations for the next meeting. A vote of members decided the next meeting will be in Lisbon on Monday 08 and Tuesday 09 September 2025, following the IAGA-IASPEI joint scientific assembly.

# 8 Closing

JM expressed thanks to all meeting participants and thanked André Wierman and ON staff for hosting the meeting. DB thanked JM for his work in arranging and chairing the meeting.

# 9 Plenary decisions and action items

## 9.1 Decisions

| Number | Description |
|---|---|
| Rio24 P.D01 | The next meeting will be held at IPMA Lisbon on 08-09 September 2025 |

## 9.2 Action items

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 |
|---|---|---|
| Rio24 P.A01 | chairs/secretary | Complete sub-committee reports, decision logs and action item list by 6 weeks after completion of the meeting |
| 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 |
| 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 |
| Rio24 P.A04 | OpsCom secretary | Complete draft minutes, including reports from sub-committees by 12 weeks after completion of the meeting |
| Rio24 P.A05 | committee members | Review the draft minutes within 14 weeks after meeting |
| Rio24 P.A06 | OpsCom secretary | Complete corrections and amendments to the minutes with 16 weeks |
| Rio24 P.A07 | OpsCom secretary /OpsCom chair | Review minutes for publication |
| Rio24 P.A08 | committee members | Review draft "public" minutes |
| 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. |

| | | |
|---|---|---|
| Rio24 P.A10 | Chairs | As necessary, arrange an online sub-committee meeting or document meeting before the next face to face meeting |
| 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 |
| Rio24 P.A12 | OpsCom chair | Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET's communication with community |
| Rio24 P.A13 | OpsCom chair | Publish draft agendas 2 weeks before the next INTERMAGNET meeting |
| Rio24 P.A14 | JM | Investigate use of INTERMAGNET data in publication using DOI statistics |
| 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 |
| 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) |

# 10 Executive Council

## 10.1 Meeting overview and participants

David Boteler, Ellen Clarke (online), Gauthier Hulot (online), Kristen Lewis, Jürgen Matzka, Andrew Lewis.

ExCon meetings were held in person on 07 November (EC online; GH unavailable) and 08 November (EC and GH online). All ExCon members attended a joint meeting with IMO to discuss the INTERMAGNET participation policy and two-tiered/variation stations (section 10.5). Selected ExCon members participated in DD and TM sub-committee meetings.
A face-to-face meeting was held with available ExCon members (DB, KL, JM, AL) and sub-committee chairs (CT, JRD, RL, SB) on Saturday 09 November for further discussions on OpsCom membership and the management structure within INTERMAGNET (section 10.7)

## 10.2 INTERMAGNET OpsCom members

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

DB suggested reaching out to specific individuals for OpsCom. Candidates for the role of chair of GIN sub-committee will need to be considered as SF cannot continue in that role for an extended period.

## 10.3 Emeritus officers

Discussions were put on-hold until strong candidates for this class of officer emerge.

## 10.4 Certificates for officers and data checkers

Parts of this section have been removed from this public copy of the minutes as it contained discussion about individuals, observatories or institute.
DB has prepared mock-up certificates, but a problem remains with the quality of the signature images that requires more work. Certificates should be issued as both A4 and Letter format paper. It was agreed that members of the data checking team should receive a certificate during their period of service rather than the end of their term, with the certificate showing their start date. INTERMAGNET officers should receive a certificate at the completion of their term with the certificate showing their period of service. AL has provided a list of data checkers with their period of service to DB but more information may be required.

## 10.5 IMO participation policy, variometer data and a two-tier system

*A joint discussion between the IMO sub-committee and ExCon (see also section 13.7.1)*

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

There are a few IMOs which do not submit data due to specific problems and hence are in breach of INTERMAGNET's participation policy. For many of these IMOs problems can be complex and progress

towards submitting definitive data is slow, however discussions between data checkers and these IMOs is often effective. The IMOs in this situation create much work for data checkers. There are a smaller number of IMOs that do not submit any data or do not perform absolute observations. Such IMOs are clearly in breach of the policy.
These issues lead into discussion on a two-tier IMO system, the question of accepting high-quality variometer stations and adopting a stricter approach to non-performing IMOs.
DB noted that some users of geomagnetic data do not require fully calibrated absolute data and variometer data is adequate for their research. DB asked to explore the consequences if INTERMAGNET adopted a two-tiered system and accepted variometer data from IMOs which were experiencing periods of difficulty. Such IMOs could drop into a second-tier category and submit variometer data and remain part of the INTERMAGNET network.
CT commented that this approach was likely to result in many observatories falling into tier-two and never finding a way back to full IMO status, which may result in a separation between rich and poor countries.
TR noted there are fundamental physical requirements for IMOs as well as requirements for definitive data and INTERMAGNET requires a clear policy.
KL suggested if IMO where experiencing funding issues these difficulties could be compounded by relegation to tier 2 status.
CT added he has received the suggestion that some particularly important or remote IMOs could be classified a "core" observatory which qualify for additional assistance from INTERMAGNET.
GH questioned if there is an increasing trend in the number of IMOs with problems. CT noted there are usually about 10 -12 out of 120 IMOs that have problems, although the current situation with the pause on checking of IMOs from the Russian Federation has caused a temporary increase in the number of IMOs not submitting definitive data.
GH endorsed the idea of a core group of observatories and expressed concern about observatories falling into the second tier and remaining there. A policy is required on how to progress back to full status and suggested, as a condition for accepting variation data for a finite period, INTERMAGNET should request a recovery plan from any IMO that does not provide definitive data. The recovery plan should explain the path to return to producing definitive data. INTERMAGNET should also explore how it fits in the context of the SuperMAG. SuperMAG is a data portal for variometer networks but does not actually produce any data itself.
JM explained his view that INTERMAGNET should be strict where IMOs are creating much work for data checkers. We can also be strict when there is bad data but we need to be relaxed with membership in INTERMAGNET and policy decisions are required to implement this scheme.
JM believes we need more time to discuss a two-tiered system and variometer stations and suggests we could be more relaxed on data delivery deadlines such as those imposed by IRDS production (or DVD production in the past). Given the value of real-time data, we could consider prioritising those IMOs producing real-time data even if they do not provide definitive data.
CT suggested that data checkers should be encouraged to seek assistance and advice from INTERMAGNET on how to handle specific problem IMOs. The policy for non-performance is quite rigidly defined with formal deadlines. Without those deadlines there would be a grey area that is difficult to manage. CT also questioned if we start accepting variometer station do we then need to establish a variometer data checking regime along-side the definitive data checking.
DB's opinion is that real-time variometer data would not be checked as there is an expectation that most data will be upgraded to definite quality data.
EC expressed concern that accepting variometer data may dilute INTERMAGNET's valuable reputation for high quality data and agreed we must be careful not to create more work but some form of variometer data checking is required.

DB responded that careful explanation will be required to the community to ensure the difference between variometer data and definitive data are clear.
TR agreed there is a wide range of data quality amongst variometer station and we must be very careful in what station are accepted.
AL commented that accepting stations into INTERMAGNET that are purely variation stations is another issue over and above the discussion on retaining IMOs as variation stations (or second-tier stations) for finite time periods while they resolve problems.

## 10.6 Variometer data in INTERMAGNET

*Further discussions on issues related to accepting variometer data*

There are several existing large variometer networks such as SuperMag, the Japanese MAGDAS network and the network run by Denmark. JM is a member of the Ultra Large Terrestrial International Magnetic Array (ULTIMA) which is a consortium co-ordinating variometer networks. ULTIMA meets irregularly before American Geophysical Union meetings.
A significant difference between these networks and a proposed INTERMAGNET variometer network would be stable, long-term operations backed by INTERMAGNET institutes which generally have stable, public funding and high data quality standards like an undisturbed environment and stable temperature for the variometer. INTERMAGNET can also offer real-time variation data which other variometer networks do not.
The initial focus could be to use INTERMAGNET's limited resources to encourage existing IMOs to submit data in true real-time and move slowly and carefully towards supporting a variometer network while not duplicating other variometer networks.
DB noted the spatial distribution of the IMO network is not sufficient for space weather applications nor the global geomagnetic activity map. Variometers are easier to set up than observatories to fill these gaps as a first step.
EC questioned if INTERMAGNET were to take on variometer data would it dilute our reputation for high quality observatory data. BGS now runs three variometer sites to fill data gaps for GIC projects and commented that it does take effort to set up and run these stations.
GH agrees that accepting variometer data from existing IMOs would allow slow expansion and time to explore variometer data standards and usage.
There is still uncertainty and more discussion and thought is required. A discussion document is needed to explore definition of standards via a matrix of existing standards for variometers and the range of data applications - this may result in highlighting a common data standard.
GH commented that global field models (IGRF and the WMM) are strong drivers for observatory data and the role of INTERMAGNET. Similar drivers could be uncovered for variometer data, such as space weather operations, which could be used to argue for increase funding and resources.
AL agrees broadly with EC and noted INTERMAGNET strengths are real-time, high quality, baseline-controlled data.

