

# INTERMAGNET Meeting Minutes

## (public edition)

South African National Space Agency  
Hospital Street,  
Hermanus 7200, Western Cape,  
South Africa

Sunday 03 September – Tuesday 05 September, 2017



### Participants:

#### EXCON:

Carol Finn (CF), USGS, USA  
Gauthier Hulot (GH), IPGP, France  
Alan Thomson (AT), BGS, UK

Excused: David Boteler (DB) GSC, Canada

#### OPSCOM:

Charles Blais (CB), GSC, Canada  
Stephan Bracke (SB), IRM, Belgium  
Simon Flower (SF), BGS, UK  
Benoit Heumez (BH), IPGP, France  
Andrew Lewis (AL) GA, Australia  
Jürgen Matzka (JM), GFZ, Germany  
Jan Reda (JRD), IoG PAS, Poland  
Hiroaki Toh, (HT), KU, Japan  
Chris Turbitt (CT), BGS, UK

The following members participated via on-line communication for selected sessions:  
Sergey Khomutov (SK) IKIR, Russia  
Roman Leonhardt (RL), ZAMG, Austria  
Benoit St-Louis (BSL), GSC, Canada

Excused:  
Virginie Maury (VM), IPGP, France

#### Guests:

Ellen Clarke, BGS  
Jeremy Fee, USGS  
Reiner Friedel, LANL  
Michael Kosch, SANSA  
Jimmy Makoloane, SANSA  
Emanuel Nahoya, SANSA

Masahito Nose, KU  
Anatoly Soloviev RAS  
Larisa Trichtchenko, GSC  
Liejun Wang, GA  
Jun Yoshimura, JMA

**Institute Abbreviations:**

BGS – British Geological Survey

JMA - Japan Meteorological Agency

GA – Geoscience Australia

GFZ –German Research Centre for Geosciences

GSC – Geological Survey of Canada

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

LANL – Los Alamos National Laboratory, USA

NRCan – Natural Resources Canada

RAS – Russian Academy of Sciences

SANSA – South African National Space Agency

USGS – United States Geological Survey

ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Austria

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# INTERMAGNET Meeting Minutes

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

Throughout these minutes, participants are identified using the initials given in the list of committee members.

## 1 Welcome and introductions

The meeting was held at the offices of the South African National Space Agency in Hermanus, South Africa. SF, OPSCOM chair, welcomed participants and opened the meeting.

Michael Kosch, SANSA Chief Scientist, welcomed participants, presented an overview of the 80-year history of the Hermanus magnetic observatory/SANSA Space Science Division and described the logistics of the meeting.

AT, chair of EXCON, welcomed participants and thanked the SANSA local organisers.

## 2 Committee structure and membership

### 2.1 Executive Council (EXCON)

Alan Thomson*
David Boteler
Carol Finn
Gauthier Hulot

### 2.2 Operations Committee (OPSCOM)

Chair                Simon Flower\*  
Secretary        Andrew Lewis

Subcommittees

Definitive Data (DD)	IMO Applications and Standards (IMO)	Technical Manual (TM)	GINS/WWW/Data Format (GWD)	Instruments and Data Acquisition (IDA)
Jan Reda*	Chris Turbitt*	Benoit St Louis*	Charles Blais*	
Charles Blais	Stephan Bracke	Stephan Bracke	Stephan Bracke	Sergei Khomutov
Simon Flower	Benoit Heumez	Andrew Lewis	Simon Flower	Jurgen Matzka
Benoit Heumez	Sergei Khomutov	Jurgen Matzka	Roman Leonhardt	Benoit St Louis
Roman Leonhardt	Andrew Lewis	Hiroaki Toh	Virginie Maury	Chris Turbitt
Andrew Lewis	Jurgen Matzka	Chris Turbitt	Jan Reda	
Virginie Maury	Virginie Maury		Hiroaki Toh	
Hiroaki Toh	Benoit St Louis			

\* Chair of council/committee/subcommittee

## 2.3 Changes to membership

There were no changes to the EXCON membership.

After the Dinant meeting and prior to this meeting SF was elected as chair of OPSCOM following the resignation of Jean Rasson. Before this meeting SF resigned from his role as chair of GWD and CB was appointed as the chair of GWD. Tim White (USGS) resigned from INTERMAGNET before this meeting. SF expressed concerns on the number of officers absent from this meeting and noted in particular the absence of the TM chair (BSL) as a challenge to progressing the work of TM sub-committee. SF noted the TM video-conference held in September 2016 was very effective to authorise updates to the manual with the approval of the subcommittee.

## 3 Agenda for meeting and minutes from previous meeting

The agenda for the meeting was presented by SF with some minor timing changes to the published agenda and with the addition of a presentation on MagPy software by Jeremy Fee on Tuesday afternoon and an update on the e-mailing lists and missing data notifications by JM. CT noted he plans to consolidate the IMO and TM meetings into longer time blocks.

EXCON will meet off-site on Monday morning to facilitate the early departure of GH at 10 am on Monday.

The amended agenda for the meeting was accepted and is available in the appendix.

Agendas for subcommittee meetings were presented by the subcommittee chairs and are available in the sub-committee minutes included below. These agenda were accepted.

The draft minutes for the Dinant meeting were noted with a call for any corrections or additions to be sent to the secretary. Paragraphs on three presentations given at the Dinant meeting were requested from the presenters to complete section 6 of the Dinant minutes.

## 4 Presentation of guests

Guests introduced themselves and nominated sub-committee meetings they would like to attend

Ellen Clarke (BGS) interested in DD and GWD subcommittee

Jeremy Fee (USGS) interested in attending the GWD and TM discussions

Masahito Nose (WDC Kyoto University) former member of OPSCOM interested in DD and GWD

Liejun Wang (GA)

Jun Yoshimura (JMA, Kakioka Obs) also observed at the 2015 Niemegek meeting.

Other guests not present in this session:

Larisa Trichtchenko (GSC)

Reiner Freidel (LANL)

Anatoly Soloviev (RAS)

Jimmy Makoloane, SANSA

Emanuel Nahoya, SANSA

## 5 The committee structure

The committee structure was considered and the difficulties for some members to attend meetings discussed. It was decided OPSCOM Chair will compile an attendance list in advance of future meetings to identify possible problems with committee membership. To ensure there will be adequate member representation for each sub-committee OPCOM chair will, as necessary, invite non-members as temporary stand-ins to meetings to represent members unable to attend.

CT suggested deputy chairs could be nominated for each sub-committee so work can progress if the chair is unable to attend a meeting.

Consideration was given on how to assist/encourage attendance by members experiencing difficulty in attending, including formal letters of invitation by EXCON.

It was generally agreed that OPSCOM requires more members, with new members from areas not currently represented, such as South America, India and China, being particularly important. SF suggested inviting key people who are well connected in these areas to attend as observers to encourage openness and inclusiveness at the meetings. Suggestions for new members should be passed to EXCON and OPSCOM chair.

There is no longer any OPSCOM membership from the Golden GIN but CF noted staffing issues at USGS make it difficult to identify a candidate at this stage.

SF agreed to announce future meetings to the community via on the “worldobs” mailing list ([worldobs@gfz-potsdam.de](mailto:worldobs@gfz-potsdam.de)) and to target specific visitors who are considered important to INTERMAGNET business with email invitations.

### 5.1 IDA Sub Committee

The role of the IDA sub-committee was considered and it was decided there is insufficient on-going work to re-establish the IDA subcommittee at this time. Additionally, the difficulty for existing members of OPSCOM to find the time to attend to IDA matters was noted. SF suggested an OPSCOM officer be appointed to keep a watching brief on items arising that are relevant to IDA and that officer could identify the need for the IDA to convene as necessary. Possible topics to be considered by the IDA are: emerging instrumentation for 1-second data; digital filtering; data processing software; real-time data and message brokers; compilation of instrument and manufacturer lists. There were no volunteers for this position. CT suggested one member prepares and presents a report on possible IDA topics. The IDA will not meet during this meeting. SF will wait to hear from a self-nominated volunteer to keep a watching brief on future IDA business.

## 6 How we work

SF explained his goal to make the work of INTERMAGNET more open and accessible. SF questioned if there is a better way to work and whether the comprehensive minutes are entirely necessary. GH commented that the minutes are an invaluable record of the history of actions and are a very useful document even if they are not read in their entirety.

SF suggested the minutes for this meeting should effectively comprise five separate sets of minutes; one for the plenary sessions prepared by AL, and one for each of the sub committees prepared by the subcommittee chairs. The chairs will be responsible for recording and managing action items and decisions from each subcommittee and managing the flow of action items within subcommittee and plenary sessions.

It was agreed that the minutes should be made publicly available to the community, perhaps with some sensitive topics redacted. An agreed set of minutes will be published after INTERMAGNET committee

members have been given time to considered any sensitive sections that should be redacted. SF and AL will develop a procedure/time table to publish the minutes. AT noted we must be careful about having two versions of the minutes, an internal version for INTERMAGNET and an external published version. The idea of on-line meetings between the annual face-to face meetings was discussed and it was agreed that at least one on-line meeting for each subcommittee should be very valuable to encourage completion of INTERMAGNET business and endorse committee decisions. Appropriate consideration is required for the timing of meetings given the various time-zones involved. Formal “document meetings” scheduled over a few days or on-line forum meetings were also suggested as a useful alternative to on-line meetings to address the problem of different time-zones.

AT suggested at least one intermediate meeting is required for each sub-committee but gave discretion to the sub-committee chairs to arrange these meetings.

SF will structure this meeting, and the future annual face-to-face meetings, to include a session of group work scheduled for the last afternoon after the formal meeting has been closed.

## 7 Presentation in plenary sessions

### 7.1 How we communicate with members (AT)

*A presentation to pose questions and promote discussion on how to improve the way INTERMAGNET communicates with the community.*

Currently the main forms of communication from INTERMAGNET are:

- an annual report from the meetings;
- the website;
- the DVD;
- presentations at IAGA meetings.

AT noted, in his position as EXCON chair, he sees misunderstandings within the community on the role of INTERMAGNET.

Is this current level of communication adequate and what is the best way to make INTERMAGNET more visible and relevant? Should INTERMAGNET and IAGA communicate more closely? How can we encourage the IMO institutes to feel more strongly connected to INTERMAGNET and the community? Does INTERMAGNET communicate enough to ensure we remain visible and relevant?

Who needs to know? What is the future of INTERMAGNET?

In the discussion AT noted INTERMAGNET should highlight the requirements for ground base networks in space weather research and asked if INTERMAGNET should be a champion for geomagnetism in general, both ground based and space-based?

HT questioned if we still need ground-based monitoring and GH explained that satellite data analysis cannot be done without ground-based data and at the simplest, an assessment of the geomagnetic environment is required from the ground based observatory data. It is important to consider adding a space component to INTERMAGNET.

Should we be using social media?

Publishing the minutes from meetings will be very useful to improve communications.

AT and SF concluded by noting that we would keep a review of our communications and strategy as a regular item in future meetings.

## 7.2 Progress on 1 second data (JRD)

### *A report on progress of 1-second definitive data*

38 IMOS provided 1 -second data for 2014 in IAGA2002 format. All these data were checked by JRD using CheckData1S, and a format conversion application developed by JRD and the IMCDview software. 36 IMOs were accepted. 2 IMOs were not accepted due to data spikes and problems of on-site construction. These data are not yet available on the IMAG website.

So far only 3 IMO's have submitted 1-second data for 2015 but the 01 October deadline is yet to be reached. Data are requested in ImagCDF format, but there are problems for some IMOs creating ImagCDF data and also with checking data in ImagCDF format because existing checking tools cannot read ImagCDF. MagPY may be a solution to some of these issues.

At this stage, the 1-second data does not need to meet the standard and data are not checked against the 1-second standard. The idea was to get a critical mass of IMOs producing 1-second data so processes for data receipt and checking could be developed and refined.

The 2015 call for 1-second data could be opened up to IAGA-2002 format data after the 01 October deadline has passed.

More details are included in the DD minutes below.

## 7.3 Licensing and DOIs (SF)

### *A presentation to report on progress and stimulate discussion on the important issues of data licensing and Digital Object Identifiers*

#### 7.3.1 Licensing

The existing INTERMAGNET license (available on the INTERMAGNET web site) is a good document but it is not suitable for modern usage as it is not widely recognised around the world and is not machine readable. EPOS and other data users require a modern, widely accepted, machine-readable licence. There are two main licensing authorities, "Creative Commons" and "Open Data Commons". Creative commons have a number of licences but the "CC-BY-NC" is closest to the existing INTERMAGNET licence. The USGS use CC-0, which allows any users to do anything with their data.

There are questions on how INTERMAGNET would apply the licence to data.

INTERMAGNET cannot mandate any particular licence for IMOs, but INTERMAG could make a recommendation that institutes consider the issue of data licensing and perhaps INTERMAGNET could develop a default position for those cases when institutions do not apply a licence. No licence is not a good option and the subject of licensing demands a wide community discussion. An IAGA task force has been established. There will be information on the IAGA V-DAT web page and Masahito Nose will add any discussions to that site. SF will contact interested parties by email to stimulate discussion. IAGA/WDC/INTERMAGNET are three players involved in licensing decisions. The IAGA taskforce will recognise diversity and make a recommendation for those institutes who have not adopted a licence. INTERMAGNET should consult with the community and perhaps submit a proposal suggesting the CC-BY-NC is a good replacement for the existing INTERMAGNET licence.

#### 7.3.2 DOIs

The web site "DOI.org" provides a useful definition for DOIs as digital identifiers of objects. For INTERMAGNET the DOI system should:

- allow citation of data;
- allow recognition and acknowledgment for data providers;
- allow discovery and on-line access to data;

- allow re-use and reproducibility of data;
- Include metadata to uniquely identify data sets.

INTERMAGNET should concentrate first on the easier task of creating DOIs for definitive data before tackling the more complex data types, but even this is complicated.

There are at least two possible options for INTERMAGNET:

- create DOIs for data;
- recognise and harvest already existing DOIs created by institutes and keep a searchable database for DOIs associated with IMOs;
- a hybrid of these two options.

The World Data System has assigned a DOI for INTERMAGNET as a whole.

Jeremy Fee commented that the work done by INTERMAGNET in checking and hosting definitive data adds value to the data and helps guarantee reproducibility of the data held by INTERMAGNET and so justifies a separate DOI for those data.

Data reproducibility and large data citation lists are two issues which need consideration. Long citation lists are normal in other areas and journal authorities almost certainly have guidelines and solutions for this problem.

There are options for creating DOIs for geomagnetic data: one DOI for an entire observatory network (as done by the French at BCMT and the seismic community); a DOI per observatory; a DOI per observatory per year. Each DOI has an associated landing page so the DOI allows discovery of the dataset, but there are no standards for landing pages.

SF noted DOIs will be recorded in the geomagnetic metadata system with a query tool could allow searching for DOIs.

Jeremy notes the seismic community has one DOI for an entire network – INTERMAGNET could offer to create DOIs for IMOs.

SF noted we must first get a system working for definitive data and then start looking at quasi-definitive data and that ultimately the acknowledgement for data must end up with the institute producing the data.

Masahito noted that the ability for institutes to mint DOIs will vary, so guidance or a document from INTERMAGNET will be very helpful for institutes. Who in INTERMAGNET can draw up the suggested guidelines? Can we look outside INTERMAGNET for expertise?

INTERMAGNET could build up expertise first or make some decision in the near future.

A group comprising Masahito Nose, Ellen Clarke, Jeremy Fee, SB and BH volunteered to work on a discussion document describing best practice with DOIs and recommendations to IMOS on DOIs.

## 7.4 Continuation of the DVD (JRD)

*A presentation on the pros and cons of continuing to publish an annual compilation of definitive data on DVD or substitute media.* Further details of the presentation are in the DD minutes included below.

In the discussions that followed CB noted that ImagCDF format can allow for K indices, baselines and other metadata to be easily included in the data files and SF noted that the new metadata system under development could also store much of the metadata necessary, so metadata is not a technology problem.

CF asks why we are still considering this – CT notes the DVD is one of the most effective methods of communication to IMOs and it represents a tangible object and creates an enforceable deadline for data delivery. BH commented the DVD deadline does work to encourage data delivery but is it also very important that data are released on-line as soon as they are available.

Rather than a physical DVD, AT suggested a news item published in a journal (EOS or similar) to announce data – this could act as a citable reference and could be linked to a document on the INTERMAGNET website listing contributing IMOs.

## 7.5 Web service (SF)

*A discussion on the impending changes to the INTERMAGNET on-line data distribution system.*  
NRCAN can no longer host the INTERMAGNET web services. A call for applications from interested institutes to host the web service and ftp service was circulated amongst INTERMAGNET officers a few months ago. A committee made up of three members of EXCON will consider any applications received. It is important to implement the web service soon as it has been waiting for release for quite some time.

## 7.6 European Plate Observing System (EPOS) (SF)

*An explanation and update on the EPOS project.*  
EPOS has 10 science themes, of which geomagnetism is one. EPOS will provide interoperable data with the ability to mix data sets from other disciplines within EPOS to encourage new research. EPOS is funding the geomagnetism metadata scheme under development at BGS and GFZ. The EPOS project is about 50% through the implementation phase which will be followed by an operations phase. The first operational systems are to be delivered by the end of September. The geomagnetic community will supply data from INTERMAG, World Data Centres, the IMAGE variometer chain, magnetic indices through ISGI, magnetic field models and magnetotelluric data.

