INTERMAGNET Meeting Minutes

Public Edition

13 – 15 July 2020
On-Line

Participants:

EXCON:

David Boteler (DB) NRCan, Canada
Gauthier Hulot (GH), IPGP, France
Alan Thomson (AT), BGS, UK
Kristen Lewis (KL) USGS, US

OPSCOM:

Charles Blais (CB), NRCan, Canada
Stephan Bracke (SB), IRM, Belgium
Simon Flower (SF), BGS, UK
Benoît Heumez (BH), IPGP, France
Andrew Lewis (AL) GA, Australia
Roman Leonhardt (RL), ZAMG, Austria
Jürgen Matzka (JM), GFZ, Germany
Virginie Maury (VM), IPGP, France
Achim Morschhauser, GFZ, Germany
Tero Raita, U. Oulu, Sodankylä Obs, Finland
Jan Reda (JRD), IoG PAS, Poland
Benoît St-Louis (BSL), NRCan, Canada
Hiroaki Toh, (HT), KU, Japan
Chris Turbitt (CT), BGS, UK
Sergey Khomutov, (SK), IKIR, Russia

Institute Abbreviations:

BGS – British Geological Survey
GA – Geoscience Australia
GFZ –German Research Centre for Geosciences
IAGA – International Association of Geomagnetism and Aeronomy
IKIR – Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS, Russia
IoG PAS – Institute of Geophysics, Polish Academy of Science
IPGP – Institut de physique du globe de Paris, France
IRM – Institut Royal Météorologique, Belgium
KU – Kyoto University, Japan
NRCan – Natural Resources Canada
SGO - Sodankylä Geophysical Observatory, Finland
USGS – United States Geological Survey
ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Austria

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INTERMAGNET Meeting Minutes

This public edition of the minutes has been edited to remove material relating to individual observatories, institutes or individuals. Throughout these minutes, references to subcommittees and committee members are identified using the abbreviations shown in section 2 below and initials included above in the list of participants. Text shown in *italics* represents comments from participants taken from meeting documents. These comments may have been paraphrased by the secretary during the preparation of these minutes.

1 Meeting format

The meeting was initially planned as a traditional in-person format to be held in Kazan, Russia following the XIX IAGA Geomagnetism Instrument workshop. International travel restrictions in response to the COVID-19 pandemic made it necessary to postpone the IAGA workshop and re-cast the INTERMAGNET meeting to an on-line format.

The geographic diversity of the INTERMAGNET committee membership imposes time-zone difficulties for multi-day live on-line meetings so the meeting was structured as an on-line document meeting. In order to achieve outcomes in the time available all participants were requested to follow the published agenda as closely as possible over the three days of the meeting while working in the time-zone best suited to their needs. Individual sub-committees held live on-line meetings as required, including the Executive Council and Technical Manual subcommittee.
Documents for the meeting were hosted by GFZ on their NextCloud productivity platform:

https://nextcloud.gfz-potsdam.de/s/yLdpcGiaFtFqFm2
Password:

Additional document discussions were hosted using the "issues" feature available on the INTERMAGNET GitHub repository. GitHub issues were used extensively by the GWD subcommittee and to a lesser extent by the DD subcommittee.

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

The INTERMAGNET email lists hosted by GFZ and a newly created slack channel were also available throughout the meeting for real-time messaging and general announcements.
https://intermagnetworkspace.slack.com/archives/C016JL56HDM
opscom_intermagnet@gfz-potsdam.de
excon_intermagnet@gfz-potsdam.de

Plenary presentations were available on the NextCloud document server as PowerPoint files, many with pre-recorded commentary. The presentations have been transferred to the INTERMAGNET web site and links are available below.
It is customary to welcome external guests to INTERMAGNET meetings, but the format of this meeting was not suitable to accommodate guests. The password protected NextCloud document server was not open to guests. It was possible for guests to contribute to public-access GitHub "Issues" discussions and guest input has been included in these minutes.

2 Committee structure and membership

2.1 Executive Council (EXCON)

Alan Thomson*
David Boteler
Gauthier Hulot
Kristen Lewis

2.2 Operations Committee (OPSCOM)

Chair	Simon Flower*
Secretary	Andrew Lewis

Subcommittees

Definitive Data (DD)	GINS/WWW/Data Format (GWD)	IMO Applications and Standards (IMO)	Technical Manual (TM)	Instruments and Data Acquisition (IDA)
Jan Reda* (P)	Charles Blais* (P)	Chris Turbitt* (P)	Benoît St Louis* (P)	
Achim Morshhauser (S)	Achim Morshhauser (P)	Andrew Lewis^ (P)	Andrew Lewis (P)	Achim Morshhauser (S)
Andrew Lewis (S)	Hiroaki Toh (P)	Benoît Huemez (S)	Chris Turbitt^ (P)	Benoît Huemez (S)
Benoît Heumez^ (P)	Jan Reda (P)	Benoît St-Louis (P)	Hiroaki Toh (S)	Benoît St Louis (S)
Charles Blais (P)	Roman Leonhardt (P)	Jürgen Matzka (P)	Jürgen Matzka (P)	Chris Turbitt (S)
Hiroaki Toh (P)	Simon Flower (P)	Sergey Khomutov (P)	Stephan Bracke (S)	Jürgen Matzka (S)
Roman Leonhardt (P)	Stephan Bracke (P)	Tero Raita (S)		Sergey Khomutov (S)
Sergey Khomutov (S)	Virginie Maury (P)	Virginie Maury (S)		
Simon Flower (P)				
Tero Raita (P)				
Virginie Maury (P)				

* Chair of council/committee/subcommittee; ^ Deputy Chair of subcommittee
(P) Primary affiliation; (S) secondary affiliation

2.3 Changes to membership

Kristen Lewis commenced as the USGS representative on EXCON.

3 Agenda, minutes and membership

3.1 Agendas

The main agenda for the meeting is available in the appendix. Sub committee meeting agendas are included in the sub-committee sections below.

3.2 Approval of minutes from Ottawa

Minutes from the Ottawa meeting were published in January 2020. 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 Committee membership

SF identified two areas where additional skills and help may be required:

- Checking 1 minute and one second data;
- Development of web applications and data display tools.

JRD noted the system for checking 1-minute data is working well but finding volunteers can be difficult. He suggested it may be necessary to impose a time limit for data cross-checking tasks. In contrast, the 1-second data checking system does not exists and someone is required to lead that task.
CB agreed on the need for more technical staff to develop applications hosted on GitHub.com and also contributors to the look, feel and content on the new web site.

BSL noted that TM requires additional technical expertise to integrate the Technical Manual to the new GitHub environment.
TR mentioned there is interested from SGO to develop apps using the online data.

4 Progress on plenary actions items

4.1 Action items from Ottawa meeting (2019)

Number	Responsible	Description	Status (Green = completed, Orange = ongoing; Red = not started)
P.A01	chairs/AL	Complete subcommittee reports, decision logs and action item list by 6 weeks after completion of the meeting	Completed
P.A02	Chairs	Supply a report on subcommittee activities for inclusion in the "Report to IMOs" by 6 weeks after completion of the meeting	Completed
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	Completed (late)
P.A04	AL	Complete draft minutes, including reports from subcommittees by 12 weeks after completion of the meeting	Completed
P.A05	committee members	Review the draft minutes within 14 weeks after meeting	Completed
P.A06	AL	Complete corrections and amendments to the minutes with 16 weeks	Completed
P.A07	AL/SF	Review minutes for publication within 20 weeks after meeting	Completed
P.A08	committee members	Review draft "public" minutes within 22 weeks	Completed
P.A09	AL	Upload minutes to INTERMAGNET document archive, publish the "public" minutes on INTERMAGNET web site and notify IMOContacts by 24 weeks after completion of the meeting	Completed IMO contacts were notified in the report to IMOs
P.A10	chairs	Arrange an online subcommittee meeting or document meeting before the next face to face meeting	
P.A11	SF	Request committee members for recommendations on targeted invitations by 10 weeks before the next meeting	Superseded by Covid situation
P.A12	AT	Invite IAGA secretary-general (or other suitable representative) to attend next physical meeting	Intention was to invite Jesper Gjerloev (SuperMAG). He was interested but was

			not convinced he had funds to travel. Kazan meeting postponed and no 'guests' at online meeting.
P.A13	SF	Commence arrangements for the next meeting with the local host by 10 weeks before the next meeting	Superseded by Covid situation
P.A14	SF	Finalise the list of attendees and resolve any non-attendance issues 6 weeks before the next meeting	Completed
P.A15	SF	Request committee members for agenda items for inclusion at the next meeting and request chairs to create subcommittee agendas	Completed
P.A16	SF	Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET's communication with community	Completed
P.A17	SF	Announce INTERMAGNET meetings on worldobs mailing list	Superseded by Covid situation
P.A18	AT	Arrange an INTERMAGNET discussion session during the next IAGA observatories workshop	Not done. Workshop was postponed.
P.A19	SF	Publish draft agendas 2 weeks before the next INTERMAGNET meeting	Completed (late)
P.A20	SF/AM	Publish new version of IMCDView and data conversion software onto GitHub	Not started
P.A21	SF	Generate metadata reports and provide via email to IMOs (in WDC call-for-data) asking for correction and feedback	In progress. Work has been done to generate database views for the reports.
P.A22	SF/K.Elger/BH/JRD	Prepare metadata and publish DOI for 2014 data	Completed
P.A23	SF/K.Elger/BH/JRD	Prepare metadata and DOI for 2015 data release (1991-2015)	Completed
P.A24	SF/K.Elger/BH/JRD	Commence preparation on metadata and DOI for 2016 INTERMAGNET Reference Data Set (IRDS-2016) 1991 – 2016	In progress
P.A25	AL	Make Quasi-Definitive comparison software available on GitHub	Completed 2019-08-15
P.A26	BH/SB/E.Clarke/J.Fee/SF	Prepare a DOI discussion document suggesting best practice and offering advice to IMO's on using DOIs – carried over from Vienna	Not started
P.A27	AT/GH	INTERMAGNET letter of support for nanoMagsat	Completed
P.A28	SF	Investigate inclusion of metadata from "readme" files into DOI information (and	Not started

		definitive data IAGA2002 file headers) to describe known issues with definitive data	
P.A29	Committee/community	Inspect "intermagnet.github.io" and provide feedback on style and content to CB	At least one review was provided
P.A30	Committee/community	Create a GitHub account – email link to be provided by CB	Many committee members opened a GitHub account

4.2 Outstanding items from previous meetings

Number	Responsible	Description	Status (Green = completed, Orange = ongoing; Red = not started)
P.A19 (Vienna, 2018)	AT	Arrange an INTERMAGNET discussion session during the next IAGA observatories workshop	To be completed Kazan workshop was postponed.
P.A22 (Vienna, 2018)	AT	Investigate data disclaimers and the question of liability in relation to commercial/privately funded observatories joining INTERMAGNET	no reply from BGS legal team. Requires some more discussion in EXCON given IMAG is not a legal entity AT (7th July 2020): Not now convinced we are liable in any way. Each institute has individual disclaimers.
P.A24 (Vienna, 2018)	SF	Publish new version of IMCDView and data format conversion software on GitHub	Superseded by P.A20

4.3 Secretary Correspondence

Since the Ottawa meeting a small number of emails were received and answered through the secretary_intermagnet@gfz-potsdam.de email address.

Date	Details
2019-10-29	Martin Schmidt (GUX-Aasiaat) High School teacher seeking data from Godhavn observatory.
2019-11-22	Andy Smith (University College London) Notification of INTERMAGNET data used in publication. Smith, A. W., Freeman, M. P., Rae, I. J., & Forsyth, C. (2019). The influence of sudden commencements on the rate of change of the surface horizontal magnetic field in the united kingdom. Space Weather, 17. https://doi.org/10.1029/2019SW002281
2020-03-17	Emmanual Lokoti Seeking observatory or variometer data from the Lake Naivasha area of Kenya's rift valley.
2020-04-03	Sajith Babu S (Catholicate College, Pathanamthittam, India) Seeking explanation of the terms co-latitude and east longitude
2020-04-24	Patrick MontPlaisir (Western Area Power Administration, Sierra Nevada USA) Availability and licence conditions for observatory data for U.S. DoE requirements for GIC monitoring under TPL-007-3 R12

Michaela Gleave, a Sydney (Australia) based multi-media artist requested access to low-latency observatory data for a smart-phone app to "sonify" magnetic variations. Michaela also contacted SF (Edinburgh GIN), BH, CT and a number of other IMOs.

5 Presentation in plenary sessions

5.1 Progress on one-second data (JRD)

A report on the situation with one second definitive data collection from 2014 – 2019.

https://intermagnet.github.io/meetings/2020-Online/Reda_Progress_on_one_second_data.pptx

One second definitive data has been collected since 2014. For 2014 nearly all the submitted data have been checked and accepted. For later years, while the amount of submitted data is similar to 2014, the amount of accepted data has declined due to problems with checking ImagCDF format files, checking procedures and data checker resources within INTERMAGNET.

SF inquired if the MagPy or gm_convert software tools were useful for checking the data and converting from ImagCDF to IAF format. SF also asked if any of the one-second definitive data are made available to users.
JRD replied that data which have been checked are on the Paris-GIN ftp server and could be published on the INTERMAGNET web site.

AM asked if there are any plans to upgrade the IMCDView software with the ability to read ImagCDF format files.
SF replied that we don't intend to do this. In fact we intend to remove all of the parts of the software that can read and convert data to IAF format, since this functionality is now available in the gm_convert software. The gm_convert software can already read CDF format files.

5.2 Report on definitive data timeliness (JRD)

A summary of definitive data for 2017-2019 and preparations for IRDS-2015 and IRDS-2016.

https://intermagnet.github.io/meetings/2020-Online/Reda_Report_on_definitive_data_timeliness.pptx

120 IMOs provided data for 2017, 112 for 2018, and so far 76 have submitted for 2019. The situation for 2019 is much better than normal for this time of year, both in the number of IMOs which have submitted data and also the number accepted. About 40 IMOs have not yet provided 2019 data. 25 years of data have been published in USB2015, this has also been published as IRDS-2015. Data for IRDS-2016 have been compiled and uploaded to ftp servers on the Paris GIN and GFZ.