### 10.6.1 Improving real-time data submissions

EC is working on GIC modelling across Europe for the European Space Agency and is keen to encourage European IMOs to provide data in real-time. INTERMAGNET is working to improve real-time data performance but the next steps to encourage IMOs have not been decided. MQTT is now available and can stream data by the second but of those IMOs using file-based data transfers some could probably increase the file transfer rate with little additional work as many seem to work on hourly transfers. A

data submissions rate of every 5 minutes would be a valuable step forward. Information is needed on data delivery rates across the network.
AL noted that data latency statistics are available from the Edinburgh GIN.
JM and DB will seek further information from the GINs if they can currently accept data every 5 minutes and draft a letter to IMOs requesting 5 minute data submissions and offering information about the new MQTT and Seedlink systems which are under development at the GINs.

## 10.7 Clarification of OpsCom structure and management team

### 10.7.1 Management team

A management team will be established consisting of all chairs (ExCon, OpsCom, sub-committee), co-chairs and secretaries (ExCon and OpsCom). The management team will be responsible for day -to-day management and operations.

### 10.7.2 OpsCom members

OpsCom members can be nominated by institutes operating IMOs, membership requires confirmation by ExCon. Alternative routes to membership are to become a data checker or to be nominated from within INTERMAGNET. OpsCom members have access to all INTERMAGNET documents, they are encouraged to participate in meetings. They can take on tasks if they want.

### 10.7.3 Sub-committee membership

A sub-committee chair can nominate new sub-committee members. Membership requires confirmation by ExCon. Members can be assigned tasks, members have voting rights in the sub-committee and in OpsCom. In order to discuss group membership or any other subject that might require discretion, any group within INTERMAGNET (Excon, OpsCom, the sub-committees, the management team) can decide to conduct private sessions (I.e. without guests) alone or together with other groups.

*There is a proposal by DB, seconded by JM, to not use the term 'officer' in the future. Future categories would then be: chair (including. co-chair and secretary), and member (incl. deputy chair) of ExCon, sub-committee or OpsCom.*

## 10.8 Other business

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

## 10.9 ExCon decisions and action items

### 10.9.1 Decisions

| Number | Description |
|---|---|
| Rio24 EXC-D01 | A management team will be established for day-to-day management and operations of INTERMAGNET |

### 10.9.2 Action items

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

| Action | Responsible | Description |
|---|---|---|
| Rio24 EXC.AI-01 | JM | Inform András Csontos of his successful nomination to OpsCom |
| Rio24 EXC.AI-02 | KL | Nominate Brendan Geels as a OpsCom member |
| Rio24 EXC.AI-03 | EC | |
| Rio24 EXC.AI-04 | DB, AL | Continue progressing the preparation and distribution of certificates of appreciation for current data checkers and recently retired officers. AL to provide further information on data checkers as required |
| Rio24 EXC.AI-05 | ExCon | Further discussions on emeritus membership when likely candidates emerge |
| Rio24 EXC.AI-06 | ExCon | Establish a management team consisting of ExCon members, ExCon and OpsCom chairs, sub-committee chairs, co-chairs and secretaries. |
| Rio24 EXC.AI-07 | DB | Develop a discussion document on variometer data, including a matrix of data usage, instrumentation and data standards. |
| Rio24 EXC.AI-08 | JM and DB | Confirm with GIN sub-committee if GINs can accept data submissions at 5-minute intervals and draft a message to IMOs: explaining new developments and data protocols currently under development for true real-time data submissions and requesting IMOs increase data submission rates to 5 minutes if possible, using their current systems. |

# 11 Definitive Data sub-committee

## 11.1 Meeting overview

The DD sub-committee met on Thursday and Friday 7-8 November via a hybrid meeting to progress matters relating to definitive data.

## 11.2 Participants and mentions

Achim Morschhauser (AM), Andrew Lewis (AL), Benoit Heumez (BH), Charles Blais (CB), Kristina Rossavik (KR), Jan Reda (JRD), Jürgen Matzka (JM), Maggie Pueringer (MP), Marcos Vinicius da Silva (MVS), Matthew Gard (MG), Roman Leonhardt (RL), Simon Flower (SMF), Shun Imajo (SI), Tero Raita (TR), Virginie Maury (VM).

## 11.3 Agenda

1. Personnel matters related the work of the sub-committee
2. Review of progress on actions items from Sopron IM Meeting 2023
3. Report on the 1-min and 1-sec Definitive Data collection and publications
4. Paris GIN issues regarding access to 1-sec and 1-min data

5. Publication of definitive 1-sec data on the INTERMAGNET web and as DOI
6. Discussion on what to publish on the INTERMAGNET web with the 1-minute definitive data
7. Discussion on the migration of 1-min definitive from IAF to CDF format
8. Issue of incorrect Jump signs in yearmean files
9. Problem of permission for INTERMAGNET checkers/officers to modify file contents
10. Issue of the frequency of performing absolute scalar S measurements
11. Matters regarding certificates or other official letters following the publication definitive data.
12. DD Sub-committee Action Items
13. Other matters for discussion
14. Summary

## 11.4 Review of actions items from 2023 Sopron meeting

| Number | Responsible | Description | Status |
|---|---|---|---|
| **DD.1** | JRD | Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2023 by end of January 2024. | **Done,** (Sent Feb 19 and repeated Mar 22, 2024) |
| **DD.2** | RL | Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2022 by the end of February 2024 | **Done** (Sent Mar15, 2024) |
| **DD.3** | JRD | Compilation IRDS2020 and cooperation with GFZ to publish as DOI | **Done** |
| **DD.4** | AL, SI, JRD | Continuation of work on the IYFV annual mean data format, especially contact with IAGA regarding Disturbed annual means. | **Done** (forwarded Technical Manual Jul 4, 2024) |
| **DD.5** | RL | Continuing work on IMBOT | **Done** |
| **DD.6** | JRD, SF | Establish working group concerning the publication 1sec definitive data (on INTERMAGNET web and as DOI) | **Done** |
| **DD.7** | BH | Prepare a letter to IMOs and parent institutes regarding DOI publications 2017, 2018, 2019 and if possible 2020. Sending letters to IMOs. | Letters related 2017-2019 were not sent. We propose to resume sending emails signed by ExCon to imo contacts starting from DOI 2020 |
| **DD.8** | RL, BH | Development of the concept of confirmation of definitive 1min data publication on the INTERMAGNET web (acceptance letter, software). | **Ongoing** (template prepared, to be generated by IMBOT) |
| **DD.9** | TR, BH | Assistance to the IMO Committee regarding IMOs of concern discussed during Sopron meeting (eg. IPM,DLT). | **Done** |

| | | | |
|---|---|---|---|
| **DD.10** | JM, AL, RL | Development of a new version IBFV base line format to account for manual and automatic measurements | **Not started** |
| **DD.11** | VM, BH, SMF | Organizing easy access to all the most up-to-date IAF files (since 1991) published on the INTERMAGNET web page (step3) | **Ongoing** There are offers and proposals to solve the problem. |
| **DD.1** | JRD | Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2023 by end of January 2024. | **Done.** (Sent Feb 19 and repeated Mar 22, 2024) |
| **DD.2** | RL | Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2022 by the end of February 2024 | **Done** (Sent Mar15, 2024) |

## 11.5 Personnel matters related to the work of the sub-committee.

The following persons have joined the Definitive Data sub-committee:

- Kristina Rossavik (KR) - U.S. Geological Survey
- Maggie Pueringer (MP) - U.S. Geological Survey
- Marcos Vinicius da Silva |(MVS) - GFZ German Research Centre for Geosciences
- Matthew Gard (MG) - Geoscience Australia