## 7.7 Geomagnetic metadata (SF)

*A description of the metadata system under development at BGS and GFZ in conjunction with EPOS.*  
The system is a relational database of metadata on geomagnetism being implemented in the BGS oracle system. There is a group of about 40 people interested in the work and the system has now been peer reviewed within BGS. Work has started to populate the system and generate XML files. The system is multilingual and will power the INTERMAGNET web site, control what is available through EPOS and be used more widely than just INTERMAGNET.

The main entities in the system are: Observatories, addresses, institutes, people, instruments and data sets but it also allows for photographs, time periods etc. The data set entity has flexible fields for DOIs. An application will be developed to allow institutes to update their own metadata with security control and there are plans to develop a general web services to query the metadata.

There has been significant progress since last year.

## 7.8 Update on nanoMagSat (GH)

*An update on progress of the proposal for cube satellites to augment the SWARM satellite mission.*  
SWARM continues to be excellent but some data analysis and modelling applications require faster local time sampling than SWARM can provide due to the polar orbits of the space craft. SWARM data can be used for global full field analysis once every three to six months due to orbits shifting only slowly in local time. SWARM data has been used to model magnetic tidal ocean signals and crustal field models but there are some artifacts in the data due to the north-south orbit orientation. For these reasons, it would be nice to get data from a satellite with an inclined orbit with better local time coverage. A 60-degree inclined orbit would be optimal for local time resolution but it would not sample the polar latitudes. Such an orbit would take about 1 month for entire local time coverage.

This could be done with a 12U “nanoMagSat” satellite with appropriate instrumentation such as an Absolute Scalar Magnetometer. The ASM has been shown to be capable of producing vector data and

the high frequency scalar data is also very useful. There has recently been progress on the ASM instrument to improved resolution and accuracy.

A nanoMagSat launch date in 2021 would be ideal as the three SWARM satellite orbits will then be aligned making local time sampling more of a problem. After 2021 solar activity will increase and so shorten the life of the satellites.

There is support for a nanoMagSat but the project is not yet fully funded. ESA is interested and ESA/CNES collaboration would be good. INTERMAGNET have written letters of support and the US have written a report endorsing the capability of the ASM instrument for US military use. An IAGA resolution was accepted in the Cape Town assembly to encourage space measurements by continuing the SWARM mission and working on improvements.

The overall cost for the initial 12U satellite would be 5-10 million Euro, including launch, and costs should decrease for later satellites. JM asked if the costs included the ground segment- ESA would make the SWARM ground segment available for a nanoMagSat proposal, but partners are welcome.

## 7.9 INTERMAGNET global activity map (AT)

*A presentation, on behalf of DB, as a reminder of the INTERMAGNET geomagnetic activity map (<http://www.intermag.net/activitymap/activitymap-eng.php>) and to stimulate discussion on the importance of real-time magnetic data and visualisations of data held by INTERMAGNET.*

The global activity map on the INTERMAGNET web site shows magnetic activity but there are only a small number of IMO's providing data in real-time. More stations available in real-time would make a more useful product for space weather monitoring.

AT questioned the causes for data delays and if there is scope for INTERMAGNET to develop other data visualisation not already done by other groups. INTERMAGNET should advertise products like this more widely.

CB noted that DB wants to develop real-time GIC analysis and is encouraging production of real-time data from IMOs.

In the discussions that followed the reason for real-time data embargos by some institutes were explained by the requirements of commercial interests. Perhaps hourly ranges or images of data rather than actual data could be provided in real-time.

CB noted Canada cannot distribute data within 24 hours but hourly range data should be OK. Ellen Clarke noted the BGS has a 7 or 8-day embargo to satisfy first-use requirements of commercial customers such as the National Grid but they could consider releasing data images rather than the actual data.

## 7.10 Observatories and space weather modelling (Reiner Friedel)

*A presentation to highlight the requirement for 1-second observatory data in radiation belt modelling.*

Radiation belt modelling is required to monitor space weather effects on satellites from geosynchronous orbits down to low earth orbit. Current models describe the physical processes but driving these models with statistical average input data can only produce average output behaviour. The main limitation on radiation belt modelling is accessing the large amount of data required to constrain the model parameters. Radiation belt modellers have started to use more ground based data and the real-time aspect of INTERMAGNET data is very interesting to the community.

1 Hz magnetometer data from ground based magnetometer arrays is required and more work is required to explore the transfer function between data from ground based stations and what is observed in space. Ground based VLF and ULF measurements offer a viable source of useful data and could be quite cheaply added to existing IMOs. There are many ground based arrays but work is required to co-ordinate and collect this magnetometer data and make it available. Perhaps

INTERMAGNET could be a conduit to co-ordinate this effort by promoting discussion in the observatory community and developing useful derived products.

A wish list includes a ground based network measuring magnetometer and VLF data; continuous real-time data analysis to estimate wave amplitudes, electron density and diffusion coefficients.

SF suggested EXCON talk with Reiner to take this forward.

## **7.11 World Meteorology Organisation/OSCAR and INTERMAGNET (Larisa Trichtchenko)**

*A presentation to highlight the role of the WMO in space weather activities and to encourage communications between INTERMAGNET and the WMO.*

Since 2008 the World Meteorological Organisation (WMO) has co-ordinated research into space weather activities and has published a four-year plan (2016-2019). This work includes publishing documents to promote space weather observations, guidance for making space weather observations and development of a space weather portal (WMO/Spaceweather).

OSCAR the “observing systems capability analysis and review” tool is an on-line repository (<https://www.wmo-sat.info/oscar/>) of metadata for observations. OSCAR is split into “space” and “surface”. The space section includes information on satellites and instrumentation for climate and space weather monitoring. OSCAR “surface” is the metadata repository for the WMO integrated Global Observing system (WIGOS) and is still under development. OSCAR surface allows on-line searches on ground based stations.

INTERMAGNET could be involved in OSCAR.

AT noted this is the first contact between the WMO and INTERMAGNET and commented that once the geomagnetic metadata system has been completed it will perhaps be useful for OSCAR and WMO.

INTERMAGNET could contribute expertise in ground-based observatory metadata. A mechanism for discussion is required between WMO and INTERMAGNET.

## **7.12 Present and future threats and how we face them (HT)**

*A summary of recent threats to ground based networks in the past and some lessons on how to deal with any such threats and problems in the future.*

Recently there have been concerns about the USGS geomagnetism program and an IAGA resolution and on-line partition has been run in support of the USGS program. The threat to the USGS network is not yet resolved and is still waiting on senate budget approval.

Some years ago, the Danish Meteorological Institute geomagnetic network was under threat and was taken over by Danish Technical University.

In 2010 the GSI segment of the Japanese network was threatened. WDC Kyoto helped face the threat and found that academic arguments were not so useful but legal arguments based on the need for runway magnetic bearings were the most powerful argument.

These experiences indicate there is a clear and present danger for the INTERMAGNET network and international collaboration may strengthen the INTERMAGNET network as a whole.

It is clear that ground networks are required for satellite studies but what is the appropriate density for a global ground network? The space weather application of geomagnetic data is very useful but we may need other arguments in the future.

## **7.13 Definitive data timeliness (JRD)**

*A presentation of summary statistics of definitive data for recent years and a discussion on the timeliness of definitive data delivery and acceptance for 2014.*

The 2013 data has been published on DVD and the 2014 DVD is almost completed. For 2014 there are 111 IMO from 37 countries, this is 1 less than the all-time record of 112 IMO. For 2015 data 92 IMOs have submitted data with 82 fully accepted. For 2016, data from 71 IMO have been received with 30 accepted.

Data timeliness was illustrated with a cumulative plot showing the timing of 2014 data submissions on step1 and data acceptance. The plot is presented in the DD minutes included below. JRD will do a similar study for the 2015 data and present at the next meeting.

Discussions noted that automated emails about late data are good but one- to-one discussion between IMO and data checkers may be required to investigate the cause of delays.

Finalisation of data from a small number of IMOs takes a long time due to difficulties with data and formats and JRD noted many of the slow IMOs are often located in areas where the network is not dense, thus it is important to encourage these IMOs. If it is the same late IMOs every year then perhaps they could they be offered appropriate assistance.

JM noted that GFZ has been checking 2014 data not previously checked by the designated checkers, and he is happy to continue doing that for the next few years.

CT mentioned it would be very useful to have an automatic on-line tool to check data as part of the submission process rather than just uploading data to the ftp server and waiting for manual checking.

CB will consider the implication of developing such an automated checking process.

## 8 Next meeting

There has been one offer from the Conrad observatory to host the next INTERMAGNET meeting after the IAGA workshop in late June 2018. SF noted the importance of holding meetings outside Europe (particularly in South America) and AT mentioned the 2019 IUGG in Montreal and the 2020 observatories workshop in Russia will be opportunities for future INTERMAGNET meetings away from Europe. CF noted INTERMAGNET meetings are best scheduled to coincide with other related meetings to maximise attendance and simplify travel arrangements.

It was agreed to schedule the next meeting after the Conrad observatory IAGA observatory workshop, either at the Conrad observatory or in Vienna, SF will contact RL to confirm details.

## 9 Plenary decisions and action items

Only those decisions and actions items not captured in subcommittee minutes are included here.

### 9.1 Decisions

Number	Description
Plenary D1	Minutes from this meeting will be published on the INTERMAGNET website
Plenary D2	The next meeting will be held after the IAGA Observatories workshop in Conrad, Austria at either Conrad or Vienna.

### 9.2 Action items

Number	Responsible	Description
Plenary A1	subcommittee chairs + AL	Chairs to document action items and decisions in subcommittee minutes. Secretary to minute the plenary sessions and compile all

		minutes.
Plenary A2	subcommittee chairs	Arrange an online subcommittee meeting before the next face to face meeting.
Plenary A3	AL	Receive any corrections of Dinant minutes and co-ordinate with BSL to finalise Dinant minutes.
Plenary A4	SF, JF, SB	Provide summary paragraph of presentation made at Dinant to finalise Dinant minutes.
Plenary A5	SF	Include discussion on Communications as a standing agenda item in future meetings.
Plenary A6	SF	Announce future INTERMAGNET meetings on worldobs mailing list.
Plenary A7	SF	Call for recommendations to invite key people/representatives to next meeting. Invite IAGA representative to next meeting.
Plenary A8	Committee members	Provide suggestions or recommendation for new OPSCOM membership to SF and EXCON
Plenary A9	SF, AL	Develop procedures and time-table for pre and post meeting tasks (participant invitation, attendance lists, preparation and publishing minutes)
Plenary A10	SF	Review subcommittee membership for practicality of meetings, including the appointment of deputy chairs
Plenary A11	CT, JM, AL	Do a comparison study of all available quasi-definitive and definitive data for 2015. Jane Exton (BGS) has software to perform the comparison. Produce and publish a paper of results with INTERMAGNET authorship. Review methods of QD data production and include A.Chulliat in preparations and discussions.
Plenary A12	JM	Create DOIs for existing definitive data DVDs and report on any problems (one DOI for each DVD).
Plenary A13	BH, SB, M Nose, E Clarke, J Fee	Prepare a DOI discussion document suggesting best practice and offering advice to institutes on using DOIs.
Plenary A14	JM, SF	Commence capture of already created DOIs from institutes and add to metadata system.
Plenary A15	Committee members	Encourage their institutes to consider the issues of data licensing and DOIs.

## 10 Executive Council

### 10.1 Participants and meeting structure

31<sup>st</sup> August – 5<sup>th</sup> September 2017, SANSA, Hermanus, South Africa

EXCON met at two separate meetings in South Africa.

1. Thursday 31<sup>st</sup> August, 17:00-18:00. IAGA Scientific Assembly, Cape Town International Conference Centre.  
Attendees: D Boteler, C Finn, G Hulot and A Thomson.
2. Monday 4<sup>th</sup> September, 08:50-11:45. Hermanus.  
Attendees: C Finn, G Hulot (left the meeting at 10:00) and A Thomson.

The minutes below are a report based on both of these meetings.

### 10.2 Agenda

Cape Town and Hermanus, 31st August - 5th September 2017

#### 1. Report on EXCON Dinant Action Items

- Follow-up on any relevant items (EXC1, 3, 4, 7, others considered separately below)

#### 2. Discussion potentially leading to Decisions

- Vision and Mission Document (v2)
- INTERMAGNET web service host (if bids are received)
- Continuation of DVD versus online data?
  - (p71 of minutes) “An EXCON decision on halting production of a physical DVD was delayed. IPGP may poll IMO contacts prior to producing the 2013 DVD to ask whether they wish a physical copy to be posted. Based on the response, a decision could then be made to continue production beyond 2013 or solely publish as an ISO file on the web site.”

#### 3. General Discussion & Information

- Status of OPSCOM and subcommittees and activities
  - Progress on definitive 1-minute data
  - Progress on 1-second data
  - Progress on the Technical Manual
- Discussion on ways forward for INTERMAGNET
  - New science opportunities?
    - In Dinant we discussed nanosats, electric field measurements and standards, and variometers
    - New standards for new science opportunities?
  - Data visualisation tools and website?
    - C.f. activity index
  - ‘Statutes and by-laws’

- Do we need more procedural rules for INTERMAGNET written down?
- C.f. web service host decision
- Inviting guests to INTERMAGNET meetings
  - Is this a distraction, or helpful in building the network?
  - Mechanism? (issues=money, location, value for both sides)

#### 4. Any Other Business

### 10.3 Review of EXCON Dinant/Dourbes (2016) action items

EXCON considered each of the Dinant/Dourbes meeting action items in turn:

Number	Description	Comments	Status
<b>EXC.1</b>	Letters of invitation.	The intention had been to use possible attendance by observatory-related individuals at IAGA, as a basis for invitation to the INTERMAGNET (IM) meeting. However, we did not have prior knowledge of who was attending IAGA in order to do this. As a principle, it was regarded as good for IM to invite selected individuals to the IM meeting to encourage the spread of IM activities but it would not be mandatory on us to do so. It was later decided (in Hermanus) that EXCON ( <b>EXC.A1. – AT, SF</b> ) will issue letters of invitation to delegates from countries/regions where IM is under-represented, as appropriate to the location of any future IM annual meetings and any associated scientific meetings (e.g. IAGA/IUGG assemblies, IAGA workshops). Such an activity would also support the goals of better communications with IMOs and others. Use of the online ‘worldobs’ message board to advertise IM meetings was also agreed	<b>Not done</b> <b>See EXC.A1</b>
<b>EXC.2</b>	Letter of concern regarding future of TIH observatory		<b>Done</b>
<b>EXC.3</b>	External donations to IM	In discussion it was felt that external funding, while welcome on occasion, would not be a sustainable basis for long-term support of IM activities. However, it might be helpful on an ad hoc basis for individual activities.	<b>Not done</b> <b>– to be reconsidered at some later date</b>
<b>EXC.4</b>	Letter of support for CNES ‘nanomagsat’ project		<b>Done</b>
<b>EXC.5</b>	Consequences of reprocessing QDD	<i>Feedback from OPSCOM required here</i>	<b>ongoing</b>
<b>EXC.6</b>	Vision and Mission	Discussed in Hermanus. A decision was made in Hermanus to publish the V&M (at version 2, as revised in Hermanus)	<b>Done</b>

		with slightly revised wording	
<b>EXC.7</b>	Communications	Communication is an on-going process and the EXCON and OPSCOM chairs will lead on better and wider communications with IMOs and others. <b>(EXC.A2. – AT, SF)</b> In Hermanus, CB and BH agreed to investigate the potential for implementing an online message board for IMOs to share issue and ideas with IM officers.	<b>Ongoing</b>
<b>EXC.8 and EXC.9</b>	TN on QDD and Criteria for comparison of QDD and DD	The items were considered as superseded by events and that a comparison of QDD and DD data had in fact been completed and was available online	<b>Done</b>

## 10.4 Discussion potentially leading to decisions

### 10.4.1 Vision and Mission document (v2)

A specific wording for the IM V&M statement (Discussion Document DD27) was agreed (as below) and it was also agreed to use this in future communications and outreach, for example with external bodies and on the IM website (**EXC.D1**). EXCON considered that the wording of the V&M document be reviewed at least every 5 years to ensure continuing relevance to IM’s activity and direction.

*The INTERMAGNET vision is of*

A global, real-time, permanent geomagnetic observatory network, which is recognized as a key Earth observation system and which provides data that serves scientific research into the Earth, from its deep interior to space, and supports operational services benefiting society.

*The INTERMAGNET mission is to*

Establish, maintain and develop an organisation with a worldwide membership drawn from institutes operating geomagnetic observatories that is dedicated to supplying consistent data, with the geographical coverage, quality, and timeliness of delivery required to meet the evolving needs of research and applied science.

*The INTERMAGNET strategy is to*

- Set mandatory standards for measurement, data processing, formats and transmission for network membership, and to support geomagnetic observatory operators in achieving these standards by providing technical assistance
- Provide advice on the establishment of new observatories, to help to co-ordinate initiatives taken by member institutes and so to optimise the scientific value of the global network
- Support data services, as a member of the World Data System, by maintaining an infrastructure for geomagnetic observatory data collection and dissemination
- Communicate with data users to promote use of INTERMAGNET data and to understand their requirements, feeding this information into the definitions of operating standards

- Work closely with the International Association of Geomagnetism and Aeronomy and other organisations concerned with magnetic observatory operations
- Maintain a dialogue with technology providers to take advantage of new developments in instrumentation and data acquisition and to advise them of user demands for data to inform their system developments

#### 10.4.2 The new INTERMAGNET web service host

EXCON discussed the current status of the web service hosting and concluded that, depending on the length of time that NRCAN can continue to support the existing web service, the deadline for receipt of bids/offers to run the web service should be as sufficiently long as possible in order to encourage the community to bid. As no bids were formally received by the time of the Hermanus meeting, and that no deadline had passed for receipt of bids, there was no decision to be made by members of EXCON and a decision was therefore postponed.