5.3 Progress on IRDS and DOIs (SF)

A report on future directions in publishing INTERMAGNET data.

https://intermagnet.github.io/meetings/2020-Online/Flower_irds_and_dois.pptx

INTERMAGNET data will no longer be published on a physical media, rather it will published as a DOI referencing the INTERMAGNET Reference Data Set (IRDS). From 2015 onwards the entire INTERMAGNET data set, commencing from 1991 will be published each year. The landing page for the DOI includes metadata for each IMOs, a list of contributors, licensing conditions for the data and a link to download all the data. The data associated with each DOI will not change and any corrections required to the data set will be applied to the IRDS in following years. 2015 was the last year INTERMAGNET data were published on a physical medium and also the first year the entire data set (from 1991 to 2015) was published together. The 2016 data have been collected, the next step is to create the metadata and build the landing page.

CB asked if definitive data still need to be hosted on INTERMAGNET infrastructure.
SF and JM suggested it will not be problem if data are available on both the INTERMAGNET site and the DOI landing page at GFZ.

BH questioned if it will be necessary to create DOIs for the older versions of the data.
AM suggested DOIs to reference the data CD/DVDs should be created.
CB noted that the CD/DVD iso images will not remain on the NRCan INTERMAGNET site and suggested a DOI for the older CD/DVDs should be set up on the GFZ site instead.
SF said we certainly intend to create DOIs for the earlier publications (from 1991 to 2012). We have prioritised current publications (2015 onwards), and as usual the issue is finding time to do the work. Maybe someone could volunteer to take this on? The main task is creating the XML metadata needed for creation of the DOIs, but there are now 3 examples of this (for the 3 DOIs already created), so it should hopefully not be too big a task.

5.4 Future of the INTERMAGNET web site and archive (part 1) (CB)

A report from NRCan on the future of the INTERMAGNET web site and data archive.

https://intermagnet.github.io/meetings/2020-Online/Blais_imag_web_site.pptx

The Canadian government can no longer support the INTERMAGNET web site and data archive due to reduced staff resources and funding. For the last 2 years alternative options have been explored, including moving the web site to github.io and that must now happen by 2020-09-01. Much of the work to move the web site has been completed. The Technical Manual, Data Format and applications are yet to be completed. Technical Manual can be made available as PDF, Data Formats can reference the Technical Manual. Some applications will need to be deprecated until they can be redeveloped. BGS will host data downloads, plots and the data archive.

TR said his institute was interested in developing new applications using INTERMAGNET real-time data.
CB Explained that any Institute developing new apps will need to get the data from the new BGS archive and host its own application products.
SF said data from the Edinburgh GIN should soon be available when password protection is removed.

CB asked the GIN managers if they will be able to re-direct their rsync feeds from NRCan to BGS. CB also noted that Canada converts IAF definitive data downloaded from the Paris GIN to IAGA-2002 using an old Java program and asked if definitive data will still be hosted by INTERMAGNET or will it be only available via the DOI landing page at GFZ

SF thinks the definitive data conversion and distribution should continue to be done through the web portal since it is available quicker on the web site than via the formal DOI publication

5.5 Future of the INTERMAGNET web site and archive (part 2) (SF)

Progress on transferring the INTERMAGNET data archive to BGS

https://intermagnet.github.io/meetings/2020-Online/Flower_imag_web_site2.pptx

BGS has reluctantly agreed to take over the task of hosting the INTERMAGNET data archive from NRCan. Arrangements for storage space and security issues have commenced within BGS. Changing rsync data transfers from the GINs from NRCAN to BGS are yet to be arranged and the transfer of data held at NRCan must be organised. Data download and plotting services need to be considered. The Edinburgh GIN has some systems in-place but more features are required and there will be little chance for system development before the transfer deadline. The BGS system currently has no provision for calculation and display of hourly ranges or creating data download logs. There is much to be done, help from other institutes is welcome and users may have to accept an initial reduction in services.

5.6 Status of technical manual V5 (BSL)

A status report on version 5 of the Technical Manual.

https://intermagnet.github.io/meetings/2020-Online/StLouis_Technical_Manual.pptx

All minor corrections and additions called for during the Ottawa meetings have been submitted and recommendations have been included in the draft version. An online meeting was convened at the end of 2019 where inclusions for V5 were finalised. Delays have been experienced in 2020 due to Covid-19 but the manual is now ready for distribution. The latest version of the manual will be made available on the new GitHub web site. From version 5 onwards the version number will be a three-digit number with the most significant digit representing major revisions in the content or structure of the manual. The middle digit is for minor additions and the third digit is for minor corrections or re-wording which do not affect IMO operations – there may be several of these minor changes each year.
A DOI for version 5 will be available soon and already the next version is under development. We need to finalise details of distribution, usage and contributions to the manual via the new GitHub platform.

BSL was congratulated on finalising TM V5 to the point of publication and thanked for his efforts.

JM mentioned that data managers within GFZ have suggested publishing the TM and also other INTERMAGNET documents as a series called "INTERMAGNET Technical Reports" with INTERMAGNET and the Albert-Einstein Library as publishers
SF confirmed he is happy for the new version of the manual to proceed and be distributed via GitHub. A DOI is definitely required for the TM, and he asked how TM content updates can be reconciled against the immutability required of a published DOI.
JM suggested the TM on the web can be dynamic and a PDF version can be released up to several times each year with a new DOI as necessary.

BSL explained the TM will be available on the INTERMANGET GitHub web site as a pdf file to start and ultimately hoped to have links from the website to specific sections in the manual in html format.

CB clarified that documents on GitHub can be either markdown or html format or can be hosted as PDF files embedded on an html page. The PDF option loses all version control features and the ability to link to specific sections in the manual.
SB described two possible options - the manual as html on GitHub which will allow version control and tracking (but loss of printability) or, alternatively the manual could be developed as a shared document within the committee and converted to html for GitHub (this does not allow for individual change tracking but does allow printability).
AM noted that there are format converters for markdown to pdf.

5.7 Quasi-definitive data comparisons with definitive data 2017 (AL)

A compliance study of quasi-definitive data for 2017

https://intermagnet.github.io/meetings/2020-Online/Lewis-qd_comparison2017.pptx

Quasi-definitive data for 2017 was checked for compliance against the data standard. Data from 69 IMOs was available for the study. A total of 4 IMOs (23 months) of data where found to exceed the monthly mean difference of 5 nT between definitive and quasi-definitive data. 11% of daily data files were submitted after the three-month publication delay deadline.

SK noticed a larger than expected monthly differences in PET data and after re-visiting the data discovered the reason for this problem.

JM suggested that those IMOs found to be non-compliant should be notified and asked if it was possible to know the reason for discrepancies in the data.
AL replied that only the IMOs themselves will have the information available to investigate the reason for discrepancies in data.

SF explained the publication date in IAGA-2002 files from the Edinburgh GIN is derived from the file modification date but the Edi-GIN does do latency checks on all data and these checks could be used to analyse QD data latency. When password protection is removed from the GIN the latency data may become available again.

6 Next meeting

If the next meeting is to be a face-to-face then SF suggested the two options of holding it alongside the IAGA/IASPEI assembly in Hyderabad (Aug 2021) or alternatively associated with the Geomagnetism workshop in Kazan which was postponed from July 2020 until May or June 2021. It is also necessary to consider the possibility that next year international travel may still not be possible or may have less support from institutes. A compromise could be planning for another online meeting in six months.
CB supported an online format for the next meeting with continued contributions via GitHub.
BSL said this meetings was more effective than he expected and the mix of document and online real time meetings used by the TM committee worked well.
JRD is happy with online meetings as he has difficulty getting funding for international meetings.
AL suggested the best way to ensure certainly is for an on-line format.
TR supported an on-line meeting in 6 months.

AT also supported an online meeting and added the meeting structure worked well but lacked interaction between subcommittees and would encourage a means to allow more interaction.
The format and date for the next meeting was further discussed during a follow-on virtual meeting held soon after the main meeting and attended by Chairs and secretary. It was decided the next INTERMAGET meeting should take the form of an on-line document meeting in about six months time (early in 2021).

7 Decisions and action items

7.1 Decisions

P.D20.1	The next meeting will be a virtual meeting in early 2021

7.2 Action items

Many of the action Items considered in plenary sessions have been captured within the council and subcommittee action items in the sections below. Those actions items not fully included in the council and subcommittees lists are included here.

Number	Responsible	Description
P.A01	chairs/AL	Complete subcommittee reports, decision logs and action item list by 6 weeks after completion of the meeting
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P.A14	SF	Finalise the list of attendees and resolve any non-attendance

		issues 6 weeks before the next meeting
P.A15	SF	Request committee members for agenda items for inclusion at the next meeting and request chairs to create subcommittee agendas
P.A16	SF	Include item on next meeting agenda to seek views on effectiveness of INTERMAGNET's communication with community
P.A17	SF	Announce INTERMAGNET meetings on worldobs mailing list
P.A19	SF	Publish draft agendas 2 weeks before the next INTERMAGNET meeting
P.A20	GIN Managers -VM, HT, Abe Claycomb(?)	Investigate re-directing rsync data stream from NRCan to BGS
P.A21	AL	Inform IMOs with non-compliant 2017 QD data
P.A22	AL	Investigate availability of data latency information at GINs
P.A23	SB	Evaluate options to integrate Technical Manual V5 into git repository
P.A24	BSL	Publish TM version 5.0.0
P.A25	Committee members	Offer suggestions for prospective members for the Data Checking Task Team and committee members with web development skills.

8 Executive Council

14:00-16:15UTC, 14th July 2020, Online via Zoom

8.1 Participants

Krissy Lewis, Gauthier Hulot, David Boteler, Alan Thomson

8.2 Agenda

1. Report on progress on EXCON Ottawa 2019 Action Items
    - Follow-up on any related/relevant items
        - '25 years of IM data' paper for EOS
        - Geophysical measurements at IMOs (web-form survey)
2. Discussion Potentially Leading to Decisions
3. General Discussion & Information Exchange
    - Status of committees and activities
        - EXCON
        - OPSCOM
            - Progress on definitive 1-minute data
            - Progress on 1-second data
            - Progress on the Technical Manual
            - Progress on DOIs and data licensing
    - Items from EXCON members
        - USGS
            - Remaining concerns about SuperMag
            - Variometer data/networks
            - Real-time access of INTERMAGNET data
        - IPGP
            - Nanomagsat
        - NRCan
            - Variometer networks
        - BGS
            - None
    - INTERMAGNET future
        - New opportunities?
        - Communications?
            - Advertising INTERMAGNET via …?
            - Updates on and links to external organisations
                - e.g. IAGA, IUGG, COSPAR, EPOS, SuperMAG, OSCAR-WMO, UN-COPUOS,…
4. Review of Action and Decision Items

5. AOB

8.3 Action items

8.3.1 Progress on EXCON action items Ottawa meeting (2019)

Action	Responsible	Description	Status Green completed, Orange ongoing; Red not started
EXC.A1	EXCON, J.Love	Co-located instruments review: A web-form was drafted by USGS, to implement EXC.A7 from 2018, intended to survey other geophysical monitoring carried out at IMO facilities. JL will liaise with USGS colleagues on the present state of the web-form and EXCON will then issue the web-form as is and take stock of the results received. The initial focus will be on any electric field and higher frequency measurements, with the motivation here being the possible future development of standards in these areas by INTERMAGNET. This will complete EXC.A7 from 2018.	Web form, prepared by USGS, ready for distribution to IMOs Request IMO chair issue link to web form to IMOs with covering email.
EXC.A2	EXCON; IMO, TM committees	Liabilities for data (mis)use and IMO status removal: amendments to application form and technical manual: Amend the IMO application form such that any INTERMAGNET applicant agrees to Terms & Conditions explicitly. The application document should also be signed at a legal signatory level for any institute joining INTERMAGNET. Amend the Technical Manual in line with this, where appropriate and necessary. EXCON members will also seek opinion on INTERMAGNET's position from their institute's legal departments to get a broad legal view on INTERMAGNET as an organisation, its responsibilities and liabilities.	Ongoing re T&Cs and TM Will be added to TM V5.0.1 as V5.0.0 is closed for any new additions. Feedback from institute legal departments refer to institute-level disclaimers on data and services as 'protection' against liability. IMO application form has been updated (V3.3) and is available at https://intermagnet.github.io/membership.html but yet to be implemented on intermagnet.org
EXC.A3	AT, JM, OPSCOM	Update relationship with SuperMAG: We will engage constructively with SuperMAG, through the SuperMAG international steering committee, to reflect better the relationship, roles and services respectively of SuperMAG and	MoU signed and SuperMAG website changed to reflect INTERMAGNET wishes (which is an improvement if not perfect) AT and JM on SuperMAG

		INTERMAGNET for geomagnetic data users. The Memorandum of Understanding with SuperMAG therefore needs updating, partly also to reflect EXC.D19.1. AT will reply to SuperMAG on EXC.D19.1 and OPSCOM will support implementation of EXC.D19.1 where necessary. We will issue a guest invite to J. Gjerloev, as lead PI for SuperMAG, for the next INTERMAGNET meeting.	steering committee No invite issued, due to Covid-19 situation but will review for next time
EXC.A4	OPSCOM	INTERMAGNET website review by user community: It seems timely to consider how our website looks and feels to users. This view is also partly prompted by comments by some users in having difficulty in finding real-time data and in bulk downloading of data.	Moving to GitHub allows greater editorial control of content by members (CB). Given other OPSCOM activities, any follow up on this is not a priority at this time.
EXC.A5	OPSCOM	INTERMAGNET invites Kakioka to join the data checking team: Applications to join the INTERMAGNET data checking team are welcome and we will work with all applicants to help with any administrative issues for each institute who wish to join the team. We therefore very much welcome Kakioka's offer to assist and look forward to their active participation in the data checking team	Completed
EXC.A6	BSL, TM committee, SF	Technical Manual v5.0.0: We encourage the TM committee to complete, issue and advertise the Technical Manual V5.0.0 this year and devise a roadmap towards V6.0.0	Completed, TM V5.0.0 is ready for distribution and has been advertised in the meeting report to IMO. List of new additions has been created following Ottawa meeting and will be prioritised towards future versions at this meeting.