The following colleagues have stopped working in DD sub-committee

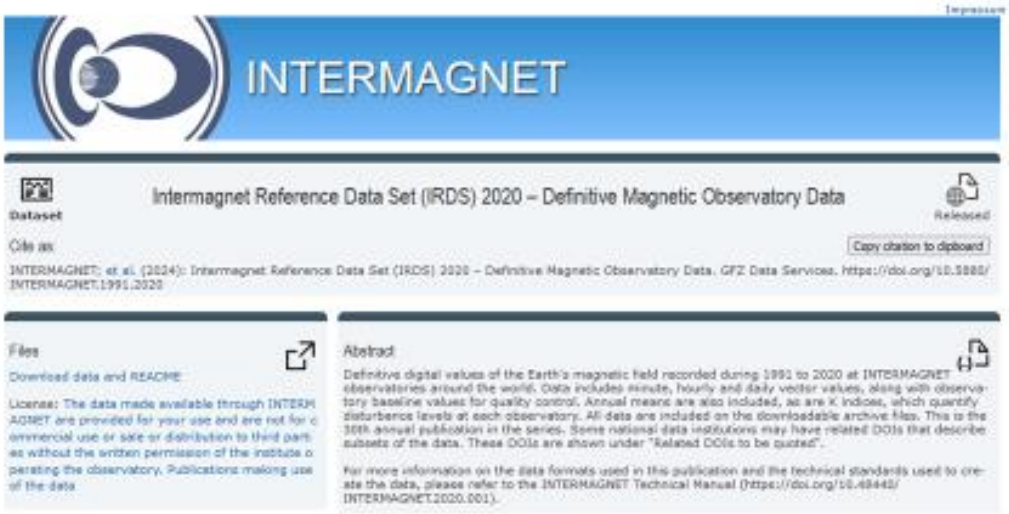
- Shun Imajo (SI)
- Andrew Lewis (AL)
- Charles Blais (CB)
- Virginie Maury (VM)

A transition of the chair of the sub-committee is planned. During the transition period, there are two chairs: Roman (RL) and Jan (JRD), with Benoit (BH) serving as the vice-chair.
The natural division of responsibilities is that RL will primarily handle 1-second data, while JRD will focus on 1-minute data. RL will also lead the Definitive Data sub-committee during INTERMAGNET meetings. JRD plans to remain professionally active for some time despite reaching retirement age.

## 11.6 1-min and 1-sec Definitive Data collection and publication

**Recent IRDS/DOI publication of 1-min definitive**
**(not presented on previous INTERMAGNET meetings)**

IRDS2020 (1991-2020) DOI released in 2024. This is the 30th annual publication in the series.

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The compilation IRDS2021 (1991-2021) is in the initial phase of compilation

In 2024, the DOI was published, containing the final IRDS2020 data compilation for the years 1991-2020. At the meeting in Brazil, it was decided that despite starting work on DOI2021, there will be no further publications of this type. Instead, all final one-minute data will be published as a DOI including all one-minute data accepted on the INTERMAGNET website from 1991 onwards. The DOI publication will continue to be hosted on the GFZ server.

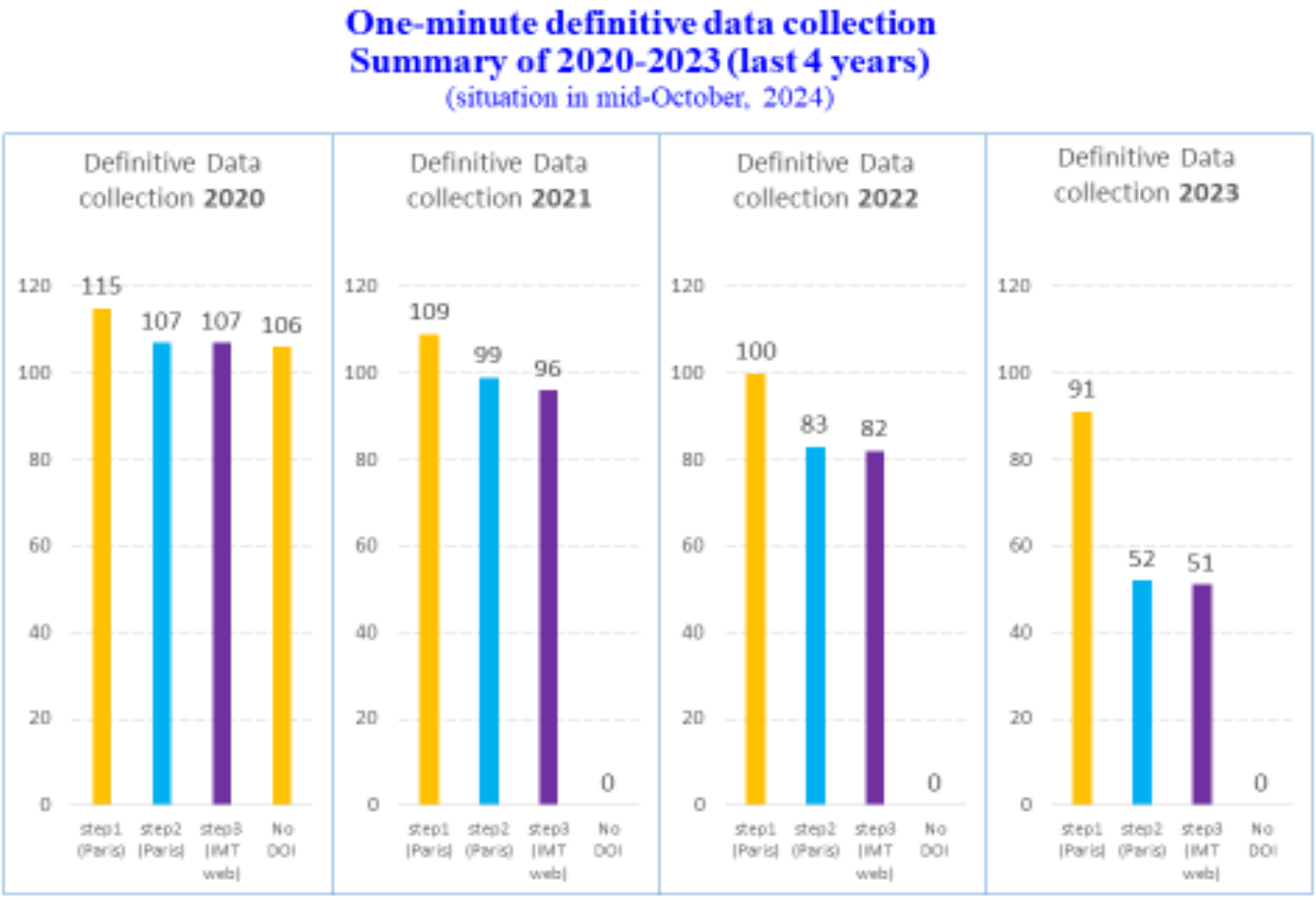


Table 1 Current status of collecting final one-minute data (Definitive), as of mid-October 2024

## 11.7 Access to 1-sec and 1-min data on Paris GIN

Problems after data migration from Ottawa:
The directory structure of the IAF 1-min Paris step3 is not homogeneous as it was earlier in Ottawa (before May1, 2023).

- This makes it very difficult to compile the IRDS for DOI publication.
- It is not compatible with IMBOT, as it needs step3 1min to verify 1-second definitive data.
- Observatories have not received step1, step2, or step3 statistics for the last few years, which are generated by the GFZ server, as a consequence of this state.

Future plans:

- GFZ will establish a homogeneous Step 3 for 1-minute data. Step 3 on the GFZ server will also serve as a continuous DOI. This publication will include observatory readme files, yearmean files, and baseline files
- As before, the minute-means will be published as Definitive on the INTERMAGNET website, maintained by BGS. On the INTERMAGNET website, as before, K indices, readme files, base files, hourly, daily and annual mean files will not be published.

This agenda item is related to Action Item Rio24 DD.3, All, JM.

## 11.8 Publication of definitive 1-sec data on INTERMAGNET web and as DOI

Current status:

- IMOs provide ImagCDF or IAGA2002 on step1-1sec-Paris.
  ftp://user1sec@par-gin.ipgp.fr/yyyy_step1/OBS/
  Both monthly CDF files (12 files) and daily CDF files (365 or 366) (eventually IAGA2002) are accepted.
- IMBOT checks the 1-sec data and sends an email report to both IMO and the data checker. In the report, the data is assessed as:
  level 0 - data did not pass the automatic reading and conversion test
  level 1 - almost ready for final reviews
  level 2 - fulfills all requirements of the automatic checking process
  If the data has been assigned level 2, it is copied to step 2.
  ftp://cdfsteptwo@par-gin.ipgp.fr/yyyy/OBS/
  Files are systematically unified in 12 CDF files. In addition to the CDF files, the level2_underreview.txt report is also copied.
- Now, the data checker proceeds with the review. If the data is accepted, a file named "step2_accepted.txt" is placed in the directory ftp://cdfsteptwo@par-gin.ipgp.fr/yyyy/OBS/. The presence of this file indicates to IMBOT that the CDF data can be copied to step3, meaning that 1-sec definitive have been accepted for INTERMAGNET web.
- So far, step 3 is not working, and therefore the 1-sec definitive can not be copied for INTERMAGNET website.