EXCON (or a subset of members as appropriate) will however evaluate bids after the deadline set by OPSCOM chair with a view to a smooth handover of responsibility within the next year, according to NRCAN's needs (**EXC.3. – EXCON**).

#### 10.4.3 Continuation of DVD versus online data?

In discussion, EXCON members decided (**EXC.D2**) that we should now move to modern digital delivery and specifically end the issuing of DVDs after the issue of the 2014 DVD. Depending on feedback from OPSCOM on any technical issues that might delay a new implementation, this new digital format should apply to the 2015 data and certainly to the 2016 data and thereafter.

EXCON's view was that we should keep the principle of a 'volume' in respect of the annual compilation of data (perhaps backed by a DOI to provide a link for individual IMOs to demonstrate their achievements). This would then be somewhat similar to the current situation in scientific paper publication where the idea of a journal and volume is maintained even though a physical paper object need not exist. Continuing the analogy, the early release of observatory data online mimics the advanced publication of an online paper, once it has passed the editorial process.

### 10.5 General discussion and information

#### 10.5.1 Status of OPSCOM subcommittees and activities

The day-1 plenary discussion was used as the basis for a wide-ranging discussion on present

- Progress on definitive 1-minute data
- Progress on 1-second data
- Progress on the Technical Manual

EXCON agreed that the issues surrounding the above were clearly recognised by OPSCOM and that all were working towards a successful outcome in each case.

EXCON otherwise felt that online/electronic and telecon discussions in subcommittees, though made difficult by time zone differences, should surely be possible at least once per year and therefore should be encouraged by all subcommittee chairs to progress activities.

In terms of organising the annual meeting EXCON felt that a schedule of activities should commence by 2 months prior to each annual meeting (**EXC.A4. – SF**) in order to be made aware of attendance issues (for IM officers) and any other impediments to a smooth and successful meeting. Both EXCON and OPSCOM would then look at any issues associated with the meeting on a case by case basis, well in advance of the annual meeting, and try to ensure maximum attendance or cover for all issues to be

discussed at the annual meeting. The options for IM to support officers could include letters of support and invitation and any other ad hoc help that is available. All IM officers are therefore encouraged to raise any issues around their attendance as early as possible so that others in IM may see if they can help.

The annual meeting is regularly held after other standing scientific meetings or observatory workshops. It is recommended that both the week before and after such other meetings be checked to ensure no clash with other scientific meetings that might reduce attendance at the IM meeting itself. There is some value in holding an IM meeting prior to any other meeting to ensure that 'hot news from IM' can be communicated at that scientific or workshop meeting.

EXCON notes that OPSCOM members have at least two roles in OPSCOM subcommittees. It is felt that it would be useful if OPSCOM members identify their primary, or lead subcommittee. This might indicate where there are remaining skills gaps that need filling with additional members.

## **10.5.2 General discussion on ways forward for INTERMAGNET**

### ***10.5.2.1 New science opportunities?***

- Relation to satellite survey missions, growth in platforms to measure and collect geomagnetic data
- Standards in long-term magnetotelluric monitoring.

### ***10.5.2.2 Data visualisation tools and website?***

- Increase number of real-time observatories contributing to data activity map (no commercial implications).
- Develop further real-time products, for example to support plasmaspheric radiation monitoring.

### ***10.5.2.3 Need for 'Statutes and by-laws'?***

- A short discussion prompted by the noting of a lack of a formal system for evaluating the new web service host.
- IM has no funding element therefore formal S&B not seen as required.
- IM has sufficient other issues in hand for us to consider this of low priority – we have successfully negotiated other such issues in the past – a sign of the strength of IM.

### ***10.5.2.4 Inviting guests to INTERMAGNET meetings***

- For example, directly and through the 'worldobs' message list.
- Value to the health of IM from input from others.

## **10.6 Any other business**

Miscellaneous items briefly raised in the meetings of EXCON:

### **10.6.1 EPOS and IM.**

It was asked if EPOS might be able to support some activities undertaken by IM, given that it seeks to use IM as a source of data. AT noted that there were limited funds within the EPOS project for such activities and therefore he felt that this was unlikely to be a productive angle. However, EPOS would need to agree data access agreements with individual institutes, which could make for significant complications in the coming years on both sides, in terms of funding.

## 10.6.2 Communications

EXCON discussed further, following the very useful discussion at the plenary meeting on 3<sup>rd</sup> September, how we can reach out to other communities, projects and programs. Activity by the WMO (e.g. the OSCAR program) and the UN, for example, on space weather means that it becomes imperative that IM communicates a position on international developments on standards and related issues. The opportunities to create unique data products, based on IM real-time data is noted elsewhere.

## 10.6.3 Relationship with IAGA.

IAGA's executive committee requested that INTERMAGNET increase the visibility of the link to IAGA on the IM website. AT noted at the IAGA excon meeting that reciprocal action would be welcome by all. A further discussion in EXCON suggested that a standing INTERMAGNET report at every IAGA meeting, maybe at business meetings, would be welcome (**EXC.A5. – AT**).

## 10.7 EXCON decisions and action items

### 10.7.1 Decisions

Number	Description
<b>EXC.D1</b>	The IM 'vision and mission' statement, subject to at least a 5-yearly review, is (wording as above).
<b>EXC.D2</b>	End the annual issue of a DVD of observatory data with the 2014 1-minute data release on DVD. Move to a modern digital solution, including online data availability from 2015 onwards.

### 10.7.2 Action items

Number	Responsible	Description
<b>EXC.A1</b>	AT, SF	Issue letters of invitation to key regional IMO and observatory institutes to attend next IM meeting as guests. Also use the 'worldobs' message board to advertise and encourage guests.
<b>EXC.A2</b>	AT, SF, with support from CB and BH	Develop and act on a communications strategy and plan, based on the discussions in plenary at Hermanus.
<b>EXC.A3</b>	EXCON, SF	Assess web service offers/bids and assist transfer of web service to new host.
<b>EXC.A4</b>	SF	Create a schedule of work at 2 months prior to the annual meeting to ensure that attendance is maximised by IM officers and that all issues to be discussed at the meeting have adequate skills and knowledge present.
<b>EXC.A5</b>	AT	Volunteer an IM status report to the IAGA division five business meeting and increase visibility of links between IM and IAGA on both the IM and IAGA websites.

## 11 Definitive data subcommittee

### 11.1 Participants

#### Committee Members

Jan Reda (JRD, Chair), Charles Blais (CB), Hiroaki Toh (HT), Simon Flower (SF), Roman Leonhardt (RL, via Skype), Benoit Heumez (BH), Alan Thomson (AT), Carol Finn(CF), Gautier Hulot (GH), Stefan Bracke (SB)

#### Guests

Jeremy Fee, Jun Yoshimura, Ellen Clarke, Liejun Wang, Masahito Nose, Larisa Trichtchenko, Anatoly Soloviev, Reiner Friedel, Pieter Kotze, Emanuel Nahayo, Jimmy Makoloane, Pierre Cilliers, Nomcebo Yende, Mike Kosch

### 11.2 Agenda

- Realization actions items after Dinant Meeting (Belgium)
- Reports on the 1-min and 1-sec Definitive Data collection
- Data medium instead of DVD for 1-min definitive data sets
- Continue publication of definitive data (DD) on DVD (or substitute) or only have data online
- Problems regarding delays on definitive data delivery / checking / publication
- Emails generated by GFZ and sent to IMOs and data checkers (statistics on Paris and Ottawa, alerts about new data on step1 and step2)
- Problems regarding data collection of 1-sec Definitive in CDF format
- Problem of K9-limits reported by International Service Geomagnetic Indices ISGI

### 11.3 Review of actions items after Dinant meetings

Action	Description	Responsible	Status
DD.1	Send CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2016 – end of January 2017 Deadline for data submission - July 1, 2017	JRD	done
DD.2	Send CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2015 – beginning of February 2017 Format CDF. Deadline for data submission – October 1, 2017	JRD	done
DD.3	Compilation of DVD 2013 without transition country to institute metadata (traditional DVD medium)	JRD	done
DD.4	Continuation of works connected with transition country metadata to institute metadata	SF, JRD, CF, CB	no progress
DD.5	Email to IMOs informing that both G=Fv-Fs and Fs are allowed for 2014 1-sec definitive data (soon after Dourbes Meeting)	JRD	done
DD.6	Developing of multiplatform software for control of complete files for DVD, in the worst case upgrading check1min program.	SF, CT, JRD	upgraded check1min
DD.7	Kind email to data checkers with request that definitive data should be checked and accepted without delay after providing data by IMOs	AL, JRD	done
DD.8	Email with question/request to data checkers whether they	AL, JRD	outstanding

	are willing to check 1-sec definitive data of “their” group of IMOs.		
<b>DD.9</b>	Developing program for conversion from IAGA2002 to CDF	RL	done

## 11.4 Report on collection of one-minute definitive data for DVD

### 11.4.1.1 DVD 2013

- before 2017 holiday DVDs have been sent by BH to IMOs and other institutions
- 112 IMOs, 38 countries, 56 institutions

### 11.4.1.2 DVD 2014 (situation 2017-08-20)

- Data collection of 1-min IAF files completed, compilation almost completed
- 111 IMOs, 37 countries
- removed (ref. 2013): AAE, AMS, DRV, GAN, GCK, PAF, PEG, WNG
- added (ref. 2013): ARS, BRD, CBB, CYG, GUI, JCO, LON
- IMOs which have been finally accepted in the last 4 months: PHU, LZH, IPM, KIV, GUI, CZT, LVV, DLT, THL, NAQ, GDH, AIA, PPT, CYG, ABG

### 11.4.1.3 DVD 2015 (situation 2017-08-20)

- Received binary files: 92 IMOs
- Fully accepted binary: 86 IMOs (data on INTERMAGNET web)

### 11.4.1.4 DVD 2016 (situation 2017-08-20)

- Received binary files: 71 IMOs
- Fully accepted binary files: 30 IMOs (data on INTERMAGNET web)

## 11.5 Report of 1-sec Definitive Data collection

### 11.5.1 2014 1-sec definitive (situation August 2017)

38 IMOs (in IAGA2002):

ABK	API	ASP	BEL	BOU	BRW	BSL	CKI	CLF	CMO
CNB	CSY	CTA	DED	EBR	FRD	FRN	GNG	GUA	HER
HLP	HON	HRN	KAK	KDU	KNY	LRM	LYC	MAW	MCQ
MMB	NEW	PEG	SHU	SIT	SJG	TUC	UPS		

- Checked and accepted: 36 IMOs
- Not yet accepted – 2 IMOs:

### 11.5.2 2015 1-sec definitive data

The situation on August 25, 2017, about 1 month before deadline:

3 IMOs have provided 2015 1-sec Definitive:

EBR (ImagCDF)	WIC (ImagCDF)	HER (IAGA 2002)
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### 11.5.3 Problems with 1-second definitive data

- Up to now there is no specification for the ImagCDF format published on the INTERMAGNET web site. CDF format is not a text format and in the beginning, it is difficult for IMOs.
- The checking program DataCheck1s.jar supports IAGA2002 format but not ImagCDF format.
- It is not clear whether IMOs use MagPy, perhaps it is necessary to promote MagPy to IMOs.
- It seems that IMOs do not have software to create 1-sec definitive data in ImagCDF format.
- Currently the situation for checking data in ImagCDF format is difficult. DataCheck1s (Java) can check IAGA2002 files but not ImagCDF.
- MagPy software (Python) supports many formats and will be developed by RL (email from RL 2017-08-11), however IMOs may have problems installing Python and MagPy.
- 2014 1-sec definitive have been checked using the following utilities:
  - DataCheck1s (Java)
  - conversion IAGA2002 to IAF (using iaga2002\_to\_iaf21.exe described in DD30), then checked using imcdview1.754.jar

### 11.6 Continue publication of definitive data on DVD (or substitute) or only online

Arguments for publication DD on DVD or substitute	Arguments in favour publication DD online only
Lack of natural pressure for late DD providers and DD checkers	Successive publication DD without waiting for majority of IMOs, Question: how to combine planned DOI with successive publication?
DVD is some type kind of feedback between INTERMAGNET and IMOs	Lower costs: DVD or substitute production is related to the additional costs. Additional costs and work is also required for distribution of DVDs
	DVDs and the hardware to read them will become rarer
	Waiting for late IMOs is disorganizing our work, it is very stressful
	A general trend in the world is towards publishing online data

#### NOTES:

- 1) We should be aware, that not only 1-min values are published on the DVDs, but also metadata files:
  - baseline file.
  - readme file for the observatory.
  - yearmean file listing annual mean values for given observatory.
  - readme-country file.
  - graphic information concerning the About-screen for institute or country.
  - graphic information concerning the Map of institutes or country
  - \*.dka text file including K-indices (K's are the same as in IAF files)

- 2) If we cease publication of the DVD these metadata files should be published online, it will require significant changes to the INTERMAGNET data download web pages (<http://www.intermagnet.org/data-donnee/download-eng.php>)
- 3) During Hermanus meeting it was decided that 1-minute 2015 definitive data will be published for the last time on durable medium (USB or DVD). After that the 1-minute definitive data will be published on INTERMAGNET web.

## 11.7 Proposals on collection of definitive data 2014, 2015, 2016 onwards

To be considered for EXCON and INTERMAGNET

- 2014: publish on DVD for the last time (eventually on USB)
- 2015: publish on USB
- 2016 onwards: publish online only

Complete definitive data set for online publication:

- codymmm.bin            12 IAF files
- yearean.cod            all annual means of given observatory from the beginning of its activity
- codyyyy.blv            baseline file
- readme.cod            text file on the given observatory

where:

cod= IAGA code; yyyy or yy = year; mmm =month

Do not publish online:

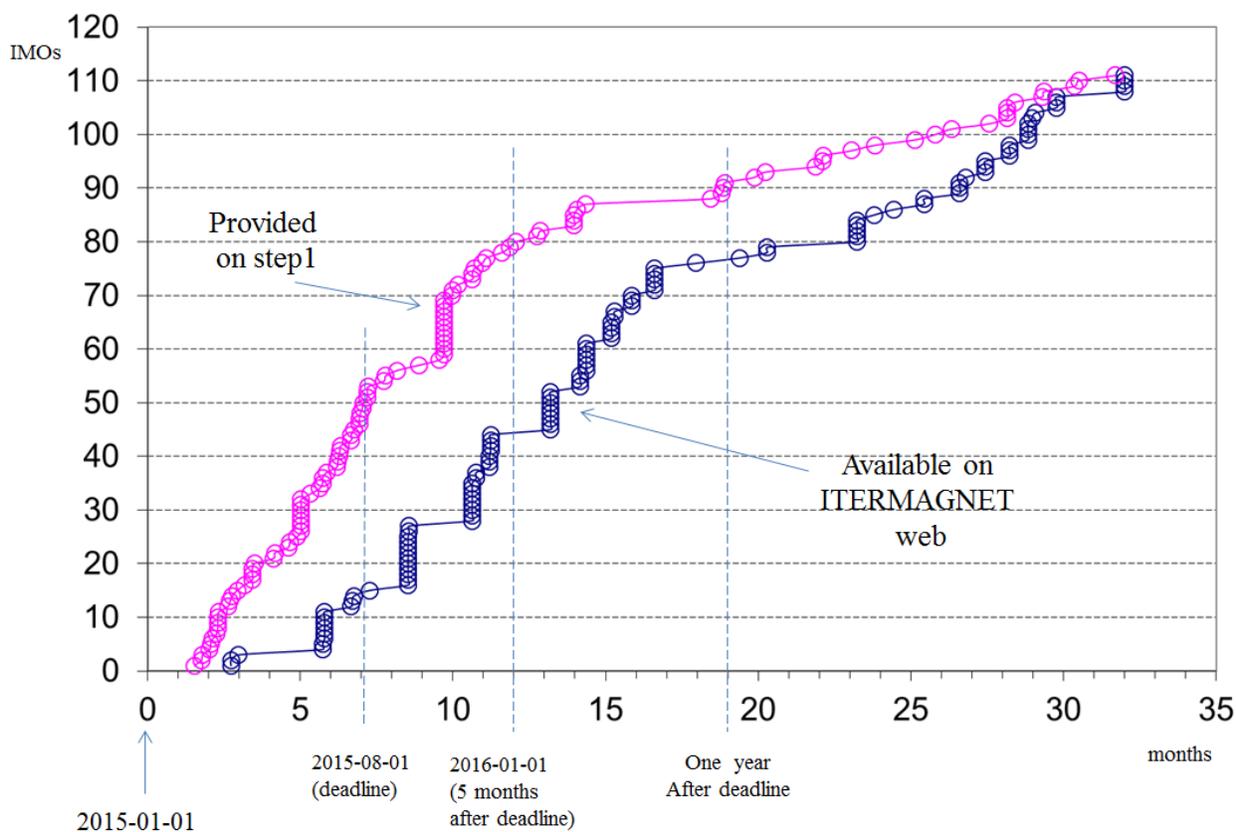
- readme.cty            readme file about contry
- cty.png                png file showing location of the observatory or group observatories on map
- ctysrn.png            about-screen including logo(s) of parent organization(s)

where:

cty=country code (3 or 2chars)

## 11.8 Delays on definitive data delivery, checking and publication

### Data collection one-minute definitive data 2014



#### 11.8.1 Problems with collection and checking of definitive data

- Late providing DD data sets, often incomplete, not properly formatted, discrepancies in metadata information, discrepancies between annual means and IAF data, discrepancies between XYZHDIF in yearmean file
- Very often information regarding country files are not provided – this is particularly troublesome especially during finalisation of a compilation.
- Unfortunately, sometimes IMOs don't check data before providing using the available utilities like IMCDVIEW Java browser or check1min.exe
- Slow or inadequate reaction for volunteer checkers and volunteer Intermagnet officers, Volunteer checkers do not always have the time to do extra work such as data checking. We all know that unfortunately in many cases teams of geomagnetologists are reduced.
- Timely provision of definitive data sets requires strong self-motivation. Sometimes there is lack of self-motivation

It was decided at the Hermanus meeting to carry out similar analysis as above for 2015 definitive data and present at the next INTERMAGNET meeting (DD.12, JRD).