8.3.2 Outstanding items from previous meetings

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

Action	Description	Status Green completed, Orange ongoing; Red not started
EXC.A1-2018	web service and archive host	EXCON supports the OPSCOM approach outlined in plenary session, in investigating separating the web service and data archive and having a test period of operations, over about one year to help define an optimum solution for the future of both of these activities.

		2020: would like to hear an update on this
EXC.A7-2018	review of geophysical monitoring at IMOs	Progress on this had been halted by exit from USGS of a student who developed the draft web-form with C. Finn. J. Love will investigate the current status of the web-form with a view to EXCON then issuing the form, probably largely in its present state, to the IMO community, primarily to assess what is being done in the areas of geo-electric and search coil measurements. EXCON remains interested in whether there is a future role for standards-setting in these areas, not least because of the growth in interest in hazardous geo-electric fields. This AI has therefore been re-stated as EXC.A1 for 2019. 2020: see EXC.A1 for progress
EXC.A9-2018	"25 years of INTERMAGNET data" paper for EOS magazine	AT will lead the drafting of this with support from EXCON colleagues and J. Love. 2020: Draft available, no comments received to date and otherwise ready to submit

8.4 Discussion on progress on EXCON Ottawa 2019 action items

8.4.1 Web form survey of other instrumentation

Two comments were received from OPSCOM, minor in nature, regarding clarity of questions. Those respondents felt that it will be important to specify the purpose of each instrument and what it is, in the replies to questions and the role of partner institutes. EXCON therefore made some edits to sharpen the web form questions, to narrow down the range of answers that could be expected, allowing easier identification of emerging themes. EXCON also expanded a few of the questions to solicit more information. For example, we are also interested in other institutes operating on our observatory sites and not just concerned about traditional observatory instruments. We are also interested in data collection protocols and transmission, e.g., as used in other sciences.
The Web form is now ready for submission to IMOs by OPSCOM chair.

8.4.2 Liabilities

Where does the responsibility lie for data: with the institute or IM collectively? IM offers checking of data provided by institutes but does not edit data or add value in other ways. EXCON therefore argues that we should simply state clearly in our documentation that IM accepts no responsibility for how IM data are used. In addition, advice from USGS and BGS legal people is that our standard institute disclaimers apply to any data released to IM. Similar disclaimers will be in place for other institutes. Therefore, other than providing a disclaimer on the website and in written communications and directing end-users to the policies of institutes whose data they may use, there is no need for additional legal 'protection'.

8.4.3 SuperMAG

Some aspects of the relationship with SuperMAG are still an issue for some IM members, and the changes already made on SuperMAG website are welcome but not perfectly in line with our wishes.

Incremental changes can certainly continue to be proposed through the SuperMAG science steering committee reps (JM and AT). One idea is to sit down with Jesper and go through the website line by line. We would consider this and we will also invite Jesper to any future face-to-face IM meeting, once the Covid19 issue is more 'resolved' and we meet again. He could also join any online meeting, e.g. briefly to discuss our mutual interests.

8.4.4 Website review

Nothing to discuss. We are happy to see IM members edit via GitHub and do not see a major revamp as a priority at this time. Closed.

8.4.5 Data checking team

Completed. Thanks to Kakioka colleagues for joining this important activity. We always welcome new data checkers and wish to give them full recognition via website and in other ways.

8.4.6 Technical manual

As this is now complete, there was nothing to discuss on this topic. Well done everyone on completing v5.0.0!

8.4.7 EXC.A1-2018 Relocation of web service and archive

Parts of this section have been removed from this public copy of the minutes as it contained discussions about individuals, observatories and institutes.
SF and CB are working through the handover of web service and archive from NRCan to BGS to a September deadline. Whilst welcome in the short term, to provide continuity of operations, we would prefer greater diversity through different IM members hosting IM activities as a better long-term solution. We don't want IM to be perceived as UK or western-centric for example. We therefore look for institutes to volunteer to take tasks on. If we can help we will be happy to do so.

8.4.8 EXC.A9-2018 25 year paper

This was discussed, agreed as being appropriate and indeed the article is ready to go to EOS (AT to progress).

8.5 Discussion and decisions

Nothing to formally decide. We did note though that it is important to recognise and highlight the role of data checkers for their own personal and their institutes benefit.

8.6 General discussion

8.6.1 Status of committees

Combining face-to-face and online working is quite possible and we seem to have no problem in carrying out the work programme we have. However, we would like a summary from the subcommittees on how they felt the meetings and activities went this time. We therefore suggest that we get together with committee chairs in a wash-up meeting to make sure all work has been done and to talk about online format and lessons learned? Perhaps in a week or two, to allow time for reflection. Simon to organise?
Do subcommittees consider succession planning for members and chairs? Something to consider.
Discussion on DOI and data licensing:

It was suggested that the DOI policy be stated clearly in the IMO application form: ask applicants via the application form to explicitly agree to IM policy on DOIs and licensing, or if they have local institute issues with their own data then we need to have clarity on what applies to the data. E.g. add to application form: "Please check the IM policy on DOIs and data licensing and state how it fits with your own institute's policy". This discussion lead to AI-1 on IMO/TM subcommittees

8.6.2 Other EXCON items?

USGS:

- SuperMAG – discussed above
- Variometer data/networks – USGS would be interested to participate if IM moved to include variometer data in our data holdings. The USGS interest is driven by developments on the seismic side via the IRIS website and what we can learn from other sciences to then apply in geomagnetism
- Real-time IM data - difficulties in accessing real-time data by some USGS individuals, either via website, or not – and how will this change on new website – ftp or?. A bit more clarity in the documentation on how to get real-time data is requested.

BGS:

- no issues

NRCan

- Not now sure why we should consider creating a variometer database, e.g. as SuperMAG already does this. Could muddy the waters in users' minds. We suggest waiting for web form survey results for insights into any demand. IM has anyway only limited human resources that may be best deployed elsewhere.

IPGP:

- The NanoMagSat proposal was submitted to ESA yesterday (13th July). This would be a constellation of three satellites with an end of 2023 first launch. The mission would provide 1Hz calibrated magnetic vector and scalar data, very low noise 2 kHz magnetic vector and scalar data, 2 kHz electron density Langmuir probe data and dual frequency GPS data (for TEC and occultation). The orbits would be one polar orbiting satellite, plus two satellites at 60 degree inclination starting at 575 km. This would provide a quick Local Time coverage. Feedback on the proposal and any resubmit will occur end-August, with a yes/no decision in the autumn.

8.6.3 IM future/communications

Nothing significant to report or discuss. All external organisations are busy with the Covid-19 situation therefore there are fewer communication demands on IM from others and less need to respond. As a general observation, there will be new means and methods for communications, in general going forward, that will change interactions for everyone.
A suggestion to quickly increase the profile of IM was made, through using Twitter to retweet high-profile publication tweets issued by individual institutes' communications teams, where these publications use IM data. We will look into this for next year, which led to AI-2 on EXCON: create a subcommittee on communications to attract younger scientists?

8.7 Decisions and action items

8.7.1 Action items

Action	Responsible	Description

EXC.AI-1	CT, BSL	The IMO application form and technical manual (as required) is to be amended to draw applicants attention to the INTERMAGNET policy on DOIs and data licensing and also to explicitly require applicants to either agree to this policy, or to state the conditions under which their institute's data may be used.
EXC.AI-2	AT, EXCON	Explore issues and ideas around use of social media to boost INTERMAGNET's profile and engagement with younger scientists, perhaps leading to a specific subcommittee on communications.

8.8 Any other business

None

Meeting ended at 16:15 UTC

9 Definitive data subcommittee

9.1 Participants

9.1.1 Committee Members:

Jan Reda (JRD, chair), Achim Morschhauser (AM), Andrew Lewis (AL), Benoit Heumez (BH), Charles Blais (CB), Hiroaki Toh (HT), Roman Leonhardt (RL), Sergey Khomutov (SK), Simon Flower (SF), Tero Raita (TR), Virginie Maury (VM)

9.1.2 Other people mentioned in the minutes:

E. Clarke, S. Macmillan, Alan Thomson (AT).

9.2 Agenda

1. A review of progress on action items from the Ottawa Meeting 2019.
2. Reports on the 1-min and 1-sec Definitive Data collection.
3. What to do if a cross-checking is significantly delayed?
   - What to do if a cross-checker needs a mediator?
4. IYFV issues
5. An idea of a checklist and other issues related to quality control of definitive
6. What are expectations from one-second definitive data?
7. Discussion on data checker reports.
8. DD Subcommittee Action Items following the Online Meeting 2020

9.3 Review of actions items

9.3.1 Actions items from Ottawa (2019)

Action	Responsible	Description	Status Green completed, Orange ongoing; Red not started
DD.A1	JRD	Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2019 by end of January 2020. The deadline for data submission is July 1st, 2020.	Sent to IMOs 2020-02-10
DD.A2	JRD	Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2018 – February 2020. The deadline for data submission is October 1st, 2020.	Sent to IMOs 2020-02-24
DD.A3	JRD	Compilation of definitive data 2016, 2017.	IRDS2016 compilation is already uploaded to GFZ server IRDS2017 compilation advanced

DD.A4	HT	Comparison of one-minute values calculated from 1-sec definitive with one-minute definitive values reported in IAF files.	Not started, partly due to COVID-19
DD.A5	BH, TR, JRD	Complete the writing guidance how to check INTERMAGNET 1-minute definitive data.	Advanced, but not finished
DD.A6	JRD	Organizing an interim Internet meeting of Definitive Subcommittee on December or January.	There was not interim meeting
DD.A7	RL	Preparation guidance how to use MagPy both as windows application and command line application for 1-sec data checking.	A manual for MagPy has been written and published. A discussion document on one second data checking with examples based on MagPy analyses, has been started on GitHub
DD.A8	BH	Completion of USB cover project, production and distribution of USB2015 with 25 years of definitive data sets.	Done.
DD.A9	AL, CB	Publish details of the definitive data cross checking task teams on the INTERMAGNET web site and include the benefits to employers/institutes of team membership. (see also EXC.A5)	Done. https://intermagnet.github.io/data_checkers.html
DD.A10	RL, BH, AL E. Clarke, S. Macmillan	Consider the IYFV format description to clarify a number of uncertainties in the format including amongst other things, the source of the total field (F) annual means, the form of longitude and the meaning of the "I" incomplete flag – at least one external data user should be included in the responsible group (suggest Susan Macmillan -BGS)	Done
DD.A11	JRD	Notify all IMOs of the requirement that minute means must be calculated to align to the start of each minute (hh:mm:00) and contact all data checkers to request they confirm definitive data comply with this requirement.	Sent to IMOs 2020-06-25

9.3.2 Outstanding action items from previous meetings

Number	Responsible	Description	Status Green completed, Orange ongoing; Red not started
DD.A1 (2018 Vienna)	TR, BH, RL, SK, AL	Preparation of a guide how to prepare, especially how to check, 1-min and 1-sec definitive data	Started needs further work before being publicized Received Version 0.2 document from TR,

			updated by BH for 1min data. Added IMO app check document by Chris and cleaning the document DD.5 for online discussion. 1sec data guide to be done after.
DD.5	BH	Production and distribution of USBs 1991-2015	Done. USB2015 distributed in Autumn 2019

9.4 Reports on the 1-min and 1-sec Definitive Data collection

9.4.1 One-minute definitive data collection: 2017 - 2019

9.4.1.1 Definitive 2017

Situation on 2020-07-07 - 2 years after deadline

Step	IMO Count
Received binary (step1):	120
After cross-checking (step2):	113 See note *1
Fully accepted (on Intermagnet web):	113

9.4.1.2 Definitive 2018

Situation on 2020-07-10 - 1 year after deadline

Step	IMO Count
Received binary (step1):	112
After cross-checking (step2):	97 see note 2*
Fully accepted (on Intermagnet web):	96 see note 3 *

9.4.1.3 Definitive 2019

Situation on 2020-07-07 - 1.5 weeks after deadline

Step	IMO Count
Received binary (step1):	76 (max. expected 120)
After cross-checking (step2):	34
Fully accepted (now or soon on web):	31

*Note 1: missing DLT, JAI, ORC, PEG, SJG, SON, SPG (Dalat, Jaipur, Orcadas, Penteli, San Juan, Sonmiani, Saint Petersburg)

*Note 2: missing BLC, BMT, CBB, CYG, DED, DLT, HER, NUR, ORC, PEG, SJG, SON, SPG, SUA, VAL (Baker Lake, Beijing Ming Tom, Cambridge Bay, Cheongyang, Deadhorse, Dalat, Hermanus, Nurmijarvi, Orcadas, Penteli, San Juan, Sonmiani, Saint Petersburg, Surlari, Valentia)

*Note 3: missing NAQ (Narsarsuaq)

9.4.2 Compilations and publications of 1-min definitive (since Ottawa Meeting)

- USB2015 (1991..2015) produced and distributed by BH in Autumn 2019
- IRDS2015 DOI (1991..2015) published in June 2020
- Completed compilation IRDS2016 (1991-2016) already uploaded on:
  - ftp://anonymous@datapub.gfz-potsdam.de/upload/INTERMAGNET-upload/
  - ftp://steptwo@par-gin.ipgp.fr/IRDS2016/

9.4.3 One-second definitive data collection: 2014-2019

Situation on 2020-07-03

Year	Provided	Accepted
2014	38	36
2015	36	12 (USGS only)
2016	36	13 (USGS only)
2017	30	7
2018	6 (ABK, BDV, EBR, LYC, UPS, WIC)	0
2019	2 (EBR, WIC)	0

The situation regarding data formats (one-sec)
2014: All IMOs provided data in IAGA2002 format
2015-2019: Most IMOs provide data in ImagCDF format except of USGS (still IAGA2002)

Problems regarding one-sec data collection:

- The most important thing that should be done while checking is a comparison with 1-min definitive, for this purpose, we need to convert CDF to IAF
- There are difficulties related to conversion from CDF to IAF
- Paradoxically, actually, it is easier to check 1-sec/IAGA2002 than 1-sec/CDF
- A lack of people who have time for checking 1-sec definitive, which is certainly more time-consuming than 1-min data checking.