Discussion about the future:

- Maybe, to simplify things, we could use the same internet locations (ftp?) and the same directories for step3 for both 1-min definitive and 1-sec definitive data
  Arguments:
  - The readme files, BLV baseline, and yearmean are common for both 1-min and 1-sec data.
  - The latest version of IMCDVIEW, which supports both 1-min and 1-sec monthly CDF, requires this directory structure.
    Such a solution is simple and convenient.
  - The future compilation of IRDS and DOI publication containing both 1-min and 1-sec definitive would be straightforward and clear.
- There are still some issues with the ImagCDF format of one-second step2, which do not conform with IM technical manual. This needs to be solved before step3 publication (see below).

Current submissions of one-second data:

- Data submitted since 2014
- Data currently analyzed for initial publication: all data since 2019
- The amount of submitted one-second data is gradually increasing from year to year. Currently up to 40 IMOs submit one-second data. The quality of the submissions is high i.e. 90% obtain IMBOT level 2 for 2022, 2023.
- IMBOT and data checkers dealing with data since 2019 only, until the publication process is ready to create step3 data sets. If this is done, then older submissions will be gradually added to the review process.

- Currently IMBOT requires an update to access definitive 1-min data again (broken since movement from NRCAN) and an update regarding ImagCDF issues in step 2. Solving these issues is critical for continuing the review process. Both issues are part of the agenda.
- Discussion on the 1-sec publication at GFZ Potsdam:
  Publication of 1 second data in the form of a data collection. Any newly accepted data should be published immediately and added to the specific years collection. Thus collections gradually increase in size. Existing parts of the collection cannot be modified, as a unique DOI is assigned to the collection.
- Open points: discuss the collection publication including DOI with responsible persons at GFZ.

## 11.9 Publishing 1-minute definitive data on INTERMAGNET web

There are two historical periods related to this issue:

Ottawa Era

- Files in IAF format provided by IMOs were published, meaning they were available for download through the web interface
- The other files provided by observatories along with IAF files (readme, blv and yearmean), were not published on the INTERMAGNET web site but were released with delayed as a CD/DVD/Pendrive/DOI.
- There were various possibilities for graphical data viewing.

Edinburgh Era (from early 2023)

- IAF files are not published.
- IAF data converted, and 1-min means are made publicly available in the following formats: IAGA-2002, ImagCDF, IMFV1.22, WDC
- K indices are not published.
- Similar to the Ottawa era, readme, BLV, and yearmean files are not published on web
- These files await publication until the release of the DOI.
- The Edinburgh GIN has an extensive interface for graphical data viewing, statistics, etc.

The list of files and data provided by IMOs but not published on the INTERMAGNET web:

- K indices
  Argument: many users of magnetic observations are more interested in activity indices than in time series data.
- BLV files containing baseline data (measured and adopted)
- readme files related to a given IMO
- Readme files related to parent organizations (or country)
- Graphic files containing, among other things, the logo of the parent organization

Questions:

- What do we want or what should we publish on the INTERMAGNET website?
- Should we publish as separate files or include them in CDF? Or maybe a mixed system?
- What about metadata related to parent organizations or the country?

## 11.10 Migration of 1-min definitive from IAF to CDF

There is no question about migration, because it is actually obvious due to the archaic nature of the IAF format used for Definitive data for nearly 35 years !

The question is “how to smoothly carry out the migration?” keeping in mind the following points:

- Providing of Definitive data by IMOs
  - Currently, 100% of IMOs can provide 1-min definitive in the IAF format.
  - It can be estimated that about 40% of IMOs could easily migrate to delivering 1-min in CDF (as they already provide 1-sec data in CDF format).
  - It seems necessary to provide IMOs with a tool for converting IAF (and IAGA2002) to CDF
- The publication of 1-minute data on the INTERMAGNET website.
  (with possible additions, K-indices, BLV, yearmean, readme files?)
- The compilation of IRDS (for DOI publication) with data since 1991
  - It seems obvious that all 1-min definitive since 1991 should be published in a uniform format in CDF. However, these will not be the same files as those provided by the observatories.
  - It will not be possible to maintain the rule that INTERMAGNET does not touch provided files.
  - Will information that is missing from the IAF files be needed for the conversion IAF to CDF? If so, how can it be obtained?
  - What about K-indices that are included in the IAF files?
- cross-checking
  - changing the format requires changes software to the data control tools
  - some of the existing ones can be adapted or updated (IMCDVIEW, MagPY), but for example check1min will need to be rewritten (Windows console application)

Is an update to ImagCDF format needed in the context of migration from IAF to CDF?

- Can K indices be included in CDF files?
- Can data from BLV files be included in CDF files?
- Can text from readme text files be included in CDF files?

This agenda item is related to Action Item Rio24 DD.04, RL, SF, SB

## 11.11 Incorrect jump signs in yearmean files

The IYFV format for yearmean files accounts for situations where the "magnetic levels" of XYZFDIF elements may change. This is defined as a jump. There can be many causes for a jump, such as:

- A change in the location of the pillar for absolute measurements
- Correction of the azimuth mark value
- Sometimes, changes of measurement methodology

Usually, jumps are small, on the order of a few nT, but sometimes they can reach several tens or even hundreds of nT.
In the IYFV format, Jumps are defined as follows:
J = Jump: jump value = old site value - new site value.
Unfortunately, errors or mistakes sometimes occur in reporting Jumps. Instead of the “old-new” values, “new-old” values are reported. Detecting these mistakes in yearmean files is not easy, but in many cases it is possible. They are not to be corrected by INTERMAGNET. IMOs are to correct them in the latest file and add a note in the comments. During the meeting, several cases of such jumps were analyzed. MVS

offered to do more analysis together with the Data Checking Task Team (Action Item Rio24 DD.05, MVS, Data Checkers).

## 11.12 INTERMAGNET checkers/officers modifying file contents

During the definitive data control process, checkers and INTERMAGNET officers often encounter minor, obvious errors, such as missing or extra spaces in yearmean files and similar issues. The restriction allowing only observatories to edit these files can delay corrections for days, weeks, or even months. It's worth considering whether strict enforcement of this rule is necessary.

Arguments for allowing corrections by checkers and INTERMAGNET officers:

- Improving the efficiency of the control process
- Reducing the time required for the 2 stages checking process

Arguments against:

- Until now, INTERMAGNET has operated in such a way that only observatories can make corrections to the content of the files.
- Partial dilution of responsibility
- WDC also applies such a rule, that only observatory can modify the data

Proposal for a slight modification to the existing rules.

- Corrections cannot be applied to values of the magnetic field, even in the case of removing a single 1-min or 1-sec sample.
- Corrections could be applied to obvious mistakes, most often to so-called typographical errors, obvious format mistakes.
- A copy of the original file must always be kept readily accessible for given IMO.
  Note1: files on step2 are not visible to IMOs.
- Any change needs to be reported to the IMO, preferably with a copy sent to other interested people.

Clarify the permission for data checkers to modify files and include it in the data checkers' guidelines. The issue of corrections should be presented to the Data Checking Task Team. This is stated in Action Item Rio24 DD.06 (Data Checkers, BH, TR).

Proposal for a summer school course specifically for data checking

- A summer school course to highlight guidelines for data checking as part of the next IAGA Workshop has been proposed.

## 11.13 Frequency of absolute scalar S measurements

It often happens that BLV files contain a small number or even no absolute measurements of the scalar component Fs. It is not entirely clear whether this is due to the lack of such measurements being taken or simply the lack of reporting of the measurements taken.
There are also other extreme situations where the BLV file indicates that such measurements are taken many times throughout each day.
Both situations are presented in the form of plots from the IMCDVIEW program.
Questions:

- Is any action needed?

- If action is needed, what action?

This agenda item is related to Action Item Rio24 DD.07, TR, BH. TR volunteered to make a script to detect gaps or lack of absolute scalar element measurements.