## 11.9 Problem of K9-limit reported by ISGI

For historical and other reasons are some discrepancies in K9-limit between the value applied by INTERMAGNET observatories and the value provided by the International Service Geomagnetic Indices (ISGI). Prof. Michel Menvielle wanted the magnetic observatories to feel free to use the K-9 limit. It would be good to verify with each observatory on the list of ISGI that the K-9 lower limit listed in their metadata matches the value that they use to derive their k-indices. This will give us a list of observatories that are using a K-9 limit that doesn't match the ISGI value. It was decided at the Hermanus meeting to make a comparison between K9-limit adopted by IMO and K9-limit determined by ISGI and look for large discrepancies (DD.9, BH).

## 11.10 Definitive Data Subcommittee decisions and action items

### 11.10.1 Decisions

Number	Description
<b>DD.D1</b>	1-minute 2015 definitive data will be published for the last time on durable medium (USB or DVD). After that the 1-minute definitive data will be published on INTERMAGNET web.

### 11.10.2 Action items

Number	Responsible	Description
<b>DD.A1</b>	CB	Lead the work and start a Discussion Document on how to prepare one-minute definitive data set for INTERMAGNET online (following the end of DVD production)
<b>DD.A2</b>	JRD	Send CALL FOR ONE-MINUTE DEFINITIVE DATA FOR 2017 – end of January 2018 . 12 IAF files, yearmean file, BLV file, observatory readme file. Total 15 files. Deadline for data submission - July 1, 2018
<b>DD.A3</b>	JRD	Send CALL FOR ONE-SECOND DEFINITIVE DATA FOR 2016 – February 2018. These data should be provided in ImagCDF format. Deadline for data submission – October 1, 2018
<b>DD.A4</b>	JRD	Compilation of 1-minute 2015 definitive data without country files. These data will be published on USB as a transition following the last DVD for 2014 and before the online only publication.
<b>DD.A5</b>	AL	Ask IMOs for information on progress in preparation/providing 1-sec definitive data. What difficulties do they face?
<b>DD.A6</b>	SF	Add supporting option for ImagCDF format - DataCheck1s.jar jar(Java application)
<b>DD.A7</b>	RL	Continue to develop MagPy software in close contact with interested people (eg. data checkers)
<b>DD.A8</b>	JRD	Tests of both MagPy software and updated version of DataCheck1s.jar
<b>DD.A9</b>	BH	Comparison between K9-limit adopted by IMOs and K9-limit determined by ISGI and look for large discrepancies
<b>DD.A10</b>	RL	Lead a Discussion Document on the online publication of 1-sec and 1-min definitive data. Identify and summarize essential aspects when switching to online publication such as: deadlines, timeliness of submission, required metadata, associated meta data and so on.
<b>DD.A11</b>	AL, JRD	Email question/request to data checkers whether they are willing to check 1-

		sec definitive data of “their” group of IMO’s. This Action Item will be carried out as soon as DataCheck1s.jar and MagPy is ready to handle ImagCDF files (DD.6 above)
<b>DD.A12</b>	JRD	Perform statistical analysis of data collection 2015 1-min definitive data and present results on the next INTERMAGNET Meeting

## 12 GINS/WWW and Data Formats Subcommittee

### 12.1 Participants

Committee members:

Charles Blais (CB), (chair) Simon Flower (SF), Benoit Heumez (BH), Stefan Bracke (SB), Hiroaki Toh (HT), Jan Reda (JRD),

Guests:

Ellen Clark (EC), Jeremy Fee (JF), Liejun Wang (LW)

### 12.2 Agenda

1. Game of Thrones farewell to Simon as chair
2. Review of Dourbes and mid-year action items
3. CDF format
  - a. Let us finish Simon's baby!
  - b. Discuss about addition of man-made or natural disturbance flagging in CDF format
4. Software for 1-second data
  - a. We need software for data checkers and for end users – where will it come from?
5. Discuss options for hosting INTERMAGNET infrastructure
  - a. Investigate potential alternate hosts
  - b. Charles: share estimate cost model for cloud-based solution
  - c. Discuss Plan B
    - i. What can NRCAN do to increase its life span?
    - ii. What sacrifices can INTERMAGNET accept to increase its longevity in NRCAN?
  - d. INTERMAGNET web service
    - i. What do we do? See Plan B.
6. User credentials
  - a. Should INTERMAGNET still request user credentials for FTP or make everything anonymous? People are already finding loopholes through the web. Web service (once public) will not keep user credentials.
7. Message brokers (data acquisition and dissemination)
8. DOI
  - a. How data is licensed in INTERMAGNET?
  - b. How do we proceed to implement DOIs at INTERMAGNET?

### 12.3 Review of action items from previous meetings

Number	Responsible	Description	Status [Green = completed, Orange= ongoing; Red = not started]
<b>Dourbes GWD.1</b>	SF	Find Discussion Documents that could be converted to technical or policy notes and ask authors to make	<b>Not started</b>

		the conversion.	
<b>Dourbes GWD.2</b>	CB	Put these new technical or policy notes (Dourbes action GWD.1) on the web site.	<b>Waiting for completion of GWD.1</b>
<b>Dourbes GWD.3</b>	CB	Create a new web page for the Dourbes meeting and put into it the presentations given at the meeting and the report to IMOs.	<b>IMO report added to publications page and metadata system presentation on the same page (confirmed with Benoit – acting secretary) that he did not receive any other presentations. Presentation on the web service will not be on the web site.</b>
<b>Dourbes GWD.4</b>	Presenters at the Dourbes meeting	Send their slides to the acting secretary (BSL).	<b>Done</b>
<b>Dourbes GWD.5</b>	Jean Rasson	Send the summary of the INTERMAGNET meeting that is created for IMOs to the worldobs mailing list.	<b>Done</b>
<b>Dourbes GWD.6</b>	SF	Send INTERMAGNET metadata schema to all people present at INTERMAGNET meeting.	<b>Sent by email, 2016-09-21</b>
<b>Dourbes GWD.7</b>	SF	Create a Discussion Document on the implications of mandating that all INTERMAGNET data must be reproducible.	<b>This is related to discussions we have been having about DOIs. Depending on how we choose the handle DOIs in INTERMAGNET it may not be necessary for INTERMAGNET to ensure data is reproducible.</b>
<b>Dourbes GWD.8</b>	EXCON	Investigate ways to find money for a web server at GSC.	<b>Concluded – not possible to find the required amount. Email has been sent by Simon Flower asking for potential hosts</b>
<b>Dourbes GWD.9</b>	RL, SF, JF, SB, CB	Create a Discussion Document on using message brokers, JF to lead the document.	<b>Jeremy and Stephan 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.</b>
<b>Dourbes GWD.10</b>	SF	Send Discussion Document on message brokers to VM and MN early for review	<b>Waiting for completion of GWD.9</b>
<b>Dourbes GWD.11</b>	BH	Create DOIs for IPGP observatories.	<b>BH: there is progress on the creation of a DOI for definitive data of our whole network. We are waiting for agreements from the institutions we collaborate with to have a joint DOI on the same landing page hosted by a French institution.</b>

			See SMF presentation at IAGA (Aug 2017) for progress update.
<b>Dourbes GWD.12</b>	HT, JF, GH, JM	Send information on how they are using DOIs to INTERMAGNET committee members.	Done. See report by IAGA working group.
<b>Dourbes GWD.13</b>	RL and JF	Publicise the new MagPy documentation and Docker images when they are available.	Docker image is ready. Instructions available on GitHub. Also a MiniConda installation available, tested on Linux. Links to this are available from INTERMAGNET web site. Still to complete a publication on MagPy, possibly for Computers and Geosciences. Will have a publicity drive once publication is prepared.
<b>Dourbes GWD.14</b>	SF	Create documentation and perhaps some simple scripts for using Autoplot with INTERMAGNET CDF format.	Ongoing
<b>Dourbes GWD.15</b>	SF	Add links to AutoPlot, MagPy and imcdview on the INTERMAGNET software web page.	Done
<b>Dourbes GWD.16</b>	RL, BH and MM	Look at how to modify CDF to include flags for man-made and natural disturbance sources.	Ongoing: A system is being trialed to see what kinds of flags are necessary.  BH: Here at Chambon, we are slowly updating our tools for data processing and considered the flagging possibility. We added one parameter in our home-made files. It consists so far in one number (0 to 9) but we have only identified a few types of flags (0 is default, data unchanged): shifted data, interpolated data and various reasons for suppressed data (like abnormal value generated by equipment, human causes like vehicles, interference signal and one that I like: "arbitrary decision" for unexplained local spikes). Our home-made files will be converted in CDF. CDF will hopefully include flags.
<b>Dourbes GWD.17</b>	SF	Modify CDF to include flag information once flags are defined (Dourbes action GDD.16).	Waiting for completion of GWD.16
<b>Dourbes GWD.18</b>	SF	Modify CDF time stamp details.	DD22 v2.4 completed
<b>Dourbes GWD.19</b>	JM	Look into the proposed additions to the IYF documentation and recommend which method of	Not started

		calculating annual means should be used.	
<b>Dourbes GWD.20</b>	SF	Update the Welcome image with Ukrainian for the website and DVD.	<b>Done</b>
<b>Dourbes GWD.21</b>	INTERMAGNET members and meeting participants	Notify SF of any software that could be useful to the community for addition to the web page on software. A brief description and URL are needed.	<b>Done</b>
<b>Dourbes GWD.22</b>	CB	Update software web page with links to all known useful software packages.	<b>Done</b>
<b>Dourbes GWD.23</b>	SF	Complete testing on software that converts data in ASCII formats (IMF, WDC, IAGA-2002) to binary formats (IAF and ImagCDF). This software is called gm_convert. Release this software to users.	<b>Ongoing</b>
<b>Dourbes GWD.24</b>	CB	Add new FAQs to the website.	<b>Done. Added geomagnetic components definition and where to get more help.</b>
<b>Dourbes GWD.25</b>	MM	Set up a distribution system for INTERMAGNET ISO images of definitive data CDs and DVDs.	<b>Removed</b>
<b>Dourbes GWD.26</b>	CB	Modify the web site to allow users to retrieve CD and DVD ISO images from the new mirror.	<b>Removed</b>
<b>Niemegk GWD.7</b>	RL	Create software in MagPy according to the defined specification that can be distributed to data checkers. Aim to have this available by Dec 2015.	<b>We will discuss later about installation of MagPy. There have been options added for data checkers (7 steps). The program supports 1 second CDF and IAG2002 format. Next step is for data checkers to test the program. Jan will try to install and do some checking before advertising to data checkers.</b>
<b>Niemegk GWD.10</b>	RL and SF	Document the use of Mathematica and MagPy to allow users to access and visualise INTERMAGNET CDF data (and for other, more general use with geomagnetic data).	<b>Done</b>
<b>Niemegk GWD.13</b>	CB	Add software to the INTERMAGNET web site and ftp site to allow these sites to distribute 1-second definitive data.	<b>Removed</b>
<b>Niemegk GWD.17</b>	CB	Add a link titled 'Geomagnetic Element G' to the 'Data Formats' page of the INTERMAGNET web site, pointing to the section of the IAF	<b>Done</b>

		documentation that describes 'G'.	
<b>Ottawa GWD.22</b>	SF	Agree this new text with OPSCOM [an addition to Note 5 in the documentation of the BLV format] and to arrange for the change to be made in the technical manual.	<b>Removed</b>

## 12.4 Plenary discussion

*WWW/GINS/Data Formats relevant items indicated during plenary discussion.*

There is a going need to improved INTERMAGNET communication and engagement from the community. Should INTERMAGNET engage in social media? Which online tools are available free?

**GWD.A1** – CB, BH – Investigate options for online discussion groups and communication

It has been a while since the FAQ provided on the web sites has had an update. A new member should proof read the content of the FAQ page, provide feedback, and suggest potential additional topics.

**GWD.A2** – SB – Read the content of the FAQ and provide feedback/corrections

## 12.5 CDF format

There was a long discussion regarding finalizing the ImagCDF discussion document created by SF and to get this format available to the community as soon as possible for 1 second data definitive data submission. There was no opposition on publishing the current version of the CDF format. SF will convert the Discussion Document CDF v2.4 to a technical note. Fabricated or other disturbances will remain in discussion but will not be included in the current version.

**GWD.D1** We will go ahead with the publication of the INTERMAGNET CDF format

**GWD.A3** – SF – Convert CDF discussion document in technical note

We will then verify that current publicized software (GitHub) is updated/work with the current version of the CDF format.

**GWD.A4** – SF, RL, CB – Test software on Github with the latest version of the CDF format

Afterwards, add new format to the FTP (and later on the web) for clients to encourage feedback. Once completed, we will advertise by email to worldobs and imocontacts.

**GWD.A5** – CB – Convert historical data to CDF format on the FTP and keep all original formats

**GWD.A6** – CB – Modify website to offer CDF format download

JF did indicate that we should engage the community better by giving them an opportunity to give feedback before finalizing. Although, there was an email advertising that second definitive data submission can be in IAG2002 or CDF. It may, however, not been well engaged. We propose to have the discussion document regarding flagging advertised publicly to better engage users once completed.

**GWD.A7** – RL, BH – Provide discussion document on disturbance flagging in CDF format.

## 12.6 Message brokers

We further discussed implementation of message brokers within INTERMAGNET to deliver real-time magnetic data. The suggested INTERMAGNET web service is a “pull” service that cannot support large quantities of expected requests from clients who intend to use it in real-time condition. For example, we already know that clients will request data from the web service at a few seconds rate. However, message brokers allow user to subscribe to a topic and data gets “pushed” (rate controlled by the service provider). It may offer a more reliable method for IMOs or GINs to send data to clients faster.

We had a preview from JF regarding message and topic format. Suggested using JSON format message with possible options of using MessagePack of which compresses the message for bandwidth purposes. JF and SB will continue work on a discussion document evaluating the message format and potential brokers.

#### **Continue GWD.9**

### **12.7 Software for 1 second data**

Two sets of software are required:

- Data checkers
- Data clients

**MagPy** is at the stage to plot second data.

USGS has **web tools** to plot data from the web service.

**Autoplot** can plot data. There may also be the options of creating basic scripts for data checkers.

RL sent around video tutorials and posted installation instructions for the MagPy package. JRD will test the data checking capabilities with the help of RL and will provide feedback. He will also ask his colleague to do the same. Once the quirks, if any, are fixed, we will send a communiqué to data checkers to do the same.

**GWD.A8** – JRD – Test MagPy package for data checkers and provide feedback to RL

**GWD.A9** – RL – Implement feedback and update relevant documentation

**GWD.A10** – JRD, RL – Provide tools to data checkers and implement feedback

### **12.8 User credentials**

CB expressed concerns about user credentials on the web service to prevent commercial users. JF and CB recognize that this is a clear challenge of implementing such function in suggested architecture format of the web service. For a message broker, it is less of a challenge due to the method of exchange. JF and SB confirm that this will be easy to implement in message brokers by doing white listing.

EC reiterated that BGS does have required data publishing delays for commercial purposes. CB also indicated that NRCAN have identical data delay requirements. In NRCAN, data will not be available to the public but there may be special arrangements available by contacting the institute directly. This discussion will differ for a follow-up meeting.

### **12.9 Data checking**

JRD presented delays in regards to definitive data submission and common problems. To help resolve some very basic checking, CB will look into a basic web application where the IMO can submit data for basic data checking.