SF: Could we change the title on the 2015 DOI to include the words "INTERMAGNET Reference Data Set"?
JRD: The title "INTERMAGNET Reference Data Set" is closer to reality. Maybe it is worth to add period e.g. 1991-2015. The title "Global magnetic observatory data 1991 - 2015" suggests that DOI includes all observatories (also non INTERMAGNET).

9.5 Discussion on what to do if cross-checking is significantly delayed or a cross checker needs a mediator?

JRD: It seems necessary to introduce a time limit for cross-checking (at least starting cross-checking). In the past took place situations that observatories provided correct data before the deadline was on the list of risk. There are situations that data checkers simply have not enough time for checking or there are other reasons for the delay. On the other site, IMOs and INTERMAGNET can't wait forever. I think that in such cases DD subcommittee with IMO subcommittee should make any decision what to do, accept the data or wait, or other decisions. In my opinion, a role of mediator or duty of judge belongs to IMO subcommittee.
AL: I agree that a time limit for data checking is required. Starting time is fully in the control of the checker, finish time depends on both checker and IMO. Perhaps start within 8 weeks from arrival of data

into Par-GIN step1 and finish within 24 weeks. Whatever time period is chosen it must be stated in the annual "Call For Data" and also in the "instructions for data checkers".
In annual "Call For Data" emails it is stated that checking should be finished within 6 months:

> *"A communication between IMOs and the responsible person, about eventual corrections, should start as early as possible and all issues should be addressed and sorted no later than 6 months after the first submission on Step1."*

When the checker knows it is not possible to check in the allocated time then perhaps a voluntary swap to another checker (via private communications or data_checker email list) is allowed?
For mediation:
In most cases only the checker and the IMO are aware of progress or problems with checking so both checker and IMO require the right to request resolution of the problem - possibly via re-allocation of checking duties (with agreement from new checker, old checker, IMO and mediator/DD Chair) or mediation.
Do we need the formal appointment of a "checker team leader/chief/mediator" or is that automatically DD Chair?
On the side of the checker: a good first step is to seek opinions from others via data_checker email list.
On the side of the IMO: contact the mediator.
The mediator could request explanation from checker and IMO; check data personally; re-allocate checking; submit for comment to checking team; call for a vote within checking team;

TR: I bring my point of view about deadline. At the moment deadline of the definitive data call is 1st July. Most of the submission comes in June. July is main holiday season in Finland, which will take first 4 weeks. For me already meetings in July breaks/postpone always holiday. There are pending actions waiting in August as the reserve staff is limited, so starting of the checking is quite impossible during summer time. Then Aug-Sep is our main field operation season before winter.
In my case the IMOs on list of concern have caused lot of work. I do not believe these IMO submission would pass IMO application study done today. I think we should have more open discussion between data checkers, what to do with problematic cases. I started discussion of one common problem seen in IMO submission. My own opinion might be more strict than other data checkers, so deciding the future of IMO membership only to my analysis might not be fair, when other IMOs data with same quality is accepted. I am not demanding nothing special, but IMOs are not able to fill. So far, I have trusted that the IMOs are capable to find what can be done, when I tell that IMO should correct baseline adoption and think other approach in it. Each one can download INTERMAGNET dataset and look other IMOs BLV files, how the adoption looks.
I would like to see, that these kind of IMOs are estimated with larger group (datacheckers email list/ IMOApp committee/DD committee??).
In general it is not highly motivating to check again and again same problems from same IMO contact with seeing any effect of the feedback given, when the data is accepted. Same time I see own region good quality data lying even longer at STEP1 without checking. Some rotation in IMOs for checking would be nice, way or other.

BH: I understand your point Tero, all 14 of IMOs I have to check were loaded on STEP1 in May/June just before I started 5 weeks on the repeat stations. Then comes holidays and follow all urgent matters. 2 months will be passed before I have the chance to start data checking.
There was this idea for data-checkers, whenever they have time to check any IMO available in STEP1. They would do that for a given amount of IMOs (14 in my case). This would probably shorten the waiting list but would need a different organisation so the same IMO is not checked by different checkers. On the

downside, some checkers (probably me too) would tend to avoid problematic IMOs. And the long term relationship between IMO and data-checkers will be lost.
The 6 months deadline already in annual call-for-data is reasonable. Maybe 6 months after the deadline the DD sub-com (members, not JR alone) can review long standing IMOs on STEP1?
The data-checker email list is recent and underused. I hope data-checkers will share questions and problems and ask for help if needed.
For mediation, I was the one asking for this topic. I encountered a problem with definitive data, trying to push the provider for correction but months pass and no modification arrived. I turned to CT and JR for their opinion and finally asked the IMO subcommittee to deliberate. But I know INTERMAGNET, the people, it is not the case of all checkers.
I'd like simple guidelines/process on how and to whom get help within INTERMAGNET. This is to be written in the 1min data checking document. A statement somewhere is needed to show definitive data is not refused/accepted by data-checkers but by INTERMAGNET.

9.6 IYFV issues

The discussion was focused on the document DD.A10_Ottawa2019_AppendixC_v2.docx regarding IYFV1.02 INTERMAGNET DVD/CD-ROM format for yearmean file. The document has been amended and is included in the appendix.

SK noted that if east longitude is used, then symbols "E" and "W" is not needed and also asked if IMO need to calculate the mean time of data used to calculate annual values.

SK – commented that the F value in the annual means should be the F value obtained by an independent scalar magnetometer because (1) F from variometer measurements can be calculated by the user and (2) independent F gives additional tool to check component data, (3) sometimes the user can get more complicated set of independent F, if variation data has been lost]

SF – suggested in a definitive data set such as this I think we should present only final data, corrected to the observatory pillar and consistently calculated from original geomagnetic elements. Whatever decision we make on this, though, the most important thing is to document what has been recorded so that users know. We can probably not go back over historic data and change it (even if we want to), but I think we should document what has been recorded where there is any doubt. Could an additional character be added to indicate source code 'F' component (vector, scalar or unknown)?

SK -asks with reference to "EEEE" what is recorded elements.. For example, IMO KHB use the dIdD as main variometer and the measured elements are D,I,F. Also KHB use scalar magnetometer with continuous recording. What is combination EEEE is true?

9.7 Discussion on a check-list and other issues related to quality control of definitive data

AL: Have the members of the one-minute data checkers group been asked if they are willing and able to contribute to 1 second data checking?

SF: Are we currently making any of the definitive 1-second data that we've been sent available to users (e.g. through the INTERMAGNET web site)?

> *JRD: There are checked IAGA2002 1-sec definitive on Paris ftp server. I think these data (so far not stamped) could be sent to INTERMAGNET web site.*

AM: Is there any plan/attempt to upgrade ImCDView such that CDF files can directly be read? In (far?) future, we should rather directly check 1s-data, and test the minute-data against it (as we do today four hourly data….).

TR: I tested check1min in Wine software, which allow the run Windows executables in different platforms. I tested it in Mac OS 10.12.5. It seems to work. DOSBox does not work as the check1min needs win32 for running.

AM: I plan to rewrite check1min in Java. JRD has provided all the details and source code of check1min to me.

JRD: Sometimes using EXE file under No Windows is not easy. Check1min is not such sophisticated as IMCDView or MagPy, but can detect the most common problems in complete data sets (including metadata files). I suppose that Java or C application could be relatively easily converted to web application in next step.

RL: I am also using check1min in a linux environment using wine. Works perfectly fine. I can post instructions here as well. We could add some document with user instructions for Linux, Mac, Windows here.

TR: There are still observatories, which reports only XYZ, even the continuous F measurement exists. Is there any statistics done hove the reporting of G is developing from IMOs? I do not remember to see this reported. If this does not exist, I can do it for next meeting. Quite straight forward to grep from readme.imo files.

TR: Roman (RL) started discussion of Checking 1s data. It looks nice. I think 1 min minute checking needs something similar and the checklist can be written here. We have discussion document DD.5 open in NextCloud, where comments /ideas written now.

RL: Yes, this is possible. You can add a simple table with results as I did in a very preliminary example for one-second. You can also rise an individual issue for checking a specific Observatory e.g. WIC2016_step1, describe the issue and assign it other data checker which you would have their opinion. They automatically will get an e-mail notification and can comment. The discussion is open and transparent. You can add graphs, links, whatsoever. If all aspects are solved you close the issue and that's it.

9.8 What are expectations from one-second definitive data?

JRD: Agenda. DD.6 "What are expectations from one-second definitive data?" is proposed within the context of 1-second definitive data checking.
To properly check 1-sec definitive a question should be asked:

- *What are users' expectations regarding one-sec definitive data?*
- *Do people need absolute levels or do they need "absolute" variations?*

- *How to check time accuracy, artificial disturbances, the noise of sensors? (such checking is even more important than in case 1-minute data)*
- *Is it possible to accurately check 1sec-data in the time domain? (60 times more data than 1-minute)*
- *Maybe more tests should be realized in the frequency domain?*

There is still an unsolved issue: who has enough time and personal motivation to lead the 1-second checking project?

AT: Jan, last year there was concern about no-one being available to create a protocol for 1-sec data checking. I don't think this situation has changed. Maybe you have heard something new?

JRD: Unfortunately, the situation regarding 1-sec checking has not changed. So far 1-sec data have been checked only by me. It concerned 1-sec provided in IAGA2002 (2014 data, 2015 onwards only USGS observatories).

RL: At one point we need to come up with a similar list of aspects/parameters to be checked as for one-minute data. I am not and never have been a data checker. Anyway, I would volunteer to start such a discussion project. I had a "quick" look at some one sec submission, not very conclusive yet, but good enough to get a basic idea what we can expect. Some examples are also posted on the GitHub issue by Sergey and myself.

SF: Is there any reason why we couldn't make the definitive 1-second data available through the INTERMAGNET archive and download/plotting application? At least then people would be able to see what has been delivered. We did originally say that we wanted data whether or not it conforms to the 1-second data standard, so I don't think the data needs a very rigorous quality check before it could be released in this way.

RL prepared the document "Checking one-second data" that serves as an introduction to the discussion. The document is reproduced in the appendix. The most recent version and relevant discussion is available at: https://github.com/INTERMAGNET/wg-definitive-data/issues/1

9.9 Discussion on data checker reports

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

JRD: Thank you Andrew for your great work concerning implementing the idea of Data Checking Team. We have received 5 reports out of 13 possible from: Sergey Khomutov, Kusumita Arora, Tero Raita, Andrew Lewis, and Jan Reda. Some reports also contain some number of general remarks regarding this issue.

Proposed questions for this discussion:

- *how to use the reports?*
- *could we demand reports from all? (in my opinion no)*

TR: Would it be better to have the status of checking kept in INTERMAGNET GitHub? This makes the process more transparent and gives status updates for officers all the time. Now we have html-file arriving monthly via email showing information from STEP1. We could have a simple table showing checking status. Now everyone keeps this information in different formats and I think the only way to encourage active use of INTERMAGNET GitHub is to start hosting living documents on GitHub. It also will add transparency and visibility to the work done by volunteers.

Another table could collect basic information about checking, for example, tasks regarding mean calculations aligned to the full minute.
JRD: At first glance, I like this idea. However, we need to collect more opinions. GitHub is public and while I think there is not a problem with the information in your example, maybe an "issues" discussion is needed on GitHub?

AL: I think reports should be voluntary - we should not add addition burden to volunteer's work if they are not willing or motivated. Reports will give a forum for data checkers to express their opinions and identify problems. If the reports are voluntary I suspect the information provided would be biased towards problems and difficult IMOs rather than good performing/easy-to-check IMOs
Evaluating reports could be a standing agenda item for IMO and/or DD subcommittees to provide information to evaluate both the IMO and the data checker performance. Reports could be archived in a private repository (eg INTERMAGNET document archive - I think the public nature of GitHub is not suitable)

AT: Q: Final question also to Jan: buried in the minutes from last year (page 40, but not recorded as an AI on Excon) is this:
*"*The proposal from Koizumi Takeshi, Director of Kakioka Observatory of establishing a CROSS-CHECKING TASK TEAM and making this public was warmly received by DD Subcommittee. We therefore recommend to EXCON to accept this proposal:
Publish both names of members and their tasks on the INTERMAGNET website. The benefits it brings to observatories or institutions whose employees work in CROSS-CHECKING TASK TEAM should be also added to the website."
Would you like Excon to agree with this proposal? It seems a good idea if it increases institutes commitment to their staff to work on INTERMAGNET activities.
JRD: A: The idea of establishing a CROSS-CHECKING TASK TEAM has been realized. The Checking Task Team Officers are listed on the new INTERMAGNET web site:
https://intermagnet.github.io/data_checkers.html

9.10 Decisions and action items

9.10.1 Action Items

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

Action	Responsible	Desription	Notes
DD.A1	JRD	Sending CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2020 by end of January 2021. Deadline for data submission is July 1st, 2021	Cc: to data checkers with the request of checking in less than 3 months after providing. If possible rotation of data checkers
DD.A2	JRD	Sending CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2019 – February 2021. The deadline for data submission is October 1st, 2021.	
DD.A3	JRD	Completion of compilations IRDS2017 DOI. Compilation of IRDS2018, if possible IRDS2019	
DD.A4	JRD, SF	Adding supplementary files to IRDS2015 DOI publication	- readme.txt - imcdview.txt

			- intermagnet_1991_2015.png - errata directory (or errata log file)
DD.A5	BH, TR	Completion advancing writing guidance how to check INTERMAGNET 1-minute definitive data.	
DD.A6	AM	Rewriting check1min in Java	
DD.A7	BH, RL, TR	Developing a 1-min checklist for data checkers and IMOs, distribution of such list to the persons concerned	datachecker_intermagnet@gfz-potsdam.de, imocontact@gfz-potsdam.de
DD.A8	RL	Developing a 1-sec checking description and checklist and distribution such materials to the persons concerned	https://github.com/INTERMAGNET/wg-definitive-data/issues/1
DD.A9	AL	Information to IMOs about results of comparison Definitive vs. Quasi-Definitive	
DD.A10	SK	Information to IMOs with remarks on determining of adopted base values	
DD.A11	CB	Preparing country/institute maps for IRDS compilations	
DD.A12	VM, JRD	Preparing information for cite.xml regarding IRDS compilations	
DD.A13	TR	IMO statistics of reporting G-values	

10 GINS/WWW and Data Formats Subcommittee

This year INTERMAGNET held the meeting online due to COVID-19. GWD opted for two platforms for information exchange.