## 11.14 Certificates or letters following definitive data publication

The issue concerns thank-you letters sent by INTERMAGNET to observatories or their parent institutions. In the past, these letters were sent along with CDs, DVDs, or USB drives containing annual Definitive Data sets. However, after IRDS compilations started being published as DOI, this practice was discontinued.
The new approach involves automatically sending personalized emails with attachments confirming the acceptance of annual Definitive Data for publication on the INTERMAGNET website. These emails would be addressed to individuals associated with a given IMO and signed by the Chair of DD. The email will be sent as soon as the Definitive Data is approved for publication on the INTERMAGNET website (Action Item Rio24 DD.08, BH, JRD, RL, EXCON).

## 11.15 Definitive Data decisions and Action Items

| No | Responsible | Description | Notes |
|---|---|---|---|
| Rio24 DD.A01 | JRD | Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2024 by end of January 2025 | |
| Rio24 DD.A02 | RL | Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2023 by the end of February 2025 | |
| Rio24 DD.A03 | All, JM | Change of DOI handling: Create DOI as growing repositories for both 1 min and 1sec definitive data. To be hosted at GFZ. Solving one second step2 issues. Automatic transfer and publication time stamping, to be started as soon as possible including 2021 onwards. | |
| Rio24 DD.A04 | RL, SF, SB | Migration of 1-min definitive data from IAF to CDF formats. This is a long ongoing process to start after software to deal with CDF are available (2026?) | |
| Rio24 DD.A05 | MVS, Data Checkers | 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. | MVS to check all existing and non existing IMOs to communicate or add comment. (Contact Will Brown from BGS/WDC) |
| Rio24 DD.A06 | Data Checkers, 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. Allow 4 weeks to IMOS to make change before it is made automatically. | |
| Rio24 DD.A07 | TR, BH | Frequency of absolute scalar measures. Data checkers to add this parameter on check list. | TR volunteered to make a script to |

| | | | |
|---|---|---|---|
| | | And communicate with IMOs to either report missing values or start performing regular measures. Only for recent data. | detect gaps or lack of pillar measurements |
| Rio24 DD.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. | |
| Rio24 DD.A09 | ExCon | Certificate for Data Checkers | |
| Rio24 DD.A10 | RL | Update Technical Manual - Data checking 1-minute | Mention IMBOT, add MagPy |
| Rio24 DD.A11 | MG, RL, SB | Development of a new version IBFV base line format to account for manual and automatic measurements | |

# 12 GINS Sub-committee

## 12.1 Meeting overview

All available members of the GIN sub-committee were online so their sub-committee meeting was held entirely online on Thursday 07 November. Additional material is available on the INTERMAGNET GitHub at https://github.com/INTERMAGNET/wg-www-gins-data-formats/tree/master/Meeting_2024-11/
# numbers used throughout this section refer to GitHub issues: https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues

## 12.2 Participants

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

## 12.3 Agenda

- Review of action items from previous meetings
- Use of MQTT for faster transport of data from observatories
  - Report on test with DOU and MAB minute data (main transmission), also BEL second data (test transmission)
  - Support at French and Japanese GINs
  - Recommendations for the future
- Use of Seedlink for inter-GIN data transport (Canada, US)
  - Report on test with BLC and MEA minute and second data (test transmission)
  - Recommendations for the future
- Removal of Rsync for inter-GIN data transport (Canada, France, Japan, US)
- Impact of including data without baselines on INTERMAGNET systems
- Review of issues on WWW-GIN-DF GitHub: https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues

## 12.4 Review of action items from previous meetings

| Action | Responsible | Description | Status |
|---|---|---|---|
| Online 2020 GWD.A5 | CB, All | Continue work on INTERMAGNET.github.io to remove all reference to intermagnet.org | **Ongoing** |
| Online 2020 GWD.A7 | CB | Point intermagnet.org to intermagnet.github.io NRCan to eventually follow up with SSC (central IT service) to change DNS CNAME of intermagnet.github.io so that the domain is still valid | **Ongoing** |
| Online 2020 GWD.A9 | SF, JF | Discussion to continue on the future of a web friendly format (JSON) for distributing data. Initial proposal of CovJSON needs a few adjustments.#7 | **Ongoing** |
| Online 2020 GWD.A10 | CB, GWD | Start a guideline for doing technical notes in markdown on GitHub #2 | **Ongoing** |
| Online 2020 GWD.A12 | SF | Correct CDF files for leap second wg-www-gins-data-formats/issues/5. Once INTERMAGNET data is transferred from NRCan to BGS, BGS will correct CDF files for leap seconds. | **Not started** |

| | | | |
|---|---|---|---|
| Online 2020 GWD.A13 | GWD | Add license information to IAGA2002 header and CDF. #1 | **Not started** |
| Online 2020 GWD.A14 | GWD | Continue the discussion on flagging geomagnetic data #3 | **Ongoing** |
| Sopron 2023 GWD.A1 | RL | To make available documentation on implementation of MQTT. | **Done** |
| Sopron 2023 GWD.A2 | SF (RL, BH, VM, TR, SB) | Design and implement an MQTT receiver for the Edinburgh GIN and report on experience using it to receive INTERMAGNET data | **Done** |
| Sopron 2023 GWD.A3 | CB | To make available his Seedlink Docker image. | **Done** |
| Sopron 2023 GWD.A5 | SF, DC, RL, AL, AG, JM, JR | To recommend changes to the BLV file format to support automatic observation instruments | **Not started** |
| Sopron 2023 GWD.A6 | DB (SF) | To take on renewal of the Memorandum of Understanding with the World Data System. | **Not started** |

## 12.5 Report on MQTT transmissions

The Edinburgh GIN has been accepting data via MQTT since April 2024. Two institutes offered to take part in a test of the MQTT service: Royal Meteorological Institute (RMI) of Belgium and the Institute of Geophysics, Polish Academy of Science (IGPAS). 1-Minute data from two RMI observatories, DOU and MAB, were initially sent as test data, but following success of this trial, MQTT was made the primary transfer mechanism for these two observatories. 1-Second data from the IGPAS observatory BEL has been successfully sent as test data.

### 12.5.1 Implementation of MQTT at Kyoto and Paris GINs

The aims of the changes describe below are to:

- Allow observatories that are capable to use the fast MQTT transfer system.
- Ensure that observatories that do not have the capability to use MQTT can continue transferring data in the same way that they do now.
- To allow the Edinburgh GIN to stop providing an Rsync service for the other GINs.

#### *12.5.1.1 Kyoto GIN*

The Kyoto GIN manager was not able to attend the meeting. The sub-committee chair will contact the Kyoto GIN manager to discuss implementation of these proposals.
**ACTION: SF to discuss MQTT implementation at the Kyoto GIN with SI.**

#### *12.5.1.2 Paris GIN*

The Paris GIN manager will investigate using MQTT for transfer of real-time data and will also look at using the Edinburgh GIN web service (https://gin-upload.bgs.ac.uk/GINFileUpload/Index.html) for non-real-time (e.g. quasi-definitive) data.
**ACTION: VM to investigate new ways of transferring data to the Edinburgh GIN.**

### 12.5.2 Changes to MQTT topic and payload formats

We discussed whether the current topic and payload formats (described here: https://github.com/INTERMAGNET/wg-www-gins-data-formats/tree/master/ImagMQTT) are suitable for our needs. We will make some changes to the current proposals.
The topic and payload description will be given the name INTERMAGNET MQTT Payload Format. The abbreviation for this name is "IMPF". The topic for MQTT messages is composed of the following elements:

<iaga-code>/<cadence>/<publication-level>

The <cadence> element contains the data sample period as an ISO8601 duration. ISO8601 durations only allow time periods of 1-second and above. To ensure that the MQTT system can support data with higher sample rates, the <cadence> element of the topic may contain either an ISO8601 duration or a sample rate in Hertz specified as an integer number with the suffix "hz", e.g. "1hz" for 1-second data.
A new element will be introduced at the start of the topic string, containing the short form of the topic/payload name. Including this in the topic allows different payload formats to be developed in the future and for the type of payload being sent to be identified from the topic string.
The "elementsRecorded" compulsory metadata item will be removed from the payload and added to the end of the topic string. This will allow for future developments where observatories wish to send multiple "streams" of data in different geomagnetic orientations and users wish to subscribe to one or more of these streams.
The new topic string is composed of the following elements:

impf/<iaga-code>/<cadence>/<publication-level>/<elements-recorded>

The only change to the payload is the removal of the "elementsRecorded" metadata field.
**ACTION: SF to update the MQTT documentation with changes to the topic and payload.**
**ACTION: SF to update BGS MQTT software and notify existing MQTT users of topic and payload changes.**
We anticipate that incorporating support for this MQTT format into MagPy will help observatories to work with the format. We request that support is added to MagPy for reading and writing MQTT payloads in the INTERMAGNET| MQTT Payload Format. We also request that the IMPF JSON schema (https://github.com/INTERMAGNET/wg-www-gins-data-formats/blob/master/ImagMQTT/ImagMQTTSchema.json) is included in MagPy (once the planned changes have been implemented).
**ACTION: RL to add support for IMPF in MagPy.**