**GWD.A11** – CB – Investigate options for automated data checking through the Web site.

### **12.10 DOI and licensing**

Done in Plenary

### **12.11 GINS/WWW and Data Formats Subcommittee decisions and action items**

#### **12.11.1 Decisions**

Number	Description
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<b>GWD.D1</b>	We will go ahead with the publication of the INTERMAGNET CDF format
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### 12.11.2 Action items

Number	Responsible	Description	Comments (Green = completed, Yellow = ongoing; Red = not started)
<b>Hermanus GWD.A1</b>	CB, BH	Investigate options for online discussion groups and communication	
<b>Hermanus GWD.A2</b>	SB	Read the content of the FAQ and provide feedback/corrections	
<b>Hermanus GWD.A3</b>	SF	Convert CDF discussion document in technical note	<b>Done</b>
<b>Hermanus GWD.A4</b>	SF, RL, CB	Test software on Github with the latest version of the CDF format	
<b>Hermanus GWD.A5</b>	CB	Convert historical data to CDF format on the FTP and keep all original formats	
<b>Hermanus GWD.A6</b>	CB	Modify website to offer CDF format download	
<b>Hermanus GWD.A7</b>	RL, BH	Provide discussion document on disturbance flagging in CDF format.	
<b>Hermanus GWD.A8</b>	JRD	Test MagPy package for data checkers and provide feedback to RL	
<b>Hermanus GWD.A9</b>	RL	Implement feedback from test done by JRD and update relevant documentation.	
<b>Hermanus GWD.A10</b>	JRD, RL	Provide MagPy tool once feedback has been implemented to data checkers and implement additional feedback	
<b>Hermanus GWD.A11</b>	CB	Investigate options for automated data checking through the Web site	
<b>Dourbes GWD.1</b>	SF	Find Discussion Documents that could be converted to technical or policy notes and ask authors to make the conversion.	<b>Not started</b>
<b>Dourbes GWD.2</b>	CB	Put these new technical or policy notes (Dourbes action GWD.1) on the web site.	<b>Waiting for completion of Dourbes GWD.1</b>
<b>Dourbes GWD.7</b>	SF	Create a Discussion Document on the implications of mandating that all INTERMAGNET data must be reproducible.	<b>This is related to discussions we have been having about DOIs. Depending on how we choose to handle DOIs in INTERMAGNET it may not be necessary for INTERMAGNET to ensure data is reproducible.</b>
<b>Dourbes</b>	RL, SF, <u>JF</u> , SB,	Create a Discussion Document on	<b>Jeremy and Stephan will continue</b>

<b>GWD.9</b>	CB	using message brokers, JF to lead the document.	<b>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.</b>
<b>Dourbes GWD.10</b>	SF	Send Discussion Document on message brokers to VM and MN early for review	<b>Waiting for completion of Dourbes GWD.9</b>
<b>Dourbes GWD.11</b>	BH	Create DOIs for IPGP observatories	<b>BH: there is progress on the creation of a DOI for definitive data of our whole network. We are waiting for agreements from the institutions we collaborate with to have a joint DOI on the same landing page hosted by a French institution. See SF presentation at IAGA (Aug 2017) for progress update.</b>
<b>Dourbes GWD.14</b>	SF	Create documentation and perhaps some simple scripts for using Autoplot with INTERMAGNET CDF format.	<b>Ongoing</b>
<b>Dourbes GWD.16</b>	RL, BH and MM	Look at how to modify CDF to include flags for man-made and natural disturbance sources.	<b>Ongoing: A system is being trialled to see what kinds of flags are necessary. BH: Here at Chambon, we are slowly updating our tools for data processing and considered the flagging possibility. We added one parameter in our home-made files. It consists so far in one number (0 to 9) but we have only identified a few types of flags (0 is default, data unchanged): shifted data, interpolated data and various reasons for suppressed data (like abnormal value generated by equipment, human causes like vehicles, interference signal and one that I like: "arbitrary decision" for unexplained local spikes). Our home-made files will be converted in CDF. CDF will hopefully include flags.</b>

<b>Dourbes GWD.17</b>	SF	Modify CDF to include flag information once flags are defined (Dourbes action GDD.16).	<b>Waiting for completion of Dourbes GWD.16</b>
<b>Dourbes GWD.19</b>	JM	Look into the proposed additions to the IYF documentation and recommend which method of calculating annual means should be used.	<b>Not started</b>
<b>Dourbes GWD.23</b>	SF	Complete testing on software that converts data in ASCII formats (IMF, WDC, IAGA-2002) to binary formats (IAF and ImagCDF). This software is called gm_convert. Release this software to users.	<b>Ongoing</b>
<b>Niemegk GWD.7</b>	RL	Create software in MagPy according to the defined specification that can be distributed to data checkers. Aim to have this available by Dec 2015.	<b>We will discuss later about installation of MagPy. There has been options added for data checkers (7 steps). The program supports 1 second CDF and IAG2002 format. Next step is for data checkers to test the program. Jan will try to install and do some checking before advertising to data checkers.</b>

## 13 IMO Applications and Standards Subcommittee

### 13.1 Participants

Committee Members

Chris Turbitt (chair), Andrew Lewis, Jürgen Matzka plus Sergey Khomutov (via Skype)

Guests: Jun Yoshimura, Anatoly Soloviev

Absent: Benoît St-Louis, Virginie Maury, Stephan Bracke

Retirements since Dinant meeting: Jean Rasson, Tim White

### 13.2 Agenda

1. IMO action Items from the 2016 meeting
2. IMO Subcommittee membership
3. IMO Applications
  - a. Update on applications from 2016:
  - b. New applications:
  - c. Former IMOs
  - d. Prospective IMOs
4. IMOs of concern:
  - a. Resolved issues
  - b. IMOs of concern and IMOs awaiting checking
  - c. Communications to IMOs of concern – is there a need to enforce policy on non-compliance more rigorously?
5. IMO Subcommittee contributions to the Technical Manual
  - a. Ref to TM action items from the Dinant meeting and DD15 (note DD15 v1.3 was updated June 2015)
6. Standards
  - a. Current status of instrumentation meeting the one-second standard
  - b. Discussion on K9 limit used by IMOs
  - c. Handling leap-seconds in one-second data
7. data processing summary by JM
8. IMO Subcommittee Action Items following the Hermanus Meeting

### 13.3 Review of action items from the 2016 meeting

*The action items review has been removed from the public copy of the minutes as it contains a number of discussions about individual observatories / institutes.*

### 13.4 IMO Subcommittee membership

Due to recent retirements and absences at this meeting, subcommittee members attending the Hermanus meeting numbered three, which was decided that was too few to be able to discuss and decide on subcommittee business. The number of members available for meetings is also affected by timing conflicts with Definitive Data and Gin/WWW/Data Subcommittee meetings. The subcommittee concluded that five members would be optimum, particularly if they were able to attend meetings and

had extensive global representation of or contact with IMOs. The subcommittee decided that current membership should be reviewed by the OPSCOM chair and that one additional member was required. A potential additional candidate was identified and the subcommittee chair is to discuss this with the OPSCOM chair.

Discuss with EXCON and OPSCOM chairs the appointment of a new member of the IMO Subcommittee (& TM Subcommittee) and the reappointment of existing members to ensure meeting attendance. **(IMO.A1 CT)**

The subcommittee also concluded that a deputy chair should be appointed so that subcommittee actions could be better distributed and so that cover could be readily appointed where the subcommittee chair is unable to attend a meeting. **(IMO.A2 CT)**

## 13.5 IMO applications

### 13.5.1 Update on applications from 2016:

*This section has been removed from the public copy of the minutes as it contains discussions about individual observatories / institutes.*

## 13.6 Former IMOs

*This section has been removed from the public copy of the minutes as it contains discussions about individual observatories / institutes.*

## 13.7 Prospective IMOs

*This section has been removed from the public copy of the minutes as it contains discussions about individual observatories / institutes.*

## 13.8 IMOs of concern

*This section has been removed from the public copy of the minutes as it contains discussions about individual observatories / institutes.*

### 13.8.1 Communications to IMOs of concern

In response to the large number of IMOs that are not complying with the standards as laid out by INTERMAGNET Policy Note PN1, the subcommittee held a discussion on whether the policy should be reviewed and/or the need to enforce policy on non-compliance more rigorously. The subcommittee concluded that PN1 is adequate and clear, therefore is not in need of re-writing.

The subcommittee discussed whether there was a case for introducing 'associate' membership for IMOs that did not fully meet the standards as laid out by PN1, but could provide valuable data in partially meeting PN1. JM suggested having a two-tier membership could improve the quality of data for those IMOs submitting that do submit definitive data and this could provide the incentive needed for IMOs who do not currently submit acceptable definitive data on time.

CT said that the idea of associate membership had been discussed by the IMO Subcommittee at the Mexico City 2005 meeting and had been rejected at that time as it was felt that retaining INTERMAGNET membership without delivering definitive data would prove to be less of an incentive to IMOs. For

example, an IMO could operate as variometer station, yet retain INTERMAGNET membership by meeting real-time data delivery standards. The 2005 meeting also decided that it was too complex and inefficient to have two sets of standards (full and associate) for data checkers to assess.

SK suggested that there was a subgroup of INTERMAGNET formed to assist IMOs with common problems: lack of consistency in data formats, etc. CT commented that support for IMOs is provided at an institute level (e.g. GFZ) but INTERMAGNET does not have the staff time to be able to assign such tasks to committee members.

The subcommittee then discussed way to improve the way that the subcommittee monitors the delivery of real-time and definitive data. JM suggested that GFZ could look at monitoring and reporting the delivery of real-time (preliminary) data by IMOs. This may also include a check on the data to see whether the data are preliminary or variometer. One source of information could be the delivery logs compiled by NRCan and stored on the INTERMAGNET FTP server. **(IMO.A7 JM)**

JM is also to add CT to the list of recipients of the e-mails sent to IMO contacts whenever and IMO fails to meet the definitive data deadline. **(IMO.A8 JM)**

CT is to draft a set of internal INTERMAGNET rules to clarify what action is to be taken when an IMO is in breach of the policies defined in PN1. CT is also to draft a sample letter to be issued to IMOs that are in breach of PN1. **(IMO.A9 CT)**

## **13.9 IMO Subcommittee contributions to the Technical Manual**

These items were discussed in the Technical Manual Subcommittee.

### **13.10 Standards**

#### **13.10.1 Current status of instrumentation meeting the one-second standard**

Not discussed

#### **13.10.2 Discussion on K9 limit used by IMOs**

Not discussed

#### **13.10.3 Handling leap-seconds in one-second data**

Not discussed

### **13.11 VNA data processing summary by JM**

Not discussed

### **13.12 IMO and Data Standards Subcommittee decisions and action items**

*The action items review has been removed from the public copy of the minutes as it contains a number of discussions about individual observatories / institutes.*

## 14 Technical Manual Subcommittee

### 14.1 Participants

Subcommittee Members: Chris Turbitt (acting chair), Andrew Lewis, Jürgen Matzka, Carol Finn (EXCON)  
Guests: Jun Yoshimura

Absent: Benoît St-Louis, Stephan Bracke, Hiroaki Toh

Retirements since Dinant meeting: Jean Rasson, Tim White

### 14.2 Agenda

1. Departure of Tim White (replacement?)
2. Review of Dinant actions items
3. Technical Manual
  - a. Responses received following the video conference meeting and the action items list
  - b. Create list of items requiring discussion/decisions for the last day session
  - c. Priority items for publication
  - d. Publication of version 5.0.0
    - i. Complete enough for first release?
    - ii. Proof read
    - iii. Data format check
4. Web
  - a. Synchronization of data format with Technical Manual (one source only with reference)
  - b. Policy and Technical notes to be published
  - c. FAQ maintenance
5. Hot topics
  - a. INTERMAGNET filters (may be a task for the IDA subcommittee?)
  - b. Web services
6. Others (round table)
7. Distribution of action items

### 14.3 Departure of Tim White (replacement?)

The TM Subcommittee membership at the Hermanus meeting numbered three, which was deemed to be less than the critical number required to effectively discuss and decide on subcommittee business. TM Subcommittee members attending the meeting were the same as those attending the IMO Subcommittee on the previous day and therefore came to the same conclusions on subcommittee membership:

- A new member of OPSCOM should be appointed – a candidate for both IMO and TM was proposed and the IMO chair will discuss this with the TM, EXCON and OPSCOM chairs
- OPSCOM should be restructured such that subcommittee membership comprises of only those members who can practically attend meetings i.e. not including OPSCOM members who belong to subcommittees that clash with TM subcommittee meetings.
- A deputy chair should be appointed by the TM chair to assist with action items and be prepared to chair meetings in the chair's absence

## 14.4 Review of Dinant actions items

#	Responsible	Description
<b>TM.1</b>	Subcommittee Chairs	Provide list of action items to secretary within 1 week using ** as an indicator for items to be presented in plenary sessions. <b>Completed.</b> Carried over to Hermanus AIs
<b>TM.2</b>	Secretary	Distribute list of action items to INTERMAGNET members within 2 weeks. <b>Completed.</b> Carried over to Hermanus AIs
<b>TM.3</b>	Subcommittee Chairs	Provide final Subcommittee reports to secretary for inclusion in the minutes within 6 weeks. <b>Completed.</b> Carried over to Hermanus AIs
<b>**TM.4</b>	Secretary	Provide draft of minutes within 12 weeks. <b>Completed.</b> Note that a decision was made that secretary will only compile plenary minutes and subcommittee minutes will be compiled by subcommittee chairs. Carried over to Hermanus AIs (changed to 16 weeks)
<b>**TM.5</b>	CT	Add meeting decisions from previous and current meetings to decision logs. <b>Completed.</b> Carried over to Hermanus AIs
<b>**TM.6</b>	BSL, CT, Technical Manual Subcommittee Members	Organize a videoconference with the Technical Subcommittee members to complete the review of the proposed changes to the manual on Wednesday September 28 at 07:00 AM Ottawa time. <b>Completed</b>
<b>TM.7</b>	CT	Add data type to be used for data transmission in Section 2.1 Sent by CT in Aug 2017 Comment by BSL: TM5 Received but not added because I wanted to discuss the wording which might cause confusion. It says that IMOs are required to transmit preliminary ( <i>adjusted or quasi definitive</i> ) within 72 hours and then says within 3 months. <b>Completed</b> as a workgroup item on final day of the meeting.
<b>TM.8</b>	BSL	Update Section 1.8 (membership and OPSCOM structure) with new INTERMAGNET members. Update new members contact information in appendix D-1 <b>Completed</b>
<b>TM.9</b>	New INTERMAGNET Members	Provide contact information to BSL for appendix D-1 by e-mail <b>Completed</b>
<b>**TM.10</b>	CB	Update various sections on the WEB site (information to be provided by Technical Manual subcommittee) <b>Completed</b>

<b>TM.11</b>	BSL	Add clarification on time stamp accuracy for one-minute and one-second data specifications <b>Completed</b> Comment by BSL: Completed for one-minute data but not sure what else is needed for the one-second data other than may be “centered on the UTC second”
<b>TM.12</b>	JM	Add a section on Quasi-Definitive data production in Chapter 6 <b>Completed</b> as a workgroup item on final day of the meeting.
<b>TM.13</b>	JM, SF	Complete missing sections in Tech Man V-5.0.0 5.2 DATA QUALITY CONTROL (JM) 6.4 DEFINITIVE DATA CALCULATION BASED ON MOST COMMON ORIENTATION(S) AND TYPE(S) OF INSTRUMENTS. (JM) 7.2 FTP SERVER 7.? WEB SERVICES 7.4 DATA VIEWER (SF) 7.2 & 7.4 were <b>completed</b> as a workgroup item on final day of the meeting. Other sections are <b>outstanding</b> .
<b>TM.14</b>	JM	Clarify the requirement for timing synchronization with the variometers in Section 4.7 Completed as a workgroup item on final day of the meeting. <b>Outstanding</b>
<b>TM.15</b>	BSL	Move Section 6.3.3.3 and 6.3.3.4 to appendices with reference in Chapter 7 <b>Outstanding</b> Comment from BSL: In progress; 6.3.3.3 re-written for the current structure with reference to appendix for historical information, 6.3.3.4 re-written for the DVD software with reference to appendix for the old CD-ROM software.
<b>TM.16</b>	JRD	Add description in Section 7.3 or 7.3.1 on how errors on CD-ROM/DVD are corrected on following years. Comment from BSL: Received the attached e-mail which has been added (with some modifications) to draft 0.7 and two other e-mails with the subject “Manual - minor remarks” not included yet but are only minor corrections. Nothing on how errors are corrected. Could you ask JRD to resend it to us? Sent by JRD in 2016, but not added to TM5. <b>Completed</b> as a workgroup item on final day of the meeting.
<b>**TM.17</b>	JM	Create a Discussion Document on the estimation of errors in the production of Definitive Data <b>Outstanding</b>
<b>TM.18</b>	SF	Add description of Data Viewer and access link in Section 7.4 <b>Completed</b> as a workgroup item on final day of the meeting.

<b>**TM.19</b>	TW	Review FAQ section on the web and generate Actions Items for new entries as required. Revise/add FAQ on Data Type <b>Outstanding.</b> Moved from TW to SB
<b>**TM.20</b>	SF	Verify that Real-time definition is consistent throughout the manual and defined along with target transmission delays. <b>Outstanding</b>
<b>**TM.21</b>	SF	Create a section describing the possibility of having a data distribution delay for one-minute and one-second data including the options and the default values. <b>Completed</b> as a workgroup item on final day of the meeting.
<b>TM.22</b>	JM	Create a section on de-spiking in Chapter 5. <b>Outstanding</b>
<b>TM.23</b>	JM & David Calp	Provide reference for Absolute quality control and curve-fitting algorithms. Section 5 was reviewed by Ellen Clarke during the workgroup. <b>Outstanding</b>
<b>**TM.24</b>	AL	Perform final review of Technical Manual V-5.0.0 draft 0.9 by the end of October <b>Outstanding</b>
<b>**TM.25</b>	GWD	Perform final review of data formats in Technical Manual V-5.0.0 draft 0.9 by the mid-November <b>Outstanding</b>
<b>**TM.26</b>	BSL	Publish the Technical Manual V-5.0.0 on the INTERMAGNET web site <b>Outstanding</b>

## 14.5 Technical Manual

### 14.5.1 Responses received following the video conference meeting and the action items list

There were no Dinant meeting action items that were known to have been completed following the video conference.

### 14.5.2 Create list of items requiring discussion/decisions for the last day session

Based on the list of Technical Manual Subcommittee action items from the Dinant meeting, the subcommittee compiled a list of actions that specifically require contributions to the Technical Manual. Added to this list were a further three items communicated by Benoît St-Louis during the meeting. These items are reported below in the section “Work Sessions”. Those items that could be completed within the time allocated for the workgroup were assigned to INTERMAGNET members. The report contains either comments and/or Technical Manual contributions resulting from the workgroup. It also contains a list of action items outstanding following the workgroup. These outstanding items have been incorporated into the complete list of Technical Manual Subcommittee action items in the table below.