- NeXT cloud hosted by GFZ Potsdam for private discussions.
- GitHub issues for all others (https://github.com/INTERMAGNET/wg-www-gins-data-formats/issues)

The following action items are linked to relevant GitHub issues where the discussion are available to the general public.

10.1 Proposal

GitHub proved to be very efficient for keeping track of discussions and notifying people when new items of discussions are added. GWD proposes that all other committees use GitHub for the following:

- INTERMAGNET meeting minutes (for actions and discussions)
- INTERMAGNET technical notes (for large pieces of completed work such as a new data format)
- INTERMAGNET technical manual

10.2 Discussion Topics

- Steps for deprecation of the intermagnet.org website to intermagnet.github.io
- A Coverage JSON format for INTERMAGNET
- Data transfer upgrade from RSYNC
- CDF leap second correction
- Correcting non-IMO and former-IMO on the FTP
- Flagging geomagnetic data and how to include that into data formats
- Proposed workflow for INTERMAGNET WWW/Gins/Data Format Working Group discussions.
- Track data license with IAGA-2002 and ImagCDF formats.

10.2.1 Review of Action Items from Ottawa (2019)

Parts of this section have been removed from this public copy of the minutes as it contained discussions about individuals, observatories and institutes.
The full path to all links is preceded by https://github.com/INTERMAGNET/

Number	Responsible	Description	Status Green completed, Orange ongoing; Red not started
Ottawa GWD.A1	CB, GINS	Clean up the FTP and make sure that non-IMO observatories are no longer contributing data to INTERMAGNET	wg-www-gins-data-formats/issues/4 Most stations cleaned up but need confirmation on end date of TEO and DMC
Ottawa GWD.A2	J. Fee	Investigate identifiers on spdx.org and how to add it to the comments of IAGA2002 files	wg-www-gins-data-formats/issues/1 Recommended header addition
Ottawa GWD.A3	SF	Look into how to add the license identifier to CDF format	Ongoing wg-www-gins-data-formats/issues/1
Ottawa GWD.A4	SB, RL	Contribute to Issue on GitHub regarding CDF format leap second error	Done wg-www-gins-data-formats/issues/5

Ottawa GWD.A5	CB	Follow up for transferring data for evaluating potential web services	Done. Will be discussed during "Future of INTERMAGNET" presentation
Ottawa GWD.A6	CB	2 months before next meeting, send an email to INTERMAGNET OpsCom to evaluate candidate web services	Cancel. Will be presented during "Future of INTERMAGNET"
Ottawa GWD.A7	J. Fee, AM, RL	Modify "contribute.md" on GitHub to instruct people on how to start using the environment	Done intermagnet.github.io/blob/master/contributing.md
Ottawa GWD.A8	CB	Start moving pages from intermagnet.org to GitHub by informing user through information boxes on current website	intermagnet.github.io/issues/28 Done. All static pages apart from those out-dated (data formats) and applications have not been moved.
Ottawa GWD.A9	CB	Add non-sensitive action items to GitHub	Done wg-www-gins-data-formats/issues
Ottawa GWD.A10	CB	Start a discussion on GitHub on the future of data exchange in INTERMAGNET	Done wg-www-gins-data-formats/issues/6

10.3 Outstanding items from previous meetings

Number	Responsible	Description	Status Green completed, Orange ongoing; Red not started
Vienna GWD.A2	SB, all	Contribute corrections/issues to FAQ	Done. Contributions added to GitHub by SB
Vienna GWD.A6	All	Create GitHub accounts and are encouraged to start using it	Ongoing
Vienna GWD.A7	CB	Add links to GitHub on web when relevant documentation needs to be linked	Community has not contributed any feedback yet.
Hermanus GWD.A5	CB	Convert historical data to CDF format on the FTP and keep all original formats	SF has recently transferred CDF data to the INTERMAGNET web. SF also gave an updated Java utility to convert IAGA2002 to CDF for the archive. Will be further discussed during the "Future of the web"
Dourbes GWD.9	RL, SF, J.Fee, SB, CB	Create a Discussion Document on using message brokers, JF to lead the document.	J. Fee and SB will continue work on the discussion document on message brokers. Discussion document will address more on message format rather than method (ex: AMQP vs MQTT). There will be different constraints between data acquisition and data dissemination. Discussions

			will continue at the next GWD meeting. Item now merged with Ottawa GWD.A10 and ongoing discussion on GitHub.

10.4 Summary of discussion topics

10.4.1 Steps for deprecation of the intermagnet.org website to intermagnet.github.io

www.intermagnet.org will be deprecated and moved to https://intermagnet.github.io. Work has commenced. The remaining plans are:

1. Data Formats Page – alter the content to reference the page number in the Technical Manual. When the Technical Manual is "web friendly" includes links with anchors
2. Observatory Plots – cannot be hosts on github.io. A new application will be hosted elsewhere (BGS)
3. Geomagnetic activity maps – a difficult issue, may need to be deprecated until another institute can contribute
4. Photographs and yearbooks – could be hosted on github.io, to they need to be hosted by INTERMAGNET at all?
5. Participating institutes – could be added to meta application
6. Technical Manual – it will be moved to intermagnet.github.io as a PDF file.

AL point 4 - yearbooks could be linked to the individual institutes and photos are not necessary.

VM point 4 – agreed with AL.

SF point 1 – agreed; point 2 - the Edi-GIN has pages for viewing data; point 3 - Data from the BGS web service could be accessed from another institute; point 5 - should be simple to write a web service to access institute information from the metadata hosted at BGS, could another institute do the client-side display application?

CB has already worked on point 5 as mentioned by SF.

SF asked about a DNS entry to point intermagnet.org to intermagnet.github.io.

CB this should be possible but Canada would still control the domain.

SB noted re-directing the domain should be possible from within GitHub.

TR suggested his institute may be able to work on the Geomagnetic activity map.

10.4.2 A Coverage JSON format for INTERMAGNET

SF has been investigating using Coverage JSON "Point Series" for geomagnetic data in his work with the EPOS project and Edinburgh GIN and proposed to establish it as an INTERMAGNET data format if others agree. There are other JSON schemas available but it is important the chosen schema conforms to standards.

CB notes that the timestamps in the format are repetitive and may results in large files for high sample rate data. He has investigated GeoJSON but considered there are problems with timestamps and pre-1970 dates in unix systems.

J Fee agreed that timestamps should not be used, but rather the "start", "end" and "num" options could be used define the time range.

SF believes CovJSON is the only option for a standards-based solution and would prefer to use iso8601 date/time format rather than epoch times.

10.4.3 Data transfer upgrade from RSYNC

CB The future of data transfer between GINS, institutes and the archive requires consideration as currently used rysnc protocol is difficult to manage, old and not secure. Some alternative are Kafka, MQTT, SEEDlink.

J Fee uses rsync over ssh and also suggested WEBDAV uploads over HTTPS or an Amazon S3 bucket with access control.

CB has only limited knowledge of WEBDAV and is concerned about who pays for an S3 bucket. Canada uses SEEDlink internally which is commercial software and widely used in seismic systems.

SF thinks we need to agree on what is to be achieved and suggest the following goals; increase the performance of the real-time network; a standards-based protocol; can be implemented by all 5 GINS and larger data providers; can transmit metadata along with data.

CB agreed with these goals.

AL mentioned that there is SEEDlink experience within the seismic network operations at Geoscience Australia and there have been discussions with integrating the data telemetry for geomag and seismic.

SF believes it would be unlikely that BGS integrates geomag with seismic as their geomag system is reliable and fit-for-purpose.

VM confirmed that IPGP seismic used SEEDlink but she has no personal experience. The problem of shifting to SEEDlink (or other) will not be cost but workforce.

CB identified the challenge of using SEEDlink not in the setup but rather getting it to transport real-time geomag data and how to deal with back fills and corrections.

HT said the situation at Kyoto is the same as IPGP and he is investigating. He has no experience with SEEDlink.

SF suggested that GINS should investigate the possibility of using SEEDlink to send data to BGS; BGS to investigate using SEEDlink to receive data from the GINS.

AM said that GFZ uses SEEDlink for a few observatories together with SeiscomP3, scripts and mseed2ascii and provided some details of the GFZ system.

CB notes that SeisComP3 is licenced but is free for non-commercial use. Canada uses the FDSNWS capabilities in SeisComP3 rather than reading miniseed files and then converts to IAGA2002 and IMFV1.22 formats using separate code.

RL says MQTT works fine in Austria for internal streaming from sensors and one external station. They are setting up a secure MQTT broke which is simple, secure and stable and has a big non-geoscience community.

SB noted that MQTT is working well for Belgium operations and suggested that MQTT is probably easier to learn than other systems if starting from a low base. Agreement must be reached on standardising the messages.

CB says the challenge with MQTT is that it requires development work by all the institutes.

10.4.4 CDF leap second correction

SB identified a problem with handling of leap seconds in the CDF format. CDF uses a text file of leap seconds which requires updating after each new leap second and noted that we cannot reply on error messaging generated by the CDF API on incorrect leap seconds; the code must externalize the use of the file "CDFLeapSeconds.txt"; CDF files must always be created with the most recent CDFLeapSeconds.txt file.

SF thought he needed to update the CDF code on the GIN to access the correct LeapSecond file and then update all the CDF files in the archive, so it may be sensible to wait until archive is transferred to BGS.

RL said that since v 0.9.3 MagPy checks the leap second table.

10.4.5 Correcting non-IMO and former-IMO on the FTP

CT identified a number of non- and former IMOs with data available in the archive.

CB has now removed all data that was safe to delete but there was recent data from DMC and TEO.

CT noted that both TEO and DMC have had membership withdrawn and KLI is not yet a member but us transmitting data to Par-GIN as a test.

CB has now corrected TEO and others except for DMV and asked VM to stop variation data transmission from DMC.

10.4.6 Flagging geomagnetic data and how to include that into data formats

In July 2019 RL provided a discussion document on data flagging.

AM would prefer a standard INTERMAGNET rule-set for flags and notes that flagging multiple single points may be cumbersome and agreed that flags should be optional.

RL agreed with standard ruleset but noted they may change over time so it is good to have some versioning included from the beginning

SF would like to extend the discussion to other institutes as there may be a view that data providers should produce the best data set without requiring decisions from end users about flagged data and noted it will be easy to include flag data in CDF format but not in IAGA-2002 format, so it may be easier to distribute the flag data in a separate file.

RL agrees that a separate file for flags is simple.

AM prefers to include flag information in the same file as the data so they are inseparable, but it would also be possible to have a separate file for flags and also include the flag information in the CDF format files.

10.4.7 Proposed workflow for INTERMAGNET WWW/Gins/Data Format Working Group discussions.

In July 2019 J. Fee proposed a work flow model using GitHub for GWD discussions.

AM suggested starting with discussion files that can be altered within GitHub.

SF thought the proposed work flow initiated discussions but did not replacing the next steps where discussions move into other forms of documentation (minutes, technical notes, manual).

CB agreed that version control is good and the system is efficient for minutes but the system will require effort for those not familiar with git and asked if a setting up a format for technical notes in markdown would be useful. The technical manual could be maintained as its own repository and linked to the website.

SF suggested any changes to the way decisions are made and recorded should be considered in plenary discussions and raised the issue of security for people outside INTERMAGNET accessing Tech Manual drafts.

CB and AM mentioned private repositories and approved users reviewing all pull requests.

SF liked the idea of a private repository for the Technical Manual and suggested the decision should be made in a wider forum within INTERMAGNET.

10.4.8 Track data license with IAGA-2002 and ImagCDF formats.

In Jul 2019 J Fee proposed including an additional header in data files for licensing information in the form of an identifier from the SPDX license list or a URL that resolves to the licence.

CB asked if the ftp archive include a licence text.

SF mentioned licencing has been described on a page in the web site so the FTP site could reference that page. Data from the Edinburgh GIN could have licencing information included at metadata.

Both SF and CB agreed the discussions should be put on hold until the archive is transferred from NRCan to BGS and more critical issues are addressed.