### 12.5.3 Rationalisation of documentation

The documentation for MQTT (and Seedlink) will eventually need to be added to the INTERMAGNET Technical Manual. However, the MQTT and Seedlink proposals are not yet sufficiently mature to allow this. In the meantime, there is a need for clear documentation to allow INTERMAGNET officers and institutes to start implementing these proposals. Work is needed to rationalise the current documentation into a single, authoritative place.
**ACTION: SF to rationalise MQTT and Seedlink documentation**

## 12.6 Use of Seedlink for inter-GIN data transport (Canada, US)

The Edinburgh GIN has been accepting data via Seedlink since April 2024. 1-minute and 1-second data from the Natural Resources Canada observatories, BLC and MEA, has been successfully sent as test data. There has been a large gap in the data received this way because of a problem authorising network access at BGS following computer upgrades, but this problem has been resolved.

### 12.6.1 Implementation at Natural Resources Canada

Real-time data from Canadian observatories is already available on a public Seedlink server. We will expand the test for transfer of Canadian data to include all observatories and then move to replace the current rsync transfers with Seedlink.
For non-real-time (*e.g.* quasi-definitive) data, Canada will investigate using the data transfer web service at the Edinburgh GIN (https://gin-upload.bgs.ac.uk/GINFileUpload/Index.html).
**ACTION: CB to investigate new ways of transferring data to the Edinburgh GIN.**

### 12.6.2 Implementation at USGS

Real-time data is transferred within USGS using Seedlink and is close to being available to INTERMAGNET. USGS will make this data available to INTERMAGNET as soon as they are able. USGS also intend to look at MQTT as a replacement for the rsync transfer of non-real-time (e.g. quasi-definitive) data.
**ACTION: BG to investigate new ways of transferring data to the Edinburgh GIN.**

## 12.7 Remove Rsync for inter-GIN data transport (Canada, France, Japan, US)

BGS would like to remove the rsync service that GINs currently use to transfer data. The motivation for doing this is because of the difficulty in maintaining the rsync receiving software at BGS.
The previous two topics have already discussed the means by which the rsync service will be replaced.

## 12.8 Impact of including data without baselines on INTERMAGNET systems

There are discussions in other parts of this meeting about the possibility of allowing geomagnetic data without baselines to be added to INTERMAGNET data stores. We discussed this with a view to any technical problems that might result from doing this.
Possible technical problems raised are:

- The INTERMAGNET data portal assumes all data sent to the GINs are full field magnetic values to enable conversion between different geomagnetic orientations. Data without a baseline would need to be marked so that the software doesn't attempt to convert in this way.
- If the proposal includes publication of definitive data without baselines, the imcdview data viewer will need to be modified so that it does not allow conversion between different geomagnetic orientations for data without baselines.
- If data from variometer networks is included, the number of available IAGA codes may be exceeded and we will need an alternative scheme for identifying recording stations.

There is an open issue on this subject if people wish to comment further: #16

## 12.9 Review of issues on WWW-GIN-DF GitHub

There are a number of old issues in the GitHub issues area for this sub-committee. These will be reviewed to see which ones can be closed. See the issues here: https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues

## 12.10 Other business

We agreed to hold regular (e.g. every 3 or 6 month) online meetings.
**ACTION: SF to organise regular online meetings of the sub-committee.**

## 12.11 GINS decisions and action items

### 12.11.1 Decisions

| Number | Description |
|---|---|
| Rio24 GIN.D1 | Hold regular (3 or 6 monthly) online meetings |

### 12.11.2 Action items

| Number | Responsible | Description |
|---|---|---|
| Rio24 GIN.A01 | SF | discuss MQTT implementation at the Kyoto GIN with SI |
| Rio24 GIN.A02 | VM | investigate new ways of transferring data to the Edinburgh GIN |
| Rio24 GIN.A03 | SF | update the MQTT documentation with changes to the topic and payload |
| Rio24 GIN.A04 | SF | update BGS MQTT software and notify existing MQTT users of topic and payload changes. |
| Rio24 GIN.A05 | RL | add support for IMPF in MagPy |
| Rio24 GIN.A06 | SF | rationalise MQTT and Seedlink documentation |
| Rio24 GIN.A07 | CB | investigate new ways of transferring data to the Edinburgh GIN |
| Rio24 GIN.A08 | BG | investigate new ways of transferring data to the Edinburgh GIN |
| Rio24 GIN.A09 | SF,CB,BG,VM | review GitHub issues |
| Rio24 GIN.A10 | SF | organise regular online meetings of the sub-committee |

# 13 IMO Applications and Standards Sub-committee

## 13.1 Meeting overview

IMO sub-committee met in a joint session with ExCon on Thursday 07 November to discuss the IMO participation policy, accepting variometer data and two-tiered system and on Saturday 09 November for discussions on IMO applications.

## 13.2 Participants

Sub-committee Officers: Chris Turbitt (chair), Benoit Heumez, Andrew Lewis, Jürgen Matzka, Tero Raita
Present: CT, BH, AL, JM, TR (DC attended the Saturday meeting)

## 13.3 Agenda

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

1. IMO action Items from the May 2023 meeting
2. IMO Applications
    a. IMOs closed or withdrawn since the May 2023 meeting:
    b. Update on previous applications:
    c. New and re-applications:
    d. Prospective IMOs
3. IMOs of concern
    a. Discussion on JM's points from preparation meeting on management of IMO list
    b. Resolved IMO issues since last meeting:
    c. Russian Federation observatories
        1. Data checking on hold (May 2023):
        2. Additional observatories (Nov 2024):
    d. Impact of the pandemic on 2020-2022 data/data checking on hold:
    e. IMOs currently listed as non-compliant:
    f. Lists of IMOs of concern and IMOs awaiting checking:
4. Discussion on the status of the INTERMAGNET one-second data standard
    a. Data formats – Proposal from DB to IAGA V-DAT working group on an 'IAGA 2002x' format as an ASCII option for 1-sec data
    b. IMO compliance levels and issues
5. IMO Sub-committee Action Items following the 2024 November Meeting

## 13.4 Sub-committee membership

DC, MG and MP joined the IMO Sub-committee following this meeting. VM has stepped down as a member of the IMO Sub-committee. JM will pause IMO membership decisions due to his involvement in many observatories but will keep membership of IMO. JM to discuss how his and AL's affiliation to the sub-committees is to work with additional ExCon duties.

## 13.5 IMO action Items from the 2023 May Sopron

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

| Number | Responsible | Description | Status |
|---|---|---|---|
| IMO.A1 | CT | Ask the DD Sub-committee to encourage IMOs to submit one-second data as quasi-definitive data | **Completed** AL to communicate this to the IMOs in the communication to IMOs |
| IMO.A2 | JM | | |
| IMO.A3 | TR | | |
| IMO.A4 | BH | | |
| IMO.A5 | CT | | |
| IMO.A6 | DC | | |
| IMO.A7 | BH | | |
| IMO.A8 | TR | | |
| IMO.A9 | TR | | |
| IMO.A10 | JRD | | |
| IMO.A11 | JM | | |
| IMO.A12 | CT | | |
| IMO.A13 | CT | | |
| IMO.A14 | CT | | |

## 13.6 IMO Applications

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

### 13.6.1 IMOs closed or withdrawn since the March 2021 meeting

### 13.6.2 Update on previous applications

#### 13.6.2.1 São Teotónio (STT)

Accepted at the Sopron meeting with recommendations. This was communicated to the observatory and acceptance dated 8-Jul-2023.

#### 13.6.2.2 Kiruna (KIR)

**Accepted**
Communication from CT to sub-committee in August 2023 with evidence from the observatory that the large offset in the Y-component is due to natural crustal field anomalies. JM replied to agree that this met the requirement, and KIR should be recommended for acceptance.