### 14.5.3 Priority items for publication

The subcommittee decided to reduce the volume of work required for version 5 of the manual to be published by:

- Simplifying missing Section 6.4 (6.4 DEFINITIVE DATA CALCULATION BASED ON MOST COMMON ORIENTATION) by describing only HDZ orientation only. This can be expanded or external references included later.

### 14.5.4 Publication of version 5.0.0

V5 of the manual is not yet ready for first release and priority should now be given to the missing sections and the larger pieces of works, especially rewriting Section 5.

Proof reading and checking of data formats have been carried forward as action items until a first publication draft of the manual is completed.

## 14.6 Web

### 14.6.1 Synchronization of data format with Technical Manual (one source only with reference)

Not discussed.

### 14.6.2 Policy and Technical notes to be published

SF is to review all existing discussion documents to see whether any of these can be converted to technical notes. (TM.A23 SF)

### 14.6.3 FAQ maintenance

SB is to review the FAQs on the IM web site and identify areas that need to be fixed, updated or added. (TM.A22 SB)

## 14.7 Hot topics

### 14.7.1 INTERMAGNET filters

May be a task for the IDA subcommittee?

The subcommittee concluded that this is perhaps not a section that should be contained in the manual as the one-second filter will vary from instrument to instrument. Different instruments will have different transfer functions above 1 Hz and the applied 1 Hz filter needs to reflect this. This contrasts with the one-minute filter because instruments tend to have a flat response between 1 Hz and one-minute. The 1 Hz filter is an issue for the instrument manufacturer. Ultimately, this is a discussion/decision for the IMO & TM Subcommittees (TM.A19 TM Subcommittee)

### 14.7.2 Web services

The subcommittee decided to remove references to web services in the manual until such services are documented and operational. (AI TM.24 BSL)

## 14.8 Others (round table)

Jeremy Fee suggested (in plenary session) that common documents (such as the Technical Manual) could be made more accessible to INTERMAGNET members through a tool such as GitHub, which would also automatically provide versioning. The GWD subcommittee is to trial this for the generation of one discussion document.

## 14.9 Technical Manual subcommittee decisions and action items

### 14.9.1 Decisions

None

### 14.9.2 Action items

#	Responsible	Description
<b>TM.A1</b>	Subcommittee Chairs	Provide list of action items to secretary within 1 week using ** as an indicator for items to be presented in plenary sessions.
<b>TM.A2</b>	Secretary	Distribute list of action items to INTERMAGNET members within 2 weeks.
<b>TM.A3</b>	Subcommittee Chairs	Provide final Subcommittee reports to secretary for inclusion in the minutes within 6 weeks.
<b>**TM.A4</b>	Secretary	Provide draft of minutes within 16 weeks. Note that a decision was made that secretary will only compile plenary minutes and subcommittee minutes will be compiled by subcommittee chairs
<b>**TM.A5</b>	CT	Add meeting decisions from previous and current meetings to decision logs.
<b>TM.A6</b>	BSL	Provide references to the two FAQ sections, “What is the BGS method for creating Quasi-Definitive Data?” and “What is the IGP method for creating Quasi-Definitive Data?”, in Chapter 6.3, “Submission of Quasi-definitive Data”
<b>**TM.A7</b>	BSL, BH, EC, Dave Calp, JM	Rewrite of Chapter 5, including new introduction, text for 5.2 “Data Quality Control”, amalgamate component descriptions with 6.1.2 to avoid duplication, introduce common error sources and ‘reliability’ of components, simplify the equations of F-P by referring to the calculations of H & Z in Section 6.4, improve the quality of the diagrams, change references to ‘computed’ baselines to ‘observed’ baselines for consistency
<b>TM.A8</b>	JM	Contribution to Section 6.4 “Definitive Data Calculation based on HDZ Oriented Variometer”
<b>TM.A9</b>	BSL	Consider replacing Appendices B-1 and B-2 of the manual (referenced in 6.3.3.1) with references to the web site
<b>TM.A10</b>	BSL	Move Sections 6.3.3.2.2, 6.3.3.2.3, 6.3.3.2.4 & 6.3.3.2.5 to Appendix
<b>TM.A11</b>	BSL	Move the text between, “The INTERMAGNET CD-ROM Software...”, and, “any data converted to WDC-files.” To Appendix
<b>TM.A12</b>	BSL	Move Section 6.3.3.3 and 6.3.3.4 to appendices with reference in Chapter 7

<b>**TM.A13</b>	SF	Once TM5 has been completed, verify that Real-time definition is consistent throughout the manual and defined along with target transmission delays.
<b>TM.A14</b>	JM	Create a section on de-spiking in Chapter 5 referencing external sources where possible.
<b>TM.A15</b>	JM & David Calp	Provide reference for Absolute quality control and curve-fitting algorithms.
<b>TM.A16</b>	AL	Once TM5 has been completed, perform final review of Technical Manual V-5
<b>**TM.A17</b>	GWD Subcommittee	Once TM5 has been completed, perform final review of data formats in the Technical Manual
<b>TM.A18</b>	BSL	Once completed, publish the Technical Manual V-5.0.0 on the INTERMAGNET web site
<b>TM.A19</b>	TM Subcommittee	Consider the need to publish filter coefficients for one-second data in the Technical Manual
<b>**TM.A20</b>	AT & BSL	Review TM Chapter 1 and include vision & mission statements plus update INTERMAGNET officer details
<b>TM.A21</b>	JM	Create a Discussion Document on the estimation of errors in the production of Definitive Data
<b>**TM.A22</b>	SB	Review the FAQs on the IM web site and identify areas that need to be fixed, updated or added
<b>**TM.A23</b>	SF	Review all existing discussion documents to see whether any of these can be converted to technical notes
<b>TM.A24</b>	BSL	Remove references in TM5 to web services until these are running and documented

## 15 Work sessions (Tuesday 05 Sep)

### 15.1 MagPY demonstration (SF and Jeremy Fee)

*A demonstration to report progress and encourage usage of the MagPY geomagnetic processing software.*

The large size of the MagPY download and the slow internet connection during this meeting prevented the planned demonstration of the installation and use of MagPY. SF encouraged people to install MagPY after the meeting and send feedback to RL.

Jeremy Fee noted the MAC version requires SpacePY and gcc or another fortran compiler to be installed separately while the Windows installation package includes SpacePY. Both installations require NASA CDF installation. It was generally noted that installation is not easy and could be improved.

Jeremy demonstrated recent enhancements to MagPY made by the USGS on how to flag spikes in data. The USGS plan to process a year of observatory data with MagPY to compare and evaluate against their existing processing tools and methods but they must first developed code to import USGS absolute observations into the MagPY system.

RL joined the session via skype but the connection quality was insufficient to allow a useful on-line demonstration.

### 15.2 E-mail lists and missing data e-mails (JM)

*A review and call for feedback on the INTERMAGNET and world-obs e-mailing lists and the automated definitive data e-mail notification system.*

#### 15.2.1 Email lists

About 6 months ago hosting of the EXCON, OPSCOM, IMOContact and worldobs mailing lists was transferred from GSC to GFZ. A number of problems, including bouncing emails have now been solved and a 10 Mb limit on attachments has been implemented. Membership of the INTERMAGNET mailing lists was reviewed. Some retired members will be removed from the list (Jean Rasson and Tim White removed, Duff Stewart to remain for a few more months). EXCON list members can send messages to the OPSCOM list but they cannot read the OPSCOM list. OPCOM list members can send to the EXCON list but not read from that list.

#### 15.2.2 Missing data e-mails

To improve timeliness of the definitive data checking process GFZ has developed a system to monitor data uploaded to the Paris GIN and send notification emails. The system has been operational since August 2017. The system sends email notification to IMOs about missing definitive data to at the start of every month. Data checkers receive a message listing new data files for 2015 and 2016 that have become available on the Paris ftp server.

There can be complications when zip files or non-standard file names are uploaded and with lists of legacy data sent to checkers.

Comments on problems, suggestions, changes or improvements should be reported to JM via email. CB suggested the messages could be sent as HTML to contain links to file lists etc.

Jeremy Fee suggested sending a follow up message to checkers if nothing has changed and perhaps a web page could be generated in addition to the e-mails so the overall status of data could be checked easily.

CT expressed desire to be copied in on messages concerning definitive data. JRD already receives messages from the system.

JM suggests we should strive for more consistency and clean-up in the step1 and step2 areas of the Paris FTP server.

### 15.3 Technical Manual (CT)

*Contributions to the Technical Manual from the workgroup held on the final day of the INTERMAGNET Hermanus meeting. The worklist was compiled from the Action Items of the Dinant 2016 meeting. Decisions made during the Hermanus meeting are highlighted in green, while actions that remain outstanding after the Hermanus meeting are highlighted in red.*

*Marginalia comments have been moved to the body of the text, identified as “Comment” with author and date included and the relevant text shaded light blue.*

#### 15.3.1 Dinant action item TM.7: data types for transmission

#	Responsible	Description	Assigned
TM.7	CT	Add data type to be used for data transmission in Section 2.1	CT
		Completed. Sent by CT in Aug 2017, but not known if added to TM5 Comment by BSL: TM5 Received but not added because I wanted to discuss the wording which might cause confusion. It says that IMOs are required to transmit preliminary (adjusted or <i>quasi definitive</i> ) within 72 hours and then says within 3 months.	
		Completed at Hermanus meeting	

#### Section 2.1 text from CT

IMOs are required to transmit preliminary data in an INTERMAGNET recognised format to one of the INTERMAGNET Geomagnetic Information Nodes (GIN) by electronic means within 72 hours of recording. Data are typically transmitted over the Internet or through satellite such that preliminary data can be made available on the INTERMAGNET web site. Note that, for the time being, GINs also accept reported data from observatories that have historically transmitted such data.

Within 3-months, observatories may transmit quasi-definitive data to one of the INTERMAGNET GINs provided these data meet the provisional baseline conditions outlined in Appendix A-1. Quasi-definitive data submission is by the same method as preliminary data submission (described in Section 6.3). Observatories may submitted quasi-definitive data in place of preliminary data if this meets the requirement of being received within 72 hours of recording.

#### 15.3.2 Dinant action item TM.11: clarification of timestamp accuracy

#	Responsible	Description	Assigned
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<b>TM.11</b>	BSL	Add clarification on time stamp accuracy for one-minute and one-second data specifications	
		Outstanding Comment by BSL: Completed for one-minute data but not sure what else is needed for the one-second data other than may be “centered on the UTC second”	
		Completed prior to Hermanus meeting	

### 15.3.3 Dinant action item TM.12: production & submission of quasi-definitive data

#	Responsible	Description	Assigned
<b>TM.12</b>	JM	Add a section on Quasi-Definitive data production in Chapter 6	JM
		Outstanding	
		Propose to change this to “Submission of Quasi-definitive Data” since the production method is covered in Chapters 5 & 6. This would then be a relatively short chapter avoiding duplication.	
		Completed at Hermanus meeting	

#### Comment on chapter 6.3 from JM

Dear Benoit,

This text was read by Hiroaki and Simon and is OK with them.

Add a chapter 6.3 SUBMISSION OF QUASI-DEFINITIVE DATA (and move 6.3 DEFINITIVE DATA to 6.4 DEFINITIVE DATA).

Note that we deliberately skip sub-chapters on SATELLITE TRANSMISSIONS, TRANSFERING DATA FROM GINs TO WEBSITE, COMMON PROBLEMS WITH DATA TRANSMISSION.

Note that it might be desirable to have a 'Production of QD data' based on the FAQ as a follow up on TM 12 after the meeting

#### Section 6 text from JM

### 6.3 SUBMISSION OF QUASI-DEFINITIVE DATA

An observatory sends quasi-definitive data to its assigned GIN via e-mail or web upload. The best way to do this is to use the IAGA-2002 data format. INTERMAGNET encourages observatories to send quasi-definitive data as soon as possible. Quasi-definitive data should be sent within 3 months after their acquisition.

#### 6.3.1 UPDATE FREQUENCIES AND FORMATS FOR PRELIMINARY DATA

Typical update frequencies are updates on a daily or monthly basis.  
For the formats, please refer to 6.2.1.

#### 6.3.2 SUBMISSION VIA WEBSERVICE

Please refer to the description for preliminary data in 6.2.3.

#### 6.3.3 SUBMISSION VIA EMAIL

Please refer to the description for preliminary data in 6.2.4.

6.3.4 HOW TO CHECK IF YOUR DATA HAS BEEN RECEIVED Please refer to the description for preliminary data in 6.2.7.

### 15.3.4 Dinant action item TM.13: missing sections

#	Responsible	Description	Assigned
<b>TM.13</b>	JM, SF	Complete missing sections in Tech Man V-5.0.0	5.2 BH
		5.2 DATA QUALITY CONTROL <b>(JM)</b>	6.4 JM
		6.4 DEFINITIVE DATA CALCULATION BASED ON MOST COMMON ORIENTATION(S) AND TYPE(S) OF INSTRUMENTS. <b>(JM)</b>	7.2 CB
		7.2 FTP SERVER	7.4 SF
		7.? WEB SERVICES	
		7.4 DATA VIEWER <b>(SF)</b>	
		Outstanding	

		<p>5.2 Not sure of the proposed content of 5.2 as this already seems to be covered by sections 5.1 – 5.6, 6.3.1. Chapter 5 needs to be read through to identify whether any topics on quality control of data are not covered by these sections.</p> <p>6.4 propose that manual is published with HDZ only for the present as this is a large topic that will take considerable time, with an intention that other orientations will follow. JM to review earlier submission and reword to this effect.</p> <p>7.2 Requires a short section on authorisation, catalogue, directory structure and instruction</p> <p>7.? Propose to defer this section until web services are implemented</p> <p>7.4 Requires a short section on imagcdview description, download, installation and reference to help contained in the application</p>	
		<p>5.2 Outstanding following Hermanus meeting. Section 5 reviewed by BH at Hermanus meeting but needs significant rework. See also comments on this section by Ellen Clarke (EC) under Dinant action item TM.23. This work needs a lead editor/author.</p> <p>6.4 Outstanding following Hermanus meeting. Decision to write for one case (HDZ) initially (to facilitate publication of TM5) with an intention to extend to other cases in the future. <b>Action item for JM.</b></p> <p>7.2 Completed at Hermanus meeting</p> <p>7.4 Completed at Hermanus meeting</p>	

**Comment on Chapter 5 from BH**

See Dinant action item TM.23

**Section 7.2 text from CB**

7.2 FTP Server

The INTERMAGNET FTP offers the ability to download large amount of data without going through a step-by-step web interface. Amongst many other advantages, the user can design

applications/scripts that request data directly from the FTP.

URL: <ftp://ftp.intermagnet.org>

The INTERMAGNET FTP server hosts the following (accessible with user credentials):

- IAGA2002 minute variation
- IAGA2002 second variation
- IAGA2002 minute provisional
- IAGA2002 second provisional
- IAGA2002 minute quasi-definitive
- IAGA2002 second quasi-definitive
- IAGA2002 minute definitive
- IAF definitive

And hosts the following publicly:

- CD/DVD ISO images

To request user credentials, the user must send an email to [nrcan.geomag-webmaster-geomag-webmaster.rncan@canada.ca](mailto:nrcan.geomag-webmaster-geomag-webmaster.rncan@canada.ca). The user must provide the name of their institute. This information is required to identify that the use of the data is not meant for commercial purposes.

The user must still comply to Conditions of Use indicated under:

<http://www.intermagnet.org/data-donnee/data-eng.php#conditions>

Once user credentials are given, the user must login to the FTP using those user credentials.

Once successful, the user is redirected to the INTERMAGNET data directory.

The data directory is structured as follows:

- sampling period/
  - o data type/
    - data format/
      - year/
        - o month/

Where:

- sampling period = minute or second
- data type = variation, provisional, quasi-definitive, or definitive
- data format = IAGA2002 or IAF
- year = 4 digit year
- month = 2 digit month

#### Comment on chapter 7.4 from SF

I think that section 6.3.2 (obtaining checking software) can be replaced by a link to the

INTERMAGNET web site software page: <http://www.intermagnet.org/publication-software/software-eng.php>

I've re-written section 6.3.3 of V0.7 of the technical manual, to update information about the DVD and associated software. Alongside this I've re-written appendix C-2 (the DVD/CD-ROM structure) including up to date and historical information for all DVDs. The document attached contains the re-write, but also contains some editorial suggestions. If you search for the text 'REFERENCE NEEDED' you'll find a number of places where I've suggested that a reference needs to be inserted. If you search for "6.6 Definitive 1-second Data" you'll see that I've suggested a short new section on 1-second definitive data, also that we should rename section 6.3. I've made a reference to a 'software page' on the INTERMAGNET web site. This is <http://www.intermagnet.org/publication-software/software-eng.php>.

Section 7.4 can then either reference or duplicate the contents of Section 6.3.3.4.

I think the document I'm sending you is too complex to ask people to review as it stands. Can you incorporate it into the V0.7 draft and then ask people to review that?

#### Section 7.4 text from SF

See Appendix A Section 6.3.3 & 7.4 text **from SF**

#### 15.3.5 Dinant action item TM.14: timing synchronization for absolute observations

#	Responsible	Description	Assigned
TM.14	JM	Clarify the requirement for timing synchronization with the variometers in Section 4.7	JM
		Outstanding	

		Requires a timing accuracy added to the paragraph, “This procedure, and the careful synchronization between the absolute measurements and variometer data, becomes more important as the magnetic field activity increases.” Note that there has been an updated version of this text sent by JM in January 2016	
		Completed at Hermanus meeting	

#### Comment on chapter 4.7 from JM

Dear Benoit,

could you please add the red text in 4.7 (see below). Note that there has been an updated version of this text sent by me in January 2016. The 1-second I give here works fine for high latitudes and is easily achievable.