10.5 Decisions and action items

10.5.1 Action Items

Number	Responsible	Description	Details
Online2020 GWD.A1	SF, CB, JF, VM, HT	GINs to investigate the ability to use SeedLink for real-time data transfer	wg-www-gins-data-formats/issues/6 It has been recognized that changing new transmissions methods will be challenging due, but not limited to, the following: • Support on the GIN institute to incorporate any methods proposed • Compatibility of protocol with geomagnetic data with minimal development effort • Cost (if any) Discussion to continue amongst GINs primarly but open to all about the future of data transfer. Current proposal, is to look at SeedLink which NRCan and USGS already support. SF to look into client that receive data (slarchive or other) and VM/HT for transmission but they are not alone. Action on all to help simplify the integration of any real-time message protocol with minimal effort at the GIN.
Online2020 GWD.A2	SF	Complete the setup at BGS to receive data via RSYNC	As part of the stop of INTERMAGNET in NRCan, BGS is to complete all development work to receive data from NRCan and all GINS.
Online2020 GWD.A3	CB	Assist in transferring all data from NRCan archive to BGS archive	One previous action is complete, NRCan can start sending all historical data to BGS.
Online2020 GWD.A4	CB, JF, VM, HT	Change all data transfer to BGS	All GINs will then change (or add a) destination of rsync transfer to BGS.
Online2020 GWD.A5	CB, All	Change intermagnet.github.io to remove all reference to intermagnet.org	
Online2020 GWD.A6	CB, SF	NRCan to advertise the change on intermagnet.org	NRCan will create a page that will indicate the new source of data, website, and tools in English only and remove all previous pages.
Online2020 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
Online2020 GWD.A8	TR, SF	Start work on a new map tool through SGO	wg-www-gins-data-formats/issues/8
Online2020 GWD.A9	SF, JF	Continue discussion on CovJSON which could be used for a	wg-www-gins-data-formats/issues/7 Initial proposal of SF of CovJSON is great but needed a few adjustments. Discussion to continue on the future of a

		web service	web friendly format (JSON) for distributing data. This could then be used to design dynamic web applications and hosted on GitHub.
Online2020 GWD.A10	CB, GWD	Start a guideline for doing technical notes in markdown on GitHub	wg-www-gins-data-formats/issues/2 Online meeting using GitHub proved efficient and GWD will provide guidelines of technical note formats and contribution.
Online2020 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.
Online2020 GWD.A13	GWD	Add license information to IAGA2002 header and CDF	wg-www-gins-data-formats/issues/1 We know how to add licensing information, but we are putting the discussion on hold until urgent matters settle. In the interim, an action item on all to visit the ticket and provide additional remarks if they wish.
Online2020 GWD.A14	GWD	Continue the discussion on flagging geomagnetic data	wg-www-gins-data-formats/issues/3 RL as started a great discussion on flagging geomagnetic data. Due to the upcoming changes in INTERMAGNET. Discussion on hold, but not forgotten, until next meeting. In the interim, action item on all to visit the ticket and provide additional remarks if they wish.
Ottawa GWD.A1	CB, VM	Clean up the FTP and make sure that non-IMO observatories are no longer contributing data to INTERMAGNET	wg-www-gins-data-formats/issues/4 Soon completed. DMC is still transmitting which VM will be looking into.

11 IMO Applications and Standards Subcommittee

11.1 Participants

Subcommittee Members: Chris Turbitt (chair), Benoit Heumez, Sergey Khomutov, Andrew Lewis, Jürgen Matzka, Virginie Maury, Tero Raita & BenoÎt St-Louis

11.2 IMO Subcommittee agenda, 2020

1. IMO action Items from the 2019 meeting
2. IMO Applications
    a. IMOs closed or withdrawn since the Ottawa meeting:
    b. Update on applications from 2019:
    c. New applications:
    d. Prospective IMOs:
3. IMOs of concern
    a. Resolved IMO issues since last meeting
    b. Lists of IMOs of concern and IMOs awaiting checking:
    c. Discussion on the acceptance IMO - 2018-19 data
    d. Discussion on the acceptance of IMO 2017-18 data
    e. Status of the discussion document on the IMO data checking procedure
4. IMO Subcommittee contributions to the Technical Manual
    a. "Dual use" customs regulations for high specification magnetometers
5. Standards
    a. Handling leap-seconds in one-second data
    b. Current status of instrumentation meeting the one-second standard
6. IMO Subcommittee Action Items following the 2020 Online Meeting

11.3 Action Items from the 2019 meeting

Parts of this section have been removed from this public copy of the minutes as it contained discussions about individuals, observatories and institutes.
Action items not completed from Ottawa meeting:

Number	Responsible	Description	Status Green completed, Orange ongoing; Red not started
IMO.A8	CT, SF	Include a note in the communication to IMOs that there are the two delays available on the web site (plotting and data download)	**To be included in 2020 report to IMOs (Action Item IMO.A1)**
IMO.A10	TR, BH	Produce a Discussion Document for data checkers on the data checking procedure, acceptable quality thresholds and what to do when these thresholds have not been met. Also start a list of "grey area" issues that need clarification from OpsCom	**Online document DD.A5 now under development. Discussion document on IMO data checking to be copied to GitHub Deleted**
IMO.A15	JM, CT	Contact government and EU	**Ongoing. Statement to be**

		agencies for clarification on whether one-second magnetometers fall foul of dual use customs regulations	**included in communication to IMOs**
IMO.A20	CT	Set a date for an interim online IMO Subcommittee meeting	**Not completed. Carried forward**

11.4 IMO Applications

11.4.1 IMOs closed or withdrawn since the Ottawa meeting:

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes.

11.4.2 Update on applications from 2019

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.4.3 New applications:

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.4.4 Prospective IMOs:

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.5 IMOs of concern

11.5.1 Resolved IMO issues since last meeting

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.5.2 IMOs of concern and IMOs awaiting checking

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.5.3 Discussion on the acceptance of IMO 2018-19 data

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.5.4 Discussion on the acceptance of IMO 2017-18 data

This section has been removed from this public copy of the minutes as it contained discussions about observatories and institutes

11.5.5 Status of the discussion document on the IMO data checking procedure

TR & BH have been working with JRD to compile a discussion document containing guidance for data checkers reviewing definitive data submissions. This is in progress and a draft is to be copied to GitHub for collaboration. (Action Item IMO.A6)

One suggestion to help data checkers reduce the work burden caused by multiple minor errors in submitted data is to request IMOs perform a preliminary check with the check1min application. The IMO Subcommittee is requesting that the DD Subcommittee instructs IMOs to include the output report of check1min along with the list of definitive data files in the next call for one-minute data and also make it clear to data checkers that this is a requirement. If there are issues with check1min.exe under specific operating systems, these should be directed to JRD. TR & AL, for example, have experience of running check1min.exe under iOS and Linux and can advise. (Action Item IMO.A7)

11.6 IMO Subcommittee contributions to the Technical Manual

11.6.1 "Dual use" customs regulations for high specification magnetometers

JM raised the issue of restrictions incurred by dual use customs regulations at the Ottawa meeting. Regulations in the EU mean that certain 'high sensitivity' magnetometers require export permits to be shipped out of the EU. Similar regulations are believed to exist in other zones/countries. These regulations have the potential to restrict shipment of fluxgate, proton, Overhauser and optically pumped magnetometers used at INTERMAGNET observatories.
A statement has been prepared for the next communication to IMOs to make institutes aware of the issue and is included in the appendix. (Action Item IMO.A2)

11.7 Standards

11.7.1 5a. Handling leap-seconds in one-second data

To be carried forward to the next meeting.

11.7.2 5b. Current status of instrumentation meeting the one-second standard

To be carried forward to the next meeting, although this is most suited to the dissolved Instruments and Data Acquisition subcommittee.

11.8 Decisions and Action Items

11.8.1 Action Items following the 2020 meeting

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

Number	Responsible	Description
Number	**Responsible**	**Description**
IMO.A1	CT, SF	Include a note in the communication to IMOs that there are the two delays available on the web site (plotting and data download)
IMO.A2	JM, CT	Include a statement in the communication to IMOs on dual use customs regulations and its impact on export of magnetometers

IMO.A6	TR, BH	Copy the discussion document on IMO data checking to GitHub
IMO.A7	CT	Make a request of the Definitive Data Subcommittee that the next call for one-minute data makes a requirement that IMOs include the output report of check1min list of definitive data files and make it clear to data checkers that this is a new requirement.
IMO.A10	CT	Set a date for an interim online IMO Subcommittee meeting

12 Technical Manual Subcommittee

12.1 Particpants

Subcommittee Members: Benoit St-Louis (chair), Chris Turbitt (deputy), Stephan Bracke, Andrew Lewis, Jürgen Matzka, Hiroaki Toh

12.2 Agenda

1. Committee membership (missing expertise?)
    a. TM and WEB integration?
2. Review of Ottawa actions items
3. Technical Manual
    a. Publication of version 5.0.0
        i. INTERMAGNET.org →GitHub
    b. DOI
    c. Future versions
        i. Development platform
        ii. Integration with WEB site
        iii. Review list of new items for version 5.0.1 or 5.1.0 (draft document provided)
        iv. Assign action items from list of new items
        v. Distribution format
4. WEB
    a. Links to data format in the Technical Manual
    b. Other links to/from the web site
    c. Policy and Technical notes to be published
    d. FAQ maintenance
    e. Keeping information available during transfer to GitHub
    f. BGS plans for the WEB site
5. INTERMAGNET on Wikipedia
    a. Can we keep it up to date?
6. Round table
7. Distribution of actions items
8. Schedule next video conference
    a. Set date and time (availability of subcommittee members?)

12.3 Committee membership

The TM Subcommittee membership was discussed at the beginning of the meeting. It was agreed that there is no need for extra membership at the moment considering the current workload but the subcommittee recognize the lack of technical expertise to develop collaboration tools under the GitHub environment, to automate the generation of the Technical Manual in different formats and to integrate the Technical manual with the WEB site. The TM subcommittee would like to suggest sharing a new technical OPSCOM member with another subcommittee.

12.4 Review of Ottawa actions items

Number	Responsible	Description	Status (Green = completed, Orange =

			ongoing; Red = not started)
TM.A1	BSL	Organize a video conference with the Technical Subcommittee members in September to prepare for publication of the Technical Manual.	Completed, held at the end of 2019 due to fieldwork conflict of several members.
TM.A2	JM, CT	Production of QD data. Might be desirable as a follow-up from Hermanus action TM.12 which was converted to submission. Could also be link with FAQs. (long term)	Ongoing, as a first step, existing QD FAQs will be integrated into the manual. FAQs will point to the proper TM section.
TM.A3	BSL	Once completed, publish the Technical Manual V-5.0.0 on the INTERMAGNET web site.	Completed, TM V5.0.0 is ready for distribution. Will only be available on GitHub, CB reported that he will not put the manual on Intermagnet.org.
TM.A4	~~Unassigned~~ JM	Create a Discussion Document on the estimation of errors in the production of Definitive Data.	Ongoing, to be developed for future release of TM. Assigned to JM to check if Vincent Lesur (IPGP) started the development of a document.
TM.A5	BSL	Consult JM & SF on minting a DOI for the publication of V5 of the Technical Manual	Completed, DOI requested and in progress at GFZ. This has generated a new action to EXCON for a name.
TM.A6	JM	Investigate whether GFZ supported IMOs can fix the issue concerning centering one-minute values on the minute	Completed, concerned IOMs have been informed and are working on solving the issue.
TM.A7	BSL	Incorporate the editorial changes to TM V5 d1.0 in advance of the online TM Subcommittee meeting September	Completed, plus decisions on unclear changes were made during the online meeting.
TM.A8	BSL	Publish V5 by 30 September 2019	Completed, TM ready for distribution.
TM.A9	DD subcommittee	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	Ongoing, waiting for directions from DD.
TM.A10	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	Ongoing, will be added in next release as v5.0.0 is closed for new additions.
TM.A11	BSL	Modify Technical Manual references to one-minute means to state that IMOs must	Completed.

		(rather than should try to) centre these values on mm:00	
TM.A12	BSL	Consult with CB & JF to format TM in an HTML form suitable for GIT that optimises the production of PDF formats of future versions of the manual (beyond the September 2019 release)	Ongoing, preliminary discussions indicate good possibilities for development collaboration under GitHub but no possibilities to produce PDF under the Git environment.
WG.35	SB, VM	Check INTERMAGNET Archive data format IYFV1.02 Appendix C-3 for text description	Completed.
WG.39	SB, VM	Check INTERMAGNET Archive data format IBFV2.00 Appendix E-4 for text description	Completed.
WG.43	Jeremy Fee, HT	Check INTERMAGNET Archive data format IAGA2002 Appendix E-5 for text description	Completed.
WG.49		Review WEB site for out of date information (???)	Completed.

12.5 Technical Manual

12.5.1 Publication of version 5.0.0

All action items required for the publication of the Technical Manual have been completed and incorporated to the final draft version of the manual which was made available on the GFZ shared drive during the meeting for comments. This version of the manual was originally created in PHP to integrate with the intermagnet.org web site and also made available in PDF for easy download and printing. The transfer to intermagnet.github.io will require some changes to the format of the manual to be compatible with the GitHub environment and to allow links from the web pages. In the meantime, the PDF version will be available for download from intermagnet.github.io.

12.5.2 Digital Object Identifier (DOI) for the Technical Manual

A DOI for the Technical Manual has been requested and Kirsten Elger from GFZ suggested to publish not only the TM but also other documents in a series that could be called “INTERMAGNET Technical Reports” (name also recommended by the TM subcommittee). The name is open to discussion and EXCON should make the decision. Suggestion for the publisher are “INTERMAGNET and Albert-Einstein Library” or “INTERMAGNET and GFZ” or “INTERMAGNET”. Again, EXCON should make the decision.
Action Item TM 01 EXCON

12.5.3 Future Versions

12.5.3.1 Development platform

The subcommittee had a discussion during the TM Zoom meeting and everyone agreed on the benefit of the GitHub collaboration platform and version control but had concern on the limitation for the distribution to the public. BSL and SB had a separate meeting on the implementation of the Technical Manual on GitHub. SB volunteered to evaluate the various options of contributing and version controlling under the GitHub environment. **Action Item TM 27 SB**

12.5.3.2 Integration with WEB site

GitHub is a development platform and has very limited options for web distribution which are either markdown or html. A PDF can also be distributed through the WEB interface but you can't take advantage of the version control. PDF would also have to be generated outside the GitHub environment.

12.5.3.3 . Review list of new items for next version

A list additions/modifications/corrections for the next version of the Technical Manual was compiled by the Technical Manual Subcommittee and made available on shared drive. The TM subcommittee discussed these items during the Zoom meeting and generated a list of action items.

12.5.3.4 Assign action items from list of new items

See section 12.8.2 for the complete list of action items.

12.5.3.5 Distribution format

The subcommittee is evaluating the different options for future versions but no decision have been made yet. External support will be requested as there is not currently sufficient expertise within the subcommittee to decide on the best format for future development of the Technical Manual. In the meantime, Version 5.0.0 will be distributed in PDF and HTML through GitHub.

12.6 Web

The subcommittee had very little time to discuss the WEB issues during this meeting and most of the topics have been postponed to the next meeting.

12.6.1 BGS plans for the WEB site

The subcommittee requested if BGS had the intention of having a portion of the WEB site hosted on a BGS server which would have solved some of the TM issues but unfortunately the plan is to only have the WEB services hosted at BGS.