There was further communication between CT and the observatory in January 2024 following TR's findings at the Sodankylä Nordic Workshop in September that the scale value for the theodolite was wrong. The observatory conducted some further analysis, which verifies that the impact of the error has been small and the baselines do not need recalculating.
Recommendation from sub-committee 2023 meeting were communicated to the observatory and therefore the sub-committee accepted KIR as IMO.

### 13.6.3 New and re-applications:

#### *13.6.3.1*

#### *13.6.3.2*

### 13.6.4 Prospective IMOs

## 13.7 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 institute.

### 13.7.1 Management of IMO list

*Discussions held jointly with ExCon*

Background: Approximately 10% of observatories are listed as IMOs of concern at any time. Issues at some observatories are resolved after a number of years, while some observatories are on this list for a long period of time. Some of these observatories are long standing observatories and/or remote observatories whose data are of particular value to the user community. However, failing to meet INTERMAGNET standards for successive years generates a large amount of work for the data checkers, as well as the DD and the IMO Sub-committees.
At the online meeting in October, JM suggested that the handling of these observatories should be reviewed to ease the workload generated by continuously problematic IMOs. JM clarified that this could mean in practice:

- Relax the deadlines on the submission of data to ease the burden on the data checkers. CT: need to decide what this means for the IM Participation Policy
- Remove poor quality data that have been published through INTERMAGNET. Poor quality can be identified in the ESA AUX_OBS data product, for example. Such problems are only evident with comparison to global data set, so aren't necessarily caught during the data checking process.

GH- IMOs should publish a recovery plan with a timetable to INTERMAGNET.
Tanja Peterson had requested that INTERMAGNET consider a set of core IMOs that are deemed of high value to the user community that, where required, can be provided with support by INTERMAGNET and the other IMOs.
This discussion is also linked to the considerations of two-tier observatory status and publication of variometer data by INTERMAGNET. Here two-tier observatory status would be implemented when an IMO has a temporary reduction in absolute quality due to lack of absolute observations, for example. This could give rise to several issues:

- variometer or lower-tier observatories would no longer be reviewed as part of the definitive data quality checking process, so may mean that alternative process would need to be introduced which is likely to result in further work for INTERMAGNET;
- publication of non- standard data by INTERMAGNET could be detrimental to INTERMAGNET's reputation in the eyes of the data users; without the requirement to meet INTERMAGNET standards to publish via INTERMAGNET, there is a potential for lack of incentive for observatories to meet those standards on data quality and delivery.

Further details reported in section 10.5

### 13.7.2 Resolved IMO issues since last meeting

| IMO | Update |
|---|---|
| | |
| | |
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| | |

### 13.7.3 Russian Federation observatories – data checking on hold

### 13.7.4 Impact of the pandemic on 2020-2022 data

### 13.7.5 IMOs currently listed as non-compliant

All of the above IMOs were given a deadline of 2022 to meet the INTERMAGNET Participation Policy.

### 13.7.6 IMOs of concern and IMOs awaiting checking

| IMO [Data Checker] | Year of Last Accepted Definitive Data | Year of Last Uploaded Data (Upload date) | Date of last transmitted RT data |
|---|---|---|---|
| | | | |
| | | | |

## 13.8 Discussion on the status of the INTERMAGNET one-second data standard

- Data formats – Proposal from DB to IAGA V-DAT working group on an 'IAGA 2002x' format as an ASCII option for 1-sec data.
  - Not discussed
- IMO compliance levels and issues
  - Not discussed

## 13.9 IMO decisions and action items

### 13.9.1 Decisions

| Number | Decision |
|---|---|
| Rio24 IMO.D01 | Kiruna (KIR) IMO application accepted as an IMO |
| Rio24 IMO.D02 | |
| Rio24 IMO.D03 | |

### 13.9.2 Action items

| Number | Responsible | Description |
|---|---|---|
| Rio24 IMO.A01 | JM | |
| Rio24 IMO.A02 | CT | |
| Rio24 IMO.A03 | CT | |
| Rio24 IMO.A04 | CT | |
| Rio24 IMO.A05 | KL | |
| Rio24 IMO.A06 | TR, CT | |
| Rio24 IMO.A07 | BH | |
| Rio24 IMO.A08 | CT | |
| Rio24 IMO.A09 | CT | |
| Rio24 IMO.A10 | DC | |
| Rio24 IMO.A11 | TR | |
| Rio24 IMO.A12 | CT | Notify the institute about decision to accept Kiruna, Sweden KIR as an IMO |

# 14 Technical Manual Sub-committee

## 14.1 Meeting overview

The Technical manual sub-committee met on Thursday 2024-11-07 in a fully face-face meeting to discuss progress and next steps for the publication of the online Technical Manual.

## 14.2 Participants

Sub-committee Members: Stephan Bracke (SB) (chair), Chris Turbitt (CT) (deputy), Andrew Lewis (AL)
Others: Jürgen Matzka (JM). David Boteler (DB)

### 14.2.1 Changes in membership

We welcome Seiki Asari and András Csontos as new members of the sub-committee. Jürgen Matzka resigned from the sub-committee.

## 14.3 Agenda

1. Review of May 2023 actions items
2. Release of Technical Manual 5.1.0
3. Technical Manual
    a. DOI
    b. Collaborative work flow
        i. reviews on development branch
        ii. new chapters on separate branches
    c. IYFV 1.03
4. WEB
    a. Links to data format in the Technical Manual
    b. Other links to/from the web site
    c. discussion on where to find what for data downloads
5. Plan next release in phases
6. Distribution of new Action Items
7. Need for new members

## 14.4 Action items from May 2023 Sopron meeting

| Number | Responsible | Description | Status |
|---|---|---|---|
| **TM.1** | JM | Generate a DOI for the next release in RST format for the Technical Manual V-5.1.0. | Ongoing -SB to provide pdf and explore possibilities to automate DOI creation linked with release tags |
| **TM.2** | SB | Publish TM V-5.1.0 once the new collaboration environment is available on GitHub. | Completed |
| **TM.3** | SB | Configure a dedicated environment to INTERMAGNET for the TM on GitHub. | Completed |
| **TM.4** | SB | Configure a dedicated environment to INTERMAGNET for the TM on ReadTheDocs. | Completed |

| | | | |
|---|---|---|---|
| **TM.5** | SB | Complete the conversion of the current version of the manual to RST (only 3 pages left). | Completed |
| **TM.6** | TM sub-committee | Install the new development tools locally and experiment with them. | Ongoing |
| **TM.7** | CT | Look at TN and FAQs for QD information to be added to the TM. | Not started |
| **TM.8** | JM | Description on the use of DOIs for data/metadata publication in INTERMAGNET. | Completed |
| **TM.9** | DD sub-committee | Provide text for the TM on the use of flags as a separate metadata field (ref. DD31) if this is to be adopted in CDF format. | Still to do |
| **TM.10** | BSL | Modify Technical Manual references to the 90% rule to state that this can be interpreted as either 90% of the values or 90% of the weight of the filter. To be included in V-5.1.0 release. | Completed |
| **TM.11** | GIN Sub-committee | Flagging of data – how to preserve data rather than deleting it using a separate flag data field. Is this only for CDF or also for other formats? | On going - still to do |
| **TM.12** | SB & CB | Configure URL intermagnet.org for GitHub and ReadTheDocs. | Completed |
| **TM.13** | BSL | Page 5 par 2 … recognized format – could add a pointer to the section in the document that describes that. Section 6.1.1. To be included in V-5.1.0 release. | Completed |
| **TM.14** | BSL | In Chapter 2 - not clear what the definitions of the data types are – add pointer to definition/relevant text. | Completed |
| **TM.15** | JM | Section 2.3.9 – add text describing where the gp ratio is used. To be included in V-5.1.0 release. | Completed |
| **TM.16** | BSL | Page 13 column 1, paragraph 1 – It makes no sense to me to use the examples of means here within a section on one-second data. Replace with filtered values. To be included in V-5.1.0 release. | Completed |
| **TM.17** | JM | Data quality: proofread the guide to the process of de-spiking data. | Completed |
| **TM.18** | SB | Incorporate suggestions/corrections from the proofread of the development V-5.0.0 to V-5.1.0 release. | Completed |
| **TM.19** | 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" | On going - requires review |
| **TM.20** | SB | Replace the description on p 47 part of toolkit used to create the website with the tool used on the new GitHub environment. Describe the various formats (RST and PDF) and how to propose changes for external contributors etc. | Completed |