Best wishes,

Jürgen

#### Section 4.7 text from JM

##### 4.7 INSTANTANEOUS BASELINE CALCULATION

The magnetic field will vary during an absolute observation. This is unavoidable since a single vector measurement may take several minutes, and the magnetic field may vary tens of nT or more during that time, especially at high latitudes. To achieve sub-nT estimation of the instantaneous vector baseline:

- the timing accuracy of the clock used for the absolute measurements should be 1 second and each single observation with e.g. the DIM and PPM should be reported with 1 second timing accuracy
- each instrumental observation, or component part (for example each PPM F, or each DIM D or I) should be reduced to a common variometer value typical of the variometer output during that observation
- a set of instrumental observations (for example one PPM F and one DIM D and I) should be reduced to a common variometer value typical of the variometer output during that set

### 15.3.6 Dinant action item TM.15: moving CD-ROM sections to appendices

#	Responsible	Description	Assigned
TM.15	BSL	Move Section 6.3.3.3 and 6.3.3.4 to appendices with reference in Chapter 7	BSL
		Outstanding Comment from BSL: In progress; 6.3.3.3 re-written for the current structure with reference to appendix for historical information, 6.3.3.4 re-written for the DVD software with reference to appendix for the old CD-ROM software.	
		Outstanding following Hermanus meeting. <b>Action item for BSL</b>	

### 15.3.7 Dinant action item TM.16: publication of corrections on CD-ROM

#	Responsible	Description	Assigned
TM.16	JRD	Add description in Section 7.3 or 7.3.1 on how errors on CD-ROM/DVD are corrected on following years.	JRD, AL
		Outstanding. Sent by JRD in 2016, but not known if added to TM5 Comment from BSL: Received the attached e-mail which has been added (with some modifications) to draft 0.7 and two other e-mails with the subject "Manual - minor remarks" not included yet but are only minor corrections. Nothing on how errors are corrected. Could you ask JRD to resend it to us?	
		Needs minor corrections plus a paragraph on how errors are corrected	
		Completed at Hermanus meeting	

#### Section 7.3.1 text from JRD & AL

##### Correcting errors in submitted data

Before 2006, when definitive data published on CD were found to contain errors the corrected data were re-published on the next available CD/DVD. The 12 corrected monthly IAF bin files and other metadata files were included, as necessary, in a subdirectory with an observatory and year specific name \OBSYYYY. (eg \BEL1995)

From 2006 and onwards any corrections to one-minute definitive data have been re-submitted to the INTERMAGNET web site. Only time-series data are available from the web

site so correction of errors in metadata files are not captured after 2006. Re-published IAF bin files contain the date (year and month) of the re-publication in the daily header records. CD/DVDs contain a text file “\errata\errata” listing the full history of corrected data and the year of the CD/DVD on which the correction was published. This file remains unchanged since the 2006 DVD.

Now the INTERMAGNET web site should be regarded as the most recent version of the definitive one-minute data.

### 15.3.8 Dinant action item TM.18: description of data viewer and CD-ROM

#	Responsible	Description	Assigned
<b>TM.18</b>	SF	Add description of Data Viewer and access link in Section 7.4	SF
		Outstanding	
		Duplication of TM.13?	
		Completed at Hermanus meeting	

#### Section 7.4

See **Dinant action item TM.13**

### 15.3.9 Dinant action item TM.20: definition of real-time

#	Responsible	Description	Assigned
<b>**TM.20</b>	SF	Verify that Real-time definition is consistent throughout the manual and defined along with target transmission delays.	
		Outstanding	
		Outstanding. Needs the latest version of the manual. <b>Action item for SF</b>	

### 15.3.10 Dinant action item TM.20: data distribution delay

#	Responsible	Description	Assigned
<b>**TM.21</b>	SF	Create a section describing the possibility of having a data distribution delay for one-minute and one-second data including the options and the default values.	CB
		Outstanding	
		Needs a paragraph describing the purpose of the publication delay, what data products are affected and	

		how to apply for a delay. Also needs a chapter identified, where the policy can be easily found (Chapter 1?)	
		Completed at the Hermanus meeting	

Section text from CB (Section to be created)

### **Data publication delays**

INTERMAGNET understands that some institutes would like to restrict their data for the public within a defined time period. Although INTERMAGNET encourages institutes to deliver their data within 72 hours, the INTERMAGNET website and FTP can enforce these rules to secure their data.

By default, if the institute does not request a data publication delay, it will be published once received by INTERMAGNET.

Two data publications delays can be requested:

Plotting delay

Download delay

For example, an institute can request that their data be plotted (image) as soon as received by INTERMAGNET but prevent the data files from being downloaded until the following day.

To request a data delay, the institute can contact the webmaster at [nrcan.geomag-webmaster-geomag-webmaster.rncan@canada.ca](mailto:nrcan.geomag-webmaster-geomag-webmaster.rncan@canada.ca).

### **Plotting delay**

The INTERMAGNET website offers online plotting utilities.

<http://www.intermagnet.org/data-donnee/dataplot-eng.php>

A delay (in days) can be added to prevent the user from plotting the data.

### **Download delay**

Data can be download via the website or the FTP.

<http://www.intermagnet.org/data-donnee/download-eng.php>

A delay (in days) can be added to prevent the user from downloading the data.

### **Exception**

There is, however, an exception to this feature. No matter the delay requested by the institute, INTERMAGNET will generate hourly range values from the data and will use these values for the INTERMAGNET Geomagnetic Activity Map.

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

It was determined by INTERMAGNET that hourly range values are too low resolution to be of any use.

15.3.11 Dinant action item TM.22: data quality - despiking

#	Responsible	Description	Assigned
TM.22	JM	Create a section on de-spiking in Chapter 5.	
		Outstanding	
		This is a large piece of work that is well linked with chapters on quality control. JM to consider delegating. Is there existing literature that describes sources, nature, detection and removal of spikes?	
		Outstanding following Hermanus meeting. <b>Action item for JM</b>	

15.3.12 Dinant action item TM.23: absolute quality control and fitting

#	Responsible	Description	Assigned
TM.23	JM & David Calp	Provide reference for Absolute quality control and curve-fitting algorithms.	Ellen Clarke
		Outstanding	
		Requires a read through to identify whether any update to Sections 5.3, 5.4 & 5.5 is needed	
		Outstanding. Section 5 reviewed by BH & Ellen Clarke at Hermanus meeting.	

Comment on Chapter 5 from BH

I went through Chapter 5.2  
 I think 5.1 looks like the introduction of 5.2 So Chapter 5 needs its own introduction  
 5.2.1 Checking procedure- introduce and define component values (X, Y, Z and DIF and HDZ). I wonder if it is where this section should be and if it is not mentioned elsewhere?  
 5.2.1 introduce the reliability of components and lists the sources of errors in both equipment and absolute measures. It might be good to add a link on work by V. Lesur to estimate errors?--  
 It needs a bit of work I think.

Comment on Chapter 5 from Ellen Clarke

Text in figures 1 & 2, page 19 & 20 is not clear and content is duplicated in Section 6.1.2  
 In Section 5.2, may be best to call this computed observed baseline value at a given point in time (to distinguish between the fitted baseline which may or may not go exactly through this point.)  
 In Section 5.5, the calculation of H at the absolute pillar from the variometer data will have been carried out already before the H value gets to this stage. It would make this section clearer if it didn't have this complication in here. This should really be explained earlier in the chapter of data processing in cases where instruments are set up to measure H, E and Z. This will also be covered in Section 6.4.

In section 5.5, the definition of deltaF is poorly worded and needs clarification. Also a plot of F-P would help.  
Figure 3, page 21 could be made clearer.

### 15.3.13 Dinant action item TM.24: review of Technical Manual

#	Responsible	Description	Assigned
<b>**TM.24</b>	AL	Perform final review of Technical Manual V-5.0.0 draft 0.9 by the end of October	
		Outstanding	
		AL yet to receive V-5.0.0 draft 0.9	
		Outstanding following Hermanus meeting. Requires final version of the manual. <b>Action item for AL</b>	

### 15.3.14 Dinant action item TM.25: review of data formats

#	Responsible	Description	Assigned
<b>**TM.25</b>	GWD	Perform final review of data formats in Technical Manual V-5.0.0 draft 0.9 by the mid-November	
		Outstanding	
		Have there been any updates to the data formats submitted after the Dinant meeting? If not, this requires a check in draft 0.7 to identify errors	
		Outstanding following Hermanus meeting. Requires final version of the manual. <b>Action item for GWD Subcommittee</b>	

### 15.3.15 Dinant action item TM.26: publication of Technical Manual

#	Responsible	Description	Assigned
<b>**TM.26</b>	BSL	Publish the Technical Manual V-5.0.0 on the INTERMAGNET web site	
		Outstanding following Hermanus meeting. Requires final version of the manual. <b>Action item for BSL</b>	

### 15.3.16 Additional item: One-second filter coefficients

#	Responsible	Description	Assigned
	<b>Section designated "Under</b>	Appendix F-2: Filter Coefficients to Produce One Second Values	

development”	Perhaps this is not a section that should be contained in the manual as the one-second filter will vary from instrument to instrument. Different instruments will have different transfer functions above 1Hz and the applied 1Hz filter needs to reflect this. This contrasts with the one-minute filter because instruments tend to have a flat response between 1Hz and one-minute. The 1Hz filter is an issue for the instrument manufacturer. Ultimately, this is a discussion/decision for the IMO & TM Subcommittees	
	Outstanding following Hermanus meeting. Requires decision. <b>Action item for TM Subcommittee</b>	

**15.3.17 Additional item: Consistency of INTERMAGNET conditions of use**

#	Responsible	Description	Assigned
Communication from BSL 4 Sep 2017		Condition on use (section 1.7) to be merged with sections 7.5.1 and 7.5.2 to eliminate discrepancies and repetitions. Rewording needed.	AT
		Review of the conditions of use in Sections listed above and a recommendation to go to BSL	
		Completed at Hermanus meeting	

**Text for Sections 1.7, 7.5 & 7.6 from AT**

**1.7 CONDITIONS OF USE**

INTERMAGNET intends, in due course, to move to a standard, machine-readable data license, such as Creative Commons or similar. Until such time, the INTERMAGNET conditions of use are that

- The geomagnetic data available through INTERMAGNET are provided for your use (and for the use of colleagues collaborating on the same project) and are not for sale or distribution by you to third parties, without the express written permission of the Institutes that operate the observatories whose data you use.
- Any report or publication that makes use of INTERMAGNET data should acknowledge the relevant Institutes as the source of data. INTERMAGNET provides two forms of acknowledgement for data use in Chapter 7.6.
- We ask that the data not be used for commercial purposes, nor in any project in which you, your organization, or your collaborators are in a commercial agreement with any

third party, without the permission of the operating Institute(s).

- Either an electronic link to or paper copy of each report or publication should be sent to those Institutes whose data you use.
- A citation reference should be sent to the INTERMAGNET Secretary (secretary@intermagnet.org) for inclusion in a publications list on the INTERMAGNET web site.

Your e-mail address, which you provide to INTERMAGNET when requesting data, will be given to each Institute supplying data so that each may monitor the use of its data.

By accessing INTERMAGNET data you signify your acceptance of these terms and conditions.

INTERMAGNET accepts no liability in respect of loss, damage, injury or other occurrence arising from the provision of these data.

## 7.5 CONDITIONS OF USE

Please refer to Chapter 1.7 for the INTERMAGNET conditions of use.

## 7.6. ACKNOWLEDGMENT OF DATA FROM OBSERVATORIES PARTICIPATING IN INTERMAGNET

Publications making use of INTERMAGNET data should include an acknowledgement statement of the form given below. The first form is for cases where data from many observatories have been used and it is not practical to list them all, or each of their operating institutes. The second is for cases where research results have been produced using a smaller set of observatories.

Suggested Acknowledgement Text (template 1)

The results presented in this paper rely on data collected at magnetic observatories. We thank the national institutes that support them and INTERMAGNET for promoting high standards of magnetic observatory practice. (www.intermagnet.org)

Suggested Acknowledgement Text (template 2)

The results presented in this paper rely on the data collected at <observatory name>. We thank <institute name>, for supporting its operation and INTERMAGNET for promoting high standards of magnetic observatory practise (www.intermagnet.org).

### Comment on Sections 1.7 & 7.6 from SF

I suggest to change occurrences of “INTERMAGNET data” to “data collected by INTERMAGNET” (or similar) to make it clear that INTERMAGNET does not own any data.

### Comment on Chapter 1 from AT

I should also point out that work is needed on IM officer details and addresses and that Chapter 1 could do with a further review, e.g. to include the V&M description.

15.3.18 Additional item: Clarification on the use of the 90% rule for missing data

#	Responsible	Description	Assigned
	<b>Communication from BSL 4 Sep 2017</b>	For the 90% rule, we give examples that 54 samples are required to produce the one-minute values but this is only true for average means. This number will change depending on the filter width. Suggestion is to specify that the example is for average only and that 90% of the coefficients are required with weight adjustment or we remove the example as it promotes that average is acceptable instead of filtering.	CT
		There is already an INTERMAGNET decision that the 90% rule applies to “both simple mean and weighted mean calculations” and stated as such in 2.4 & 3.4. The text in 6.5.4 requires changing to match the wording in 2.4 & 3.4.	
		Completed at Hermanus meeting	

Comment on Sections 2.4, 3.4 & 6.5.4 from CT

The text below is to replace the equivalent in Section 2.4. However, this paragraph may be better as a new section, “2.5 Missing Data”. The same applies for the same text in Section 3.4. Section 6.5.4 contains a simple 90% rule description, which is sufficient as this section only describes straight-forward means (hourly, daily & annual)

Section 2.4 & 3.4 text from CT

When mean (or filtered) values are to be calculated, the question of how to handle missing data arises. For a number of reasons it is difficult to devise a simple objective rule that can be applied to all cases. INTERMAGNET recommends a simple and pragmatic approach: mean values may be calculated when 90% or more of the values required for calculation of the mean are available. When fewer than 90% of the required values are available the mean value should be assigned the value used to flag missing data. INTERMAGNET recommends adoption of this rule for both simple mean and weighted mean calculations. For example, a simple daily mean value may be computed when 1296 or more one-minute values are available for the day. Similarly, if a one-minute value is constructed from one-second samples, the one-minute value may be computed when 54 or more one-second samples are available. In either case the weights applied to each sample in the mean or the filter must be re-normalized to account for the reduced number of samples available. In practice, this means dividing the sum of samples by the number of available samples in the case of a simple mean or normalizing to unity those coefficients that have been used in a filter calculation. INTERMAGNET observatories are expected to provide high levels of data continuity, so this rule is expected to be applied only rarely.

### 15.3.19 Outstanding action items following the Hermanus workgroup

**Note: The items below have been included in the action items of the Technical Manual Subcommittee following the Hermanus meeting.**

Description	Origin	Responsible
Provide references to the two FAQ sections, “What is the BGS method for creating Quasi-Definitive Data?” and “What is the IPGP method for creating Quasi-Definitive Data?”, in Chapter 6.3, “Submission of Quasi-definitive Data”	Dinant action item TM.12	BSL
Rewrite of Chapter 5, including new introduction, text for 5.2 “Data Quality Control”, amalgamate component descriptions with 6.1.2 to avoid duplication, introduce common error sources and ‘reliability’ of components, simplify the equations of F-P by referring to the calculations of H & Z in Section 6.4, improve the quality of the diagrams, change references to ‘computed’ baselines to ‘observed’ baselines for consistency	Dinant action item TM.13 & Dinant action item TM.23	BSL, BH, EC, Dave Calp, JM
Contribution to Section 6.4 “Definitive Data Calculation based on HDZ Oriented Variometer”	Dinant action item TM.13	JM
Consider replacing Appendices B-1 and B-2 of the manual (referenced in 6.3.3.1) with references to the web site	Dinant action item TM.13	BSL

Move Sections 6.3.3.2.2, 6.3.3.2.3, 6.3.3.2.4 & 6.3.3.2.5 to Appendix	Dinant action item TM.13	BSL
Move the text between, “The INTERMAGNET CD-ROM Software...”, and, “any data converted to WDC-files.” To Appendix	Dinant action item TM.13	BSL
Move Section 6.3.3.3 and 6.3.3.4 to appendices with reference in Chapter 7	Dinant action item TM.15	BSL
Once TM5 has been completed, verify that Real-time definition is consistent throughout the manual and defined along with target transmission delays.	Dinant action item TM.20	SF
Create a section on de-spiking in Chapter 5referencing external sources where possible.	Dinant action item TM.22	JM
Provide reference for Absolute quality control and curve-fitting algorithms.	Dinant action item TM.23: absolute quality control and fitting	JM & David Calp
Once TM5 has been completed, perform final review of Technical Manual V-5	Dinant action item TM.24	AL
Once TM5 has been completed, perform final review of data formats in the Technical Manual	Dinant action item TM.25	GWD Subcommittee
Once completed, publish the Technical Manual V-5.0.0 on the INTERMAGNET web site	Dinant action item TM.26	BSL
Consider the need to publish filter coefficients for one-second data in the Technical Manual	Additional item: One-second filter coefficients	TM Subcommittee
Review TM Chapter 1 and include vision & mission statements plus update INTERMAGNET officer details	Additional item: Consistency of INTERMAGNET conditions of use	AT & BSL

### 15.3.20 Appendix A Section 6.3.3 & 7.4 text from SF

**Note additional comments in RH margin**

#### 6.3.3 DATA ENCODING FOR DVD/CD-ROM PRODUCTION

1-minute definitive data for an IMO are to be provided to INTERMAGNET shortly after the end of each calendar year for inclusion in an annual INTERMAGNET DVD. INTERMAGNET will send out a ‘call for data’ to each observatory, specifying the deadline for providing data. Observatories should provide data in the INTERMAGNET Archive Format (IAF) which is described in Appendix C-1. Data can be converted to IAF using INTERMAGNET’s ‘imcdview’ DVD/CD-ROM viewing software, which can be obtained from [REFERENCE NEEDED - to the INTERMAGNET web site 'software' page

<http://www.intermagnet.org/publication-software/software-eng.php>]. Baseline data will accompany the definitive data, and will be provided in format IBFV2.00 as described in Appendix E-4.