12.7 INTERMAGNET on Wikipedia

EXCON reported that changes were made by INTERMAGNET to make the INTERMAGNET Wikipedia page more accurate but some of those changes were removed by a moderator. It seems that it will be impossible for INTERMAGNET to maintain this page current. The TM subcommittee recommended to check it occasionally to make sure it is reasonable. One of the comments received from the TM review was to add a reference link to the INTERMAGNET Wikipedia page but the TM subcommittee has decided to abstain due to the reason mentioned above.

12.8 Round table

No addition to the agenda

12.8.1 Decisions

Number	Description
TM.D01	DOI will only be requested for Major and Minor PDF version of the manual. Any 3rd digit version of the manual will only be available online.

12.8.2 Action Items

Number	Responsible	Description
TM.1	EXCON	Provide DOI names for the INTERMAGNET technical document series and for the publisher.
TM.2	BSL	Organize a video conference with the Technical Subcommittee members in October to prepare the publication of the next version of the Technical Manual.
TM.3	JM	Production of QD data. Might be desirable as a follow-up from Hermanus action TM.12 which was converted to submission. As a first step, insert related FAQs in the Technical Manual.
TM.4	JM	Review the manual to include the new INTERMAGNET Reference Data Set (IRDS). Replace CD, DVD and USB with INTERMAGNET Physical Media (IPM).
TM.5	JM	Consult with Vincent Lesur (IPGP) to see if he started the development of a document on the estimation of errors in the production of Definitive Data.
TM.6	AL	Add INTERMAGNET new licensing description of CC-BY-NC 4.0.
TM.7	CT	Look at TN and FAQs for QD information to be added to the TM
TM.8	JM	Description on the use of DOIs for data/metadata publication in INTERMAGNET.
TM.9	DD subcommittee	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
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
TM.11	GWD subcommittee	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?
TM.12	BSL	Consult with CB & JF to format TM in an HTML form suitable for GIT that optimises the production of PDF formats of future versions of the manual (beyond V 5.0.0 release)
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
TM.14	BSL	In Chapter 2 - not clear what the definitions of the data types are – add pointer to definition/relevant text.
TM.15	JM	Section 2.3.9 – add text describing where the gp ratio is used.
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.
TM.17	JM	Data quality: proofread the guide to the process of despiking data.
TM.18	DD Subcommittee	Section 6.4.3.3 Update to describe the USB structure.
TM.19	GWD Subcommittee	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"
TM.20	CB	p 47 part on toolkit used to make website will need to disappear when moving to GitHub.
TM.21	CT	Incorporate text : INTERMAGNET applicant agrees to Terms &

		Conditions explicitly. The application document should also be also signed at a legal signatory level for any institute joining INTERMAGNET.
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.
TM.23	DD Subcommittee	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.
TM.24	BSL	Appendix C-1: Change use of deltaF for “G”
TM.25	JM	Appendix C-1: Orientation of “UVZ” has no definition in Section 6.1.3
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).
TM.27	SB	Evaluate the various options of contributing and version controlling under the GitHub environment.

12.9 Schedule next video conference

CT sent a meeting invitation for 10:00UT (06:00EDT) on 14th October 2020 for an online meeting of the Technical Manual Subcommittee to discuss the next release of the TM.

13 Appendix

13.1 Agenda

13.1.1 13 July 2020 Plenary session

Topic	Type	Lead by	Document(s)
Discussion on Opscom membership	Discussion	S Flower	discussions/membership.docx
Review of plenary action items from previous meeting	Discussion	A Lewis	discussions/ottawa_plenary_actions.docx
Presentation: Progress on one second data	Presentation	J Reda	presentations/one_sec_data + presentations/Q+A_one_second_data.docx
Presentation: Progress on IRDS and DOIs	Presentation	S Flower	presentations/irds_and_dois + presentations/Q+A_irds_and_dois.docx
Presentation: Future of the INTERMAGNET web site and archive (part 1)	Presentation	C Blais	presentations/imag_web_site.pptx + presentations/Q+A_imag_web_site.docx
Presentation: Future of the INTERMAGNET web site and archive (part 2)	Presentation	S Flower	presentations/imag_web_site2.pptx + presentations/Q+A_imag_web_site.docx
Presentation: Status of Technical Manual V5	Presentation	B St-Louis	presentations/tech_man_status + presentations/Q+A_tech_man_status.docx
Presentation: Quasi-definitive data comparison with definitive data 2017	Presentation	A Lewis	presentations/qd_comparison + presentations/Q+A_qd_comparison.docx

13.1.2 July 2020 Subcommittee and EXCON sessions

Topic	Type	Lead by	Document(s)
Review of EXCON actions from previous meeting	Discussion	A Thomson	discussions/ottawa_excon_actions.docx
Review of Definitive Data Subcommittee actions from previous meeting	Discussion	J Reda	discussions/ottawa_DD_actions
Review of IMO Applications Subcommittee actions from previous meeting	Discussion	C Turbitt	discussions/ottawa_imo_app_actions
Subcommittee agenda	Discussion	C Turbitt	discussions/IMO Subcommittee Agenda.docx
Review of Technical Manual actions from previous meeting	Discussion	B St-Louis	discussions/ottawa_tech_man_actions
Review of WWW/GINS & Data Formats Subcommittee actions from previous meeting	Discussion	C Blais	discussions/ottawa_www_gin_df_actions.docx
The agenda for this subcommittee consists of the list of issues on the GitHub repository intermagnet/wg-www-gins-data-formats	Discussion	C Blais	https://github.com/intermagnet/wg-www-gins-data-formats/issues

13.1.3 July 2020 Plenary Session

Topic	Type	Lead by	Document(s)
Report and discussion on IMOs	Discussion	C Turbitt	discussions/imos
Report on definitive data timeliness	Presentation	J Reda	presentations/def_data_timeliness
Discussion on communication effectiveness	Discussion	S Flower	discussions/communications.docx
Report, decisions and action item list from EXCON	Report	A Thompson	reports/excon_decisions_and_actions
Report, decisions and action item list from Definitive Data Subcommittee	Report	J Reda	reports/DD_decisions_and_actions
Report, decisions and action item list from IMO Applications Subcommittee	Report	C Turbitt	reports/imo_apps_decisions_and_actions
Report, decisions and action item list from Technical Manual Subcommittee	Report	B St-Louis	reports/tech_man_decisions_and_actions
Report, decisions and action item list from WWW/GINS & Data Formats Subcommittee	Report	C Blais	reports/www_gin_df_decisions_and_actions
Review and agreement on decisions and action items from plenary sessions	Report	A Lewis	reports/plenary
Date and place of next meetings	Discussion	S Flower	discussions/next_meeting

13.2 Checking one-second data (DD subcommittee)

Update 0.1
Roman Leonhardt

13.2.1 Data checking principle

The primary aim of one-second data check is to examine and validate such submitted data sets. Various aspects regarding file structure, contained meta information, data in time and frequency domain are investigated for this purpose. Conclusions about the validity of the data set are drawn solely from inherent one-second data set characteristics. Comparison with "auxiliary" one-minute data products are also performed. The data checkers inform the submitting organization about any significant differences in both definitive data sets, yet (if below a certain threshold?) these differences are not used for acceptance/rejection of one second data products.

13.2.2 Aspects to be checked

1. Submitted files and formats: Are all requested files available and are they submitted in correct and readable formats (IAGA-2002, IMCDF).
    - 12 monthly IMCDF files with sec-data
    - (or 365/366 daily IAGA 2002 files)
    - correct file names
2. Meta information: Do all files contain the requested meta information and is this meta information consistent between all different files.
    - required meta information should is described in the IM format descriptions
3. Data content
    - Correct data coverage in all files.
    - If F values are provided, they should be independent measures of the field (S), or they need to be correctly denoted in the file structure.
    - Delta F variations should be within acceptable limits.
    - For IMCDF: the leap second table needs to be up-to-date.
4. Data quality
   Of particular importance should be the frequency range from 0.5 Hz to periods of about 90 sec
    - Noise level (in frequency domain)
      (too be clarified: in which frequency range, on which data sets, critical threshold value)
      my suggestions:
      calculate average spectrum for 10 quiet days for x,y,and z (too be defined, at least 6 of these days need to be available)
      IM instrument requirement is <10pT. I would suggest a critical threshold of <30pT for acceptance of data
    - White noise range (in frequency domain)
      my suggestions:
      testing the noise level is usually sufficient
    - Narrow-band "technical" disturbances should not be present
      (too be clarified)
    - Broad-band disturbances should not be present
      (too be clarified)

5. Data consistency
    - Is meta information consistent with one-minute data products, can one-minute data be reproduced by filtering one-second data using IM recommended procedures on filtering and outlier treatment.

13.2.3 Currently available software solutions:

Aspects 1,2,3,5 can be checked using MagPy's data checking routine. Aspect 4 requires additional software. Power spectra of single days can be calculated and visually inspected using MagPy. Average spectra, noise level determinations are not yet possible.
The following table was reorganized with one-second data focus, based on random one-month analysis. I did not yet include a summary of meta information tests, but they are included automatically in the MagPy quick test.

13.2.3.1 2016

Quick Test column contains MagPy data check results (XMagPy->Extra->DataCheck) from steps 1,2, and 4 which primarily focus on one-second data.
Noise Level and white noise are approximate values so far, estimated from the "flat" HF part from the X component (XMagPy->Analysis->Power). Frequency characteristics are qualitative descriptions. For all frequency related tests below a power spectrum has been calculated from a randomly picked day and therefore is not characteristic for the full data set.

Obs	Format (second)	QuickTest (one-second focus)	Observed issues (one-second only)	NoiseLevel	White-noise flattening	Frequency characteristics	Summary
WIC	IMCDF	1,1,1	None	~8 pT	None	Nothing special	data OK, format OK
UPS	IMCDF daily	1,5,4	second data in daily cdfs, minor differences to one-minute data for individual days	~20pT	below ~10 sec	Nothing special	data OK, format Update
TUC	IAGA (year zip)	1	iaga second data not readable in data check (DataCheck issue), single files no problem	~20 pT	broad-band signatures	Broad-band signature at periods below minutes	Open
SJG	IAGA (year zip)	1,1,1	None	~20 pT	below ~10 sec	Nothing special	data OK, format OK
SIT	IAGA (monthly zip)	1,1,4	filtered one-second differs slightly from one-minute, particularly check z-component	~10 pT	None	Nothing special	data OK, format OK
SHU	IAGA (year zip)	1,1,4	filtered one-second differs slightly from one-minute, particularly check	>100 pT	below ~25 sec	Nothing special	Noise Level too high, format OK

			z-component				
NEW							
MMB	IMCDF daily	1,5,	second data in daily cdfs	~ 11 pT	below ~15 sec	individual "technical" spikes	technical spikes, format Update
MCQ							
MAW	IMCDF	1,3,4	no leap second information, file names not as expected, significant differences between min and sec (>5nT)	~400 pT	below ~20sec	individual "technical" spikes	Noise Level too high, format Update
LYC							
LRM	IMCDF	1	no leap second information, file names not as expected				
KNY							
KDU							
KAK	IMCDF daily	1,	second data in daily cdfs, single file analysis no problem, imcdf not readable in data check (DataCheck issue)	~10pT	None	Nothing special	data OK, format Update
HRN							
HON							
HLP							
HER							
GNG							
FRN							
FRD							
EBR	IMCDF	1,3,1	file names not as expected for ImagCDF	100 pT	below 10 sec	minor technical peaks	noise level, format Update
DED							
CTA							
CSY							
CNB							
CMO							
CKI							
BSL							
BRW							

BOU							
BEL	IMCDF	1,3,3	file names not as expected for ImagCDF, minor differences between minute and sec (1nT)	~ 8pT	None	Nothing Special	data OK, format Update
BDV							
ASP							
ABK							

13.3 INTERMAGNET statement on dual-use export control for high specification magnetometers

Chris Turbitt & Jürgen Matzka

For inclusion with the communication to IMOs following the July 2020 INTERMAGNET meeting

Meaning of dual-use and export control: Dual-use technology is technology that can be used both for peaceful and military purposes. Export control refers to laws and regulations regarding the export of goods, software and technology that fall under the dual-use category.

Institutes affected: Those institutes shipping fluxgate magnetometers, Overhauser/proton magnetometers or optically pumped magnetometers from one country to another may be affected by the export control of dual use items.

Regulations: The following describes regulations for export from the European Union (EU) but similar regulations apply in other countries. EU Regulation 2019/2199 amending Council Regulation (EC) No 428/2009, category 6A006 – Magnetometers:

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2019:338:FULL&from=EN

Institutes be aware of EU Regulation 2019/2199 category 6A006, which restricts the export of low noise magnetometers out of the EU. Instruments that fall into this category are capable of measuring signal at 1Hz i.e. with an analogue output or with a digital output of 2Hz or higher. Regulation 2019/2199 restricts export of instruments with now noise (sensitivity) defined as:

> *Overhauser/Proton/optically pumped magnetometers:*
> *2. "Magnetometers" using optically pumped or nuclear precession (proton/Overhauser) "technology" having a 'sensitivity' lower (better) than 20 pT (rms) per square root Hz at a frequency of 1 Hz;*
>
> *Fluxgate magnetometers:*
> *3. "Magnetometers" using fluxgate "technology" having a 'sensitivity' equal to or lower (better) than 10 pT (rms) per square root Hz at a frequency of 1 Hz;*

Recommendations: Under this regulation, any instrument that falls into the categories above would require an export license granted by the corresponding government agency of the country of export. Institutes are advised to consult with the instrument manufacturer and the corresponding government agency before shipping instruments out of the EU. Similar rules might apply for countries outside the EU.

13.4 IYFV1.02 INTERMAGNET DVD/CD-ROM FORMAT FOR YEARMEAN FILE

Magnetic data with 1nT or 0.1min of arc resolution are organized on a year file basis. One file contains all annual mean values of the geomagnetic field components that are available from the observatory. File name: "YEARMEAN" and the three-letter observatory ID code as an extension. eg: YEARMEAN.BOU for Boulder.

Each file may have from 1 to 3 tables containing annual mean values. The file must contain a table of annual means for ALL DAYS for each year of INTERMAGNET membership. Optionally, any data available prior to INTERMAGNET membership and tables of annual means for QUIET-DAYS and DISTURBED-DAYS are encouraged where possible.