| | | | |
|---|---|---|---|
| **TM.21** | BSL | Incorporate changes proposed by JM to include IRDS and replace CD, DVD and USB with IPM where appropriate. To be included in version V-5.1.0. | Completed |
| **TM.22** | 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. | To be done |
| **TM.23** | DD Sub-committee | Issues related the yearmean files and IYFV1.01 data format including the definition of the “I – incomplete” flag. Do we need a new format version? Information to be provided by the DD subcommittee. | Done IYV1.03 |
| **TM.24** | BSL | Appendix C-1: Change use of deltaF for “G” | No longer relevant |
| **TM.25** | 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. | To be done |
| **TM.26** | CT | Appendix C-4: Needs to be updated to reflect this is software supplied on CDs 1991-???? and has been since been superseded by IMcdview (as described in Section 6.4.3.4). To be include in version V-5.1.0. | delete this section |
| **TM.27** | SB & JM | Add DOI links for all Technical Manual versions on the INTERMAGNET GitHub WEB site. | To be done SB |
| **TM.28** | 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. | Not done |
| **TM.29** | TM Sub-committee | Add a section on Auto D&I and Auto Baseline. | Not Done - to be checked |
| **TM.30** | AL | Add conditions of use CC-BY-NC 4.0. | Not started |
| **TM.31** | TM Sub-committee | Check and update all links on the Technical Manual and GitHub WEB Site (especially for the data formats to point to the TM). To be included in V-5.1.0 release. | Done |
| **TM.32** | SB | Distribute an instruction document on “how to submit changes” for the INTERMAGNET members and also a document for external submissions. | Ongoing |
| **TM.33** | SB | Organize video conferences as needed for the Technical Manual sub-committee. | Ongoing |
| **TM.34** | OpsCom | Provide decision on new members/org chart. To be included in V-5.1.0 release. | Not Done – to be adapted to new structure |

## 14.5 Release of Technical Manual 5.1.0

The technical manual was released shortly before the meeting and the online version is now available in html and PDF on the URL tech-man.intermagnet.org

## 14.6 Technical Manual

### 14.6.1 DOI

During the meeting we decided on following release cycle:

- A yearly release of the technical manual will have a unique DOI
- During the year intermediate versions can be released but will not have a reference DOI

### 14.6.2 Collaborative work-flow

SB explained how to work on the development branch and review changes on the online version. Two approaches will be applied:

- For small reviews and quick changes, the online fixed development branch can be used
- Bigger changes: Chapters added *etc.* will be done on a dedicated development branch

The development branch is introduced for those who want to contribute but don't have the ability to do the local installation.

## 14.7 WEB

The intermagnet.org website needs to be reviewed and cleaned.

### 14.7.1 WEB: links to technical manual

SB explained with the release of the online version of the technical manual links directly to a particular chapter can be included on the website. The links are illustrated by the data format page. This can be used to avoid redundant information and to keep the website and technical manual in sync.

### 14.7.2 WEB: links to the data download

SB explained that the way the data download page, DOI download page and explanation on how to use the data are not so easy to find and understand on the current website. After discussion online SF agreed to work on this to improve the data download page.

## 14.8 Future phased releases

From now on everything is in GitHub and releases can be scheduled and planned more frequently.

- Small changes and updates: immediately
- Bigger changes: every year after review from the technical manual sub-committee

## 14.9 TM decisions and action items

### 14.9.1 Action items

| Item | Responsible | Description |
|---|---|---|
| Rio24 TM.A01 | AL | Include Data Checkers in acknowledgment |
| Rio24 TM.A02 | AL | Add the definition of IYFV 1.03 |
| Rio24 TM.A03 | AL | Add conditions of use CC-BY-NC 4.0 |
| 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. |

| | | |
|---|---|---|
| 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. |
| Rio24 TM.A06 | JM | Appendix C-1: G represents ΔF (see description below) but description hard to find |
| 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. |
| Rio24 TM.A08 | JM/SB | Generate a DOI for the current release V-5.1.0 (SB send PDF) |
| Rio24 TM.A09 | SB | Appendix C-4: Delete section on CD-ROM Software |
| Rio24 TM.A10 | SB | Add links to previous version via DOI on the website publications |
| Rio24 TM.A11 | SB | transform documentation made to contribute into MD locally and remote |
| Rio24 TM.A12 | SB | update organizational structure in TM |
| Rio24 TM.A13 | SB | organize intermediate video conferences |
| 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) |
| Rio24 TM.A15 | DD sub-committee | Add a section on Auto D&I and AutoDIF Baseline. |
| Rio24 TM.A16 | GIN sub-committee | flagging of data could be available in MQTT and CDF |
| 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” |
| Rio24 TM.A18 | GIN sub-committee | Provide input for a chapter on MQTT |
| Rio24 TM.A19 | TM sub-committee | review web site and suggest needed corrections and better integration with TM |
| Rio24 TM.A20 | SF | Add information of usage and download possibility of definitive data via the DOIs and specify the differences |
| Rio24 TM.A21 | SF | Minor update to CDF format |
| Rio24 TM.A22 | ? | Update contact info in appendices |

# 15 Appendix

## 15.1 Meeting agenda

### 15.1.1 Thursday 2024-11-07 (12:30 to 21:00 UT)

| Time | ITEM |
|---|---|
| | breakfast at hotels |
| 08:30 | uber from hotels to ON |
| 09:30 | **Opening Plenary Session**<br>Welcome<br>Approval/changes to agenda<br>Presentation of attendees<br>Presentation of Sub-committees<br>Plenary action items from last meeting |
| 10:00 | Coffee break |
| 10:20 | **Plenary Session**<br>Plenary action items from last meeting (continued)<br>Discussion: The new general OpsCom membership<br>Discussion: Two-tier data, two-tier observatories (if time permits) |
| 10:50 | **Plenary Presentation and discussion**<br>Real-time data - Simon Flower |
| 11:20 | **Sub-committee meetings**<br>IMO and GIN and Excon |
| 12:20 | lunch, self-paying |
| 13:30 | **Sub-committee meetings**<br>TM and DD |
| 15:00 | Coffee break |
| 15:30 | **Sub-committee meetings**<br>TM and DD |
| 16:30 | **Plenary Session**<br>Reports from sub-committees |
| 17:30 | **Plenary Session - Discussion**<br>How do our users experience INTERMAGNET: we go through our website and data streams |
| 18:00 | uber to hotels in Botafogo |
| 19:30 | INTERMAGNET dinner, self-paying, walking distance to hotels |

### 15.1.2 Friday 2024-11-08 (11:30 to 18:00 UT)

| Time | Item |
|---|---|
| | Breakfast at hotel |
| 07:30 | uber from hotels to ON |

| | |
|---|---|
| 08:30 | **Plenary session - discussion**<br>variometer data<br>1-second data usefulness and need, application, availability.<br>STEP3, IMBot and IRDS production,<br>1min to cdf and 1-scond as DOI<br>publish 1-sec def ahead of DOI<br>monitor of data usage (Andrew gets it)<br>data used in publication |
| 10:00 | Coffee break |
| 10:30 | **Sub-committee meetings**<br>IMO/TM and GIN/DD and ExCon |
| 12:00 | Lunch, self-paying |
| 13:00 | **Plenary session**<br>Sub-committee reports, decisions and action item lists<br>If there is time:<br>Discussion: Which subjects do we want to work with in 2025?<br>Discussion: How do we want to organize this work? |
| 14:20 | **Session only for ExCon and OpsCom members**<br>New sub-committee members<br>Preparing work over the weekend<br>Next meeting:<br>around IAGA Lisbon (2025-08-31 to 2025-09-05)<br>Niemegk, other options |
| 15:00 | Coffee break |
| 15:00 | uber to hotels or airport |
| | Possibility for joint dinner in Botafogo |

### 15.1.3 Saturday 2024-11-09

| Time | Item |
|---|---|
| 08:30 | Hotel lobby. Chairs and ExCon members discuss sub-committee membership |
| 10:00 | Hotel lobby.<br>All committee members meet for informal discussions and demonstrations:<br>How to edit the INTERMAGNET web site on GitHub<br>How to update the Technical Manual on GitHub.<br>Analyse and map internal data flow within INTERMAGNET<br>Developing future data formats<br>IMO subcommittee discussions<br>Available ExCon members to commence work on discussion document about variometer data |

### 15.1.4 Sunday 2024-11-10

| Time | Item |
|---|---|
| 09:00 | Hotel Lobby. Discussion on using git for Discussion Documents |