### 6.3.3.1 GENERAL FEATURES

The first INTERMAGNET CD-ROM contains data from 41 observatories provided by 11 countries for the year 1991. The 1992 and subsequent DVD/CD-ROMs also contain baseline data for the year for each observatory in the form of text and plots.

Appendix B-1 of this manual provides a list of observatories currently contributing to the DVD, and Appendix B-2 gives a map showing their locations.

COMMENT Flower, Simon M: Nov 09 2016 "Wouldn't it be easier to replace these appendices with a reference to the equivalent information on the website? The information in the technical manual will go out of date very quickly."

### 6.3.3.2 IAF INTERMAGNET ARCHIVE FORMAT (DVD/CD-ROM)

The INTERMAGNET CDs and DVDs contain a variety of metadata, including contact information and quality control records. The geomagnetic data on the CDs and DVDs is held in INTERMAGNET Archive Format. This format holds minute, hourly and daily mean values as well as K indices.

The data are coded as 32-bit (long integer) binary words, with 5888 words comprising a day-long record. Each file contains one month of day-records (so files are variable length, from 28 to 31 records). Each day of data has a header and data section, the data being subdivided into minute means, hourly means, daily means and a set of K-indices. To date, five versions of this format have been used: IAFV1.00 being the original description of the format. It was only designated as version 1.00 in 2007. Minor undocumented changes were made to how the header was used over the lifetime of this version. IAFV1.10 was defined in 2008 to add the publication date, encoding of the format version number and to reserve word 16 in the header, affecting words 14, 15 and 16. In 2009, delta-F was introduced in IAFV2.00 affecting words 6,8 and 15 in the header, and words 4337 to 5776, words 5849 to 5872 and word 5876 in the data section. Also in IAFV2.00, space padding was specified to be at the left most position affecting word 13 in the header and words 5885 to 5888 in the data section were made available for each contributing institution. In 2010, IAFV2.10 was defined to allow for a missing instrument designator affecting words 6 and 15 in the header, and words 4337 to 5776 in the data section. In 2014, IAFV2.11 was introduced to add a data type flag in word 15 to indicate whether the data is definitive or quasi-definitive. Appendix C-1 provides a schematic representation of the record structure.

Each 1-day record requires 23,552 bytes, so a month-file for January would require 730,112 bytes of storage. A year of observatory data requires almost 8.6 Megabytes (Mb) of storage. The storage capacity of a CD-ROM is about 640 Mb. A single sided, single layer DVD holds about 4.7 Gb, a single sided, double layer DVD about 8.5Gb.

Observatories should provide new definitive data to INTERMAGNET in IAF V2.11, which is described here. In order to allow users of historic DVD/CD-ROM data to understand the format of the data for each year of production, previous versions (and the years they are associated with) are fully described in [REFERENCE NEEDED – *create a new appendix, or new sections to appendix C, to hold the descriptions of previous versions of the format*].

#### 6.3.3.2.1 IAFV2.11 (2014 and after)

Words 1 to 16 comprise the header section containing a mixture of text and numeric fields, including a 3-letter observatory identification preceded with a space [hex20] (ID) code, the year concatenated with the day of the year, co-latitude, longitude, elevation, reported orientation, originating organization, a D-conversion factor, data quality, instrumentation, K-9, sampling rate, sensor orientation, publication date and format version/data type. From 2014 onward, a field have been added to indicate whether the data is definitive or quasi-definitive. This field is a single bit flag in the second byte of word 15. It will be encoded as 0x00 to indicate definitive data, 0x01 to indicate quasi-definitive data. From 2010 onward, the orientation codes "XYZ" and "HDZ" have been added to "XYZG" and "HDZG" where "G" represents  $\Delta F$  (see description below). These new codes indicate that the observatory is recording 3 elements only (no scalar instrument). The D-conversion factor is a fixed value used only in the graphics portion of the access software to allow Declination to be plotted in minutes of arc and equivalent nanoteslas (nT). It is given as  $H/3438 \times 10000$ , where H is the annual mean value of the horizontal intensity. Example: If H is 16500 D will be 47993(Integer). When XYZG or XYZ is used, the D-conversion factor should be set to 10000.

ASCII values, such as the observatory ID and orientation, are also stored as 32-bit words, but are coded as the hexadecimal byte-string corresponding to the ASCII string. For example, the string "HDZF" is coded as the sequence "48 44 5A 46". Where a string is shorter than four bytes, it is padded to the left with spaces. For example, the string "ESK" is coded as the sequence "20 45 53 4B".

Word 11 is the K-9 value for the observatory in nT, word 12 is the digital sampling rate in msec, and word 13 is the sensor orientation. Sensor orientation could be XYZF, DIF, UVZ, HDZ, HDZF etc. and

should indicate which components are actually measured. If a three component sensor orientation is used, a space must be added to the left. Word 14 is the publication date encoded as 4 ASCII bytes "YYMM" provided by INTERMAGNET. The high byte (left most) of word 15 is the INTERMAGNET Archive Format version number code provided by the IMO. It takes the form of a binary single byte number ranging from 0 to 255. Zero (0x00) represents version 1.00, one (0x01) represents version 1.10, two (0x02) represents version 2.00, three (0x03) represents version 2.10 and four (0x04) represents version 2.11. The second byte in word 15 will be encoded as 0x00 to indicate definitive data, 0x01 to indicate quasi-definitive data. The other two bytes of word 15 are reserved for future use and padded with zeros. Word 16 is reserved for future use.

Words 17-5776 contain the minute values of the 4 geomagnetic elements (successively X,Y,Z,G or H,D,Z,G or X,Y,Z, or H,D,Z ) for the day. From 2009 onward, the 4th element contains the difference between the square root of the sum of the squares of the variometer components,  $F(v)$ , and the total field from an independent scalar recording,  $F(s)$ . This difference,  $\Delta F$ , is defined as  $F(v) - F(s)$ . Both  $F(v)$  and  $F(s)$  must be corrected to the location in the observatory where absolute geomagnetic observations are made. When  $F(s)$  is missing or both  $F(s)$  and  $F(v)$  are missing,  $\Delta F$  must be set to 999999. When  $F(v)$  only is missing,  $\Delta F$  must be set to  $-F(s)$ . The values of the 4 elements are stored in tenth-units with an implied decimal point. Thus, an H value of 21305.6 is stored (in tenth nT) as 213056 with a decimal point implied between the last and next-to-last digits. Words 5777-5872 are used for the hourly mean values of the successive 4 elements. From 2009 onward, words 5849-5872 always record 999999 (missing value), this is done because the 4th element in the data is a quality check for minute mean data and this quality check is meaningless for hourly means. Words 5873-5876 store the 4 daily mean values. From 2009 onward, word 5876 always record 999999 (missing value) because the quality check for daily means is also meaningless. From 2009 onward, the last 4 words (5885-5888) are available for each contributing institution. Missing data for minute, hour, and day values are stored as "999999". From 2010 onward, if a scalar instrument is not used (so no data is recorded in the fourth element) the value "888888" should be used instead of "999999". Missing K-Index values are stored as "999".

#### 6.3.3.2.2 IAFV2.10 (2010 to 2013)

Words 1 to 16 comprise the header section containing a mixture of text and numeric fields, including a 3-letter observatory identification preceded with a space [hex20] (ID) code, the year concatenated with the day of the year, co-latitude, longitude, elevation, reported orientation, originating organization, a D-

conversion factor, data quality, instrumentation, K-9, sampling rate, sensor orientation, publication date and format version. From 2010 onward, the orientation codes "XYZ" and "HDZ" have been added to "XYZG" and "HDZG" where "G" represents  $\Delta F$  (see description below). These new codes indicate that the observatory is recording 3 elements only (no scalar instrument). The D-conversion factor is a fixed value used only in the graphics portion of the access software to allow Declination to be plotted in minutes of arc and equivalent nanoteslas (nT). It is given as  $H/3438*10000$ , where H is the annual mean value of the horizontal intensity. Example: If H is 16500 D will be 47993(Integer). When XYZG or XYZ is used, the D-conversion factor should be set to 10000.

ASCII values, such as the observatory ID and orientation, are also stored as 32-bit words, but are coded as the hexadecimal byte-string corresponding to the ASCII string. For example, the string "HDZF" is coded as the sequence "48 44 5A 46". Where a string is shorter than four bytes, it is padded to the left with spaces. For example, the string "ESK" is coded as the sequence "20 45 53 4B".

Word 11 is the K-9 value for the observatory in nT, word 12 is the digital sampling rate in msec, and word 13 is the sensor orientation. Sensor orientation could be XYZF, DIF, UVZ, HDZ, HDZF etc. and should indicate which components are actually measured. If a three component sensor orientation is used, a space must be added to the left. Word 14 is the publication date encoded as 4 ASCII bytes "YMM" provided by INTERMAGNET. The high byte (left most) of word 15 is the INTERMAGNET Archive Format version number code provided by the IMO. It takes the form of a binary single byte number ranging from 0 to 255. Zero (0x00) represents version 1.00, one (0x01) represents version 1.10, two (0x02) represents version 2.00 and three (0x03) represents version 2.10. The other three bytes of word 15 are reserved for future use and padded with zeros. Word 16 is reserved for future use.

Words 17-5776 contain the minute values of the 4 geomagnetic elements (successively X,Y,Z,G or H,D,Z,G or X,Y,Z, or H,D,Z ) for the day. From 2009 onward, the 4th element contains the difference between the square root of the sum of the squares of the variometer components,  $F(v)$ , and the total field from an independent scalar recording,  $F(s)$ . This difference,  $\Delta F$ , is defined as  $F(v) - F(s)$ . Both  $F(v)$  and  $F(s)$  must be corrected to the location in the observatory where absolute geomagnetic observations are made. When  $F(s)$  is missing or both  $F(s)$  and  $F(v)$  are missing,  $\Delta F$  must be set to 999999. When  $F(v)$  only is missing,  $\Delta F$  must be set to  $-F(s)$ . The values of the 4 elements are stored in tenthunits with an implied decimal point. Thus, an H value of 21305.6 is stored (in tenth-nT) as 213056 with a decimal point implied between the last and next-to-last digits. Words 5777-5872 are used for the hourly mean values of the successive 4 elements. From 2009 onward, words 5849-5872 always record 999999 (missing

value), this is done because the 4<sup>th</sup> element in the data is a quality check for minute mean data and this quality check is meaningless for hourly means. Words 5873-5876 store the 4 daily mean values. From 2009 onward, word 5876 always record 999999 (missing value) because the quality check for daily means is also meaningless. From 2009 onward, the last 4 words (5885-5888) are available for each contributing institution. Missing data for minute, hour, and day values are stored as "999999". From 2010 onward, if a scalar instrument is not used (so no data is recorded in the fourth element) the value "888888" should be used instead of "999999". Missing K-Index values are stored as "999".

*Comment: Flower, Simon M. 09 Nov 2016 "Move to appendix"*

#### 6.3.3.2.3 IAFV2.00 (2009)

Words 1 to 16 comprise the header section containing a mixture of text and numeric fields, including a 3-letter observatory identification preceded with a space [hex20] (ID) code, the year concatenated with the day of the year, co-latitude, longitude, elevation, reported orientation, originating organization, a D-conversion factor, data quality, instrumentation, K-9, sampling rate, sensor orientation, publication date and format version. From 2009 onward, the orientation must be "XYZG" or "HDZG" where "G" represents  $\Delta F$  (see description below). The D-conversion factor is a fixed value used only in the graphics portion of the access software to allow Declination to be plotted in minutes of arc and equivalent nanoteslas (nT). It is given as  $H/3438*10000$ , where H is the annual mean value of the horizontal intensity. Example: If H is 16500 D will be 47993(Integer). When XYZG is used, the D-conversion factor should be set to 10000.

ASCII values, such as the observatory ID and orientation, are also stored as 32-bit words, but are coded as the hexadecimal byte-string corresponding to the ASCII string. For example, the string "HDZF" is coded as the sequence "48 44 5A 46". Where a string is shorter than four bytes, it is padded to the left with spaces. For example, the string "ESK" is coded as the sequence "20 45 53 4B".

Word 11 is the K-9 value for the observatory in nT, word 12 is the digital sampling rate in msec, and word 13 is the sensor orientation. Sensor orientation could be XYZF, DIF, UVZ, HDZ, HDZF etc. and should indicate which components are actually measured. If a three component sensor orientation is used, a space must be added to the left. Word 14 is the publication date encoded as 4 ASCII bytes "YYMM" provided by INTERMAGNET. The high byte (left most) of word 15 is the INTERMAGNET Archive Format version number code provided by INTERMAGNET. It takes the form of a binary single byte number ranging from 0 to 255. Zero (0x00) represents version 1.00, one (0x01) represents version 1.10

and two (0x02) represents version 2.00. The other three bytes of word 15 are reserved for future use and padded with zeros. Word 16 is reserved for future use.

Words 17-5776 contain the minute values of the 4 geomagnetic elements (successively X,Y,Z,G or H,D,Z,G ) for the day. From 2009 onward, the 4<sup>th</sup> element contains the difference between the square root of the sum of the squares of the variometer components,  $F(v)$ , and the total field from an independent scalar recording,  $F(s)$ . This difference,  $\Delta F$ , is defined as  $F(v) - F(s)$ . Both  $F(v)$  and  $F(s)$  must be corrected to the location in the observatory where absolute geomagnetic observations are made. When  $F(s)$  is missing or both  $F(s)$  and  $F(v)$  are missing,  $\Delta F$  must be set to 999999. When  $F(v)$  only is missing,  $\Delta F$  must be set to  $-F(s)$ . The values of the 4 elements are stored in tenth-units with an implied decimal point. Thus, an H value of 21305.6 is stored (in tenth-nT) as 213056 with a decimal point implied between the last and next-to-last digits. Words 5777-5872 are used for the hourly mean values of the successive 4 elements. From 2009 onward, words 5849-5872 always record 999999 (missing value), this is done because the 4th element in the data is a quality check for minute mean data and this quality check is meaningless for hourly means. Words 5873-5876 store the 4 daily mean values. From 2009 onward, word 5876 always record 999999 (missing value) because the quality check for daily means is also meaningless. From 2009 onward, the last 4 words (5885-5888) are available for each contributing institution. Missing data for minute, hour, and day values are stored as "999999". Missing K-Index values are stored as "999".

Comment: Flower, Simon M. 09 Nov 2016 "Move to appendix"

#### 6.3.3.2.4 IAFV1.10 (2008)

Words 1 to 16 comprise the header section containing a mixture of text and numeric fields, including a 3-letter observatory identification preceded with a space [hex20] (ID) code, the year concatenated with the day of the year, co-latitude, longitude, elevation, reported orientation, originating organization, a D-conversion factor, data quality, instrumentation, K-9, sampling rate, sensor orientation, publication date and format version. The orientation must be "XYZF" or "HDZF". If the F element is not measured, it must be filled with 999999 in the data section. The D-conversion factor is a fixed value used only in the graphics portion of the access software to allow Declination to be plotted in minutes of arc and equivalent nanoteslas (nT). It is given as  $H/3438 * 10000$ , where H is the annual mean value of the horizontal intensity. Example: If H is 16500 D will be 47993(Integer). When XYZF is used, the D-conversion factor should be set to 10000.

ASCII values, such as the observatory ID and orientation, are also stored as 32-bit words, but are coded as the hexadecimal byte-string corresponding to the ASCII string. For example, the string "HDZF" is coded as the sequence "48 44 5A 46".

Word 11 is the K-9 value for the observatory in nT, word 12 is the digital sampling rate in msec, and word 13 is the sensor orientation. Sensor orientation could be XYZF, DIF, UVZ, HDZ, HDZF etc. and should indicate which components are actually measured. If a three component sensor orientation is used, a space must be added at the end. Word 14 is the publication date encoded as 4 ASCII bytes "YMM" provided by INTERMAGNET. The high byte (left most) of word 15 is the INTERMAGNET Archive Format version number code provided by INTERMAGNET. It takes the form of a binary single byte number ranging from 0 to 255. Zero (0x00) represents version 1.00 and one (0x01) represents version 1.10. The other three bytes of word 15 are reserved for future use and padded with zeros. Word 16 is reserved for future use.

Words 17-5776 contain the minute values of the 4 components (successively X,Y,Z,F or H,D,Z,F) for the day. The 4th component "F" should be included only if it is measured from a scalar instrument independent of the other 3 components otherwise it must be filled with 999999. The values of the 4 components are stored in tenth-units with an implied decimal point. Thus, an H value of 21305.6 is stored (in tenth-nT) as 213056 with a decimal point implied between the last and next-to-last digits and a D value of 527.6 is stored (in tenth-minutes) as 5276 also with a decimal point implied between the last and next-to-last digits. Words 5777-5872 are used for the hourly mean values of the successive 4 components. Words 5873-5876 store the 4 daily mean values. Words 5877-5884 contain the K-Index\*10. The last 4 words (5885-5888) are reserved for future use and padded with