Description of the header block

The header contains information on observatory name, ID-code, Colatitude, Longitude and Elevation to WGS-84 datum. It further contains the headers for each data columns. Location data must be decimal degrees with two decimal places for colatitude and east longitude on the WGS-84 datum and elevation as integer metres above sea level. The header must follow the layout in the example shown below with each line no line longer 75 characters including CrLF end-of-lines.

eg: The header for Wingst is:

ANNUAL MEAN VALUES

WINGST, WNG, GERMANY.

COLATITUDE: 36.26 LONGITUDE: 9.07 E ELEVATION: 50 m

YEAR	D	I	H	X	Y	Z	F	*	ELE	Note
	Deg. min	Deg. min	nT	nT	nT	nT	nT			

Description of data space (75 characters per line including CrLf)

All data fields are right-justified. The field width must be maintained, either by zero-filling or spacefilling. The '+'sign for positive values is optional.

_YYYY.yyy_DDD_dd.d_III_ii.i_HHHHHH_XXXXXX_YYYYYY_ZZZZZZ_FFFFFF_A_EEEE_NNNCrLf
....
....
YYYY.yyy Epoch is given with 3 decimals
DDD_dd.d Declination is given in degrees and decimal minutes of arc
III_ii.i Inclination is given in degrees and decimal minutes of arc
HHHHHH H-component is given in nT
XXXXXX X-component is given in nT
YYYYYY Y-component is given in nT
ZZZZZZ Z-component is given in nT
FFFFFF F-component is given in nT calculated from vector data. If F data from previous years were calculated using a continuously recording scalar magnetometer this must be identified in an explanatory note in the footer section.
A Type of annual means. May be "A"ll, "Q"uiet, "D"isturbed, "I"ncomplete" or "J"ump. Any data calculated from less than 90% of a full year of minute data must be identified as incomplete with “I” and accompanied by an explanatory note in the footer section. Where data are marked “I” and it is not otherwise clear if they refer to All, Quiet or Disturbed days then it must be clarified in the explanatory note. The "J" is not an annual mean value, but indicates a jump in the observatory recordings, the cause

of which should be described in a note. Jump records contain measured differences between an old set-up or location and a new set-up or location within an observatory data series. They are moved to the start of the year that they occur in and are recorded only in the series of annual means. To update values (be they annual, monthly, hourly etc) before the jump so that they are consistent with values after the jump, the jump values should be subtracted. If the measured differences are in D (in degrees), H and Z (in nT) then those for I (in degrees), X, Y and F (in nT) are

$$\Delta I = \frac{180}{\pi}\frac{H\Delta Z - Z\Delta H}{F^2}$$
$$\Delta X = \Delta H \cos D - \frac{\pi}{180}\Delta \mathrm{DH} \sin D$$
$$\Delta Y = \Delta H \sin D + \frac{\pi}{180}\Delta \mathrm{DH} \cos D$$
$$\Delta F = \frac{H\Delta H + Z\Delta Z}{F}$$

And if the measured differences are in X, Y and Z (in nT) those in D and I (in degrees), H and F (in nT) are

$$\Delta D = \frac{180}{\pi}\frac{X\Delta Y - Y\Delta X}{H^2}$$
$$\Delta I = \frac{180}{\pi}\frac{H\Delta Z - Z\Delta H}{F^2}$$
$$\Delta H = \frac{X\Delta X + Y\Delta Y}{H}$$
$$\Delta F = \frac{X\Delta X + Y\Delta Y + Z\Delta Z}{F}$$

Where the full-field values are averages of the annual means before (uncorrected) and after the jump.

EEEE recorded elements. eg:"XYZF" or "HDZF". If an independent total field measurement is not made at an observatory, this field should not include an 'F' code. For example, an observatory using a three component fluxgate with one horizontal sensor aligned along the magnetic meridian and a proton magnetometer would put 'HDZF' in this field. An observatory using only the fluxgate would put 'HDZ'.

NNN Note number
CrLf Indicates a Carriage return Line feed
_ Represents a space

• Missing angular values must be coded as three 9 digits, a space, two 9 digits, a dot and one 9 digit: 999 99.9
• Missing component values must be coded as six 9 digits: 999999
• Angular values are written as degrees and minutes. Values may be written in the range 0 to 360 or -180 to 180. Observatories may choose which range to use. Negative values must always have the minus sign before the degree field, never before the minute field (including values between 0 and -1 degrees, for example "-0 59" means a value of minus zero degrees fifty nine minutes). This applies to all types of records, including jump records.

Description of the footer

At the end of the file is added a footer describing the data. The footer contains notes on jumps,

incomplete data sets etc. The footer must looks like the example below with notes adjusted for each particular observatory. Each line in the notes section should be terminated with CrLF.:

- A = All days
- Q = Quiet Days
- D = Disturbed Days
- I = Incomplete
- J = Jump: jump value = old site value - new site value

ELE = Recorded elements.

Notes:

1. The jump in the values from 1988 to 1989 is due to establishment of a new absolute pillar during 1988.
2. The jump in the values from 1993 to 1994 is due to a change in the difference delta-F between the PPM pillar and the absolute pillar. The change happened between spring 1989 and autumn 1993. Why and when is unknown.

Sample of a yearmean file

```
                        ANNUAL MEAN VALUES

                    NARSARSUAQ, NAQ, GREENLAND

COLATITUDE: 28.84 LONGITUDE: 314.56 E ELEVATION: 4 meters
   YEAR     D        I     H     X      Y     Z     F    * ELE Note
         Deg. min Deg. min nT    nT     nT    nT   nT
1983.500 326 41.6 77 15.8 12152 10156 -6673 53764 55120 A DHZ
1984.500 326 55.7 77 14.3 12171 10199 -6642 53736 55097 A DHZ
1985.500 327 11.1 77 12.9 12187 10242 -6604 53706 55071 A DHZ
1986.500 327 26.8 77 11.7 12201 10284 -6565 53679 55048 A DHZ
1987.500 327 44.5 77 09.9 12223 10336 -6524 53647 55022 A DHZ
1988.500 328 00.5 77 09.0 12235 10377 -6482 53633 55011 A DHZ
1989.000   0 02.6  0 00.7    -4     2    10    30    28 J DHZ 1
1989.500 328 13.8 77 07.2 12254 10418 -6452 53592 54975 A DHZ
1990.500 328 29.9 77 05.9 12271 10463 -6412 53571 54959 A DHZ
1991.500 328 45.6 77 04.9 12284 10503 -6371 53555 54946 A DHZ
1992.500 329 01.3 77 03.4 12302 10547 -6332 53525 54920 A DHZ
1993.500 329 17.9 77 01.6 12323 10596 -6292 53495 54896 A DHZ
1994.000   0 00.0  0 00.0    -1    -1     0    -2    -3 J DHZ 2
1994.500 329 34.3 77 00.7 12335 10636 -6247 53476 54880 A DHZ
1995.500 329 53.6 76 58.3 12366 10698 -6203 53444 54856 A DHZ
1996.500 330 13.6 76 56.0 12395 10759 -6155 53409 54828 A DHZ
1997.500 330 33.9 76 54.0 12423 10819 -6105 53381 54807 A DHZ
1998.500 330 55.6 76 52.2 12446 10878 -6048 53361 54793 A DHZ
1999.500 331 17.3 76 50.2 12473 10939 -5992 53332 54771 A DHZ
2000.500 331 39.0 76 48.4 12497 10998 -5934 53311 54756 A DHZ
2001.500 332 01.3 76 46.1 12527 11063 -5877 53278 54731 A DHZ
2002.500 332 23.6 76 44.2 12553 11124 -5817 53254 54714 A DHZ
2003.500 332 45.2 76 43.3 12564 11170 -5752 53237 54699 A DHZ
2004.500 333 07.8 76 40.5 12600 11240 -5695 53202 54674 A DHZ
2005.500 333 29.3 76 38.7 12624 11296 -5635 53176 54654 A DHZ
2006.500 333 50.4 76 36.2 12656 11360 -5580 53140 54626 A DHZ
2007.500 334 10.9 76 34.0 12686 11420 -5525 53113 54607 I DHZ 3
1983.500 326 42.3 77 15.1 12164 10167 -6677 53765 55124 Q DHZ
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1984.500 326 56.3 77 13.3 12186 10213 -6648 53734 55098 Q DHZ
1985.500 327 11.6 77 12.0 12202 10256 -6611 53704 55073 Q DHZ
1986.500 327 27.4 77 10.8 12215 10297 -6571 53676 55048 Q DHZ
1987.500 327 44.9 77 09.4 12232 10345 -6527 53648 55025 Q DHZ
1988.500 328 00.8 77 08.2 12246 10387 -6487 53631 55011 Q DHZ
1989.000   0 02.6  0 00.7    -4     2    10    30    28 J DHZ 1
1989.500 328 14.4 77 06.6 12263 10427 -6455 53591 54976 Q DHZ
1990.500 328 30.0 77 05.3 12279 10470 -6416 53567 54956 Q DHZ
1991.500 328 46.1 77 04.0 12297 10515 -6376 53551 54945 Q DHZ
1992.500 329 01.6 77 02.7 12312 10556 -6336 53521 54919 Q DHZ
1993.500 329 18.2 77 00.9 12335 10607 -6297 53491 54895 Q DHZ
1994.000   0 00.0  0 00.     -1    -1     0    -2    -3 J DHZ 2
1994.500 329 35.4 76 59.2 12357 10657 -6255 53470 54879 Q DHZ
1995.500 329 54.2 76 57.5 12380 10711 -6208 53443 54858 Q DHZ
1996.500 330 13.6 76 55.5 12403 10766 -6159 53407 54828 Q DHZ
1997.500 330 34.2 76 53.4 12431 10827 -6108 53380 54808 Q DHZ
1998.500 330 55.5 76 51.6 12456 10886 -6053 53359 54793 Q DHZ
1999.500 331 17.9 76 49.6 12483 10949 -5995 53330 54771 Q DHZ
2000.500 331 39.3 76 47.8 12507 11007 -5938 53308 54755 Q DHZ
2001.500 332 01.5 76 45.6 12535 11070 -5880 53278 54733 Q DHZ
2002.500 332 23.7 76 43.6 12562 11132 -5821 53252 54714 Q DHZ
2003.500 332 45.9 76 42.0 12584 11189 -5759 53234 54701 Q DHZ
2004.500 333 08.1 76 39.7 12613 11252 -5700 53200 54675 Q DHZ
2005.500 333 29.6 76 37.8 12640 11311 -5641 53177 54659 Q DHZ
2006.500 333 50.5 76 35.5 12669 11371 -5585 53141 54630 Q DHZ
2007.500 334 11.0 76 33.5 12694 11427 -5528 53114 54610 Q DHZ
1983.500 326 40.4 77 17.7 12121 10128 -6659 53763 55112 D DHZ
1984.500 326 54.6 77 16.5 12136 10168 -6626 53744 55097 D DHZ
1985.500 327 10.1 77 14.7 12158 10216 -6592 53707 55066 D DHZ
1986.500 327 25.6 77 13.7 12169 10255 -6552 53683 55045 D DHZ
1987.500 327 43.9 77 11.0 12205 10320 -6516 53645 55016 D DHZ
1988.500 327 59.5 77 10.9 12204 10349 -6469 53636 55007 D DHZ
1989.000   0 02.6  0 00.7    -4     2    10    30    28 J DHZ 1
1989.500 328 12.2 77 08.9 12228 10393 -6443 53598 54975 D DHZ
1990.500 328 30.0 77 07.3 12249 10444 -6400 53577 54959 D DHZ
1991.500 328 45.1 77 06.5 12258 10480 -6359 53560 54945 D DHZ
1992.500 329 00.8 77 05.6 12268 10517 -6316 53539 54927 D DHZ
1993.500 329 16.8 77 03.5 12295 10570 -6281 53502 54897 D DHZ
1994.000   0 00.0 00 00.0    -1    -1     0    -2    -3 J DHZ 2
1994.500 329 33.2 77 02.9 12300 10604 -6233 53481 54877 D DHZ
1995.500 329 52.6 76 59.7 12344 10677 -6195 53445 54852 D DHZ
1996.500 330 12.9 76 57.1 12378 10743 -6149 53411 54827 D DHZ
1997.500 330 33.7 76 54.8 12409 10807 -6099 53382 54805 D DHZ
1998.500 330 54.7 76 54.2 12416 10850 -6036 53371 54796 D DHZ
1999.500 331 17.0 76 51.9 12446 10915 -5980 53336 54769 D DHZ
2000.500 331 37.8 76 50.1 12472 10974 -5926 53317 54756 D DHZ
2001.500 332 00.3 76 47.0 12512 11048 -5873 53276 54726 D DHZ
2002.500 332 23.3 76 45.3 12536 11108 -5810 53256 54711 D DHZ
2003.500 332 44.1 76 45.7 12526 11134 -5738 53245 54698 D DHZ
2004.500 333 06.5 76 42.6 12567 11208 -5684 53206 54670 D DHZ
2005.500 333 29.1 76 40.1 12600 11275 -5625 53174 54647 D DHZ
2006.500 333 50.1 76 37.7 12631 11337 -5570 53140 54621 D DHZ
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2007.500 334 10.9 76 34.9 12672 11407 -5519 53113 54604 D DHZ
* A = All Days
* Q = Quiet Days
* D = Disturbed Days
* J = Jumps jump value = old site value - new site value
ELE = Recorded elements
Notes: 1. The jump in the values from 1988 to 1989 is due to establishment of a new absolute pillar during 1988.
2. The jump in the values from 1993 to 1994 is due to a change in the difference delta-F between the PPM pillar and the absolute pillar. The change happened between spring 1989 and autumn 1993. Why and when is unknown.
3. Incomplete All-Day mean data for 2007, only 75% of data were available

Sample of missing values

YEAR	D		I		H	X	Y	Z	F	*	ELE	Note
	Deg.min		Deg.min		nT	nT	nT	nT	nT			
1983.500	999	99.9	999	99.9	999999	999999	999999	999999	999999	A	DHZ	
1984.500	999	99.9	77	14.3	12171	999999	-6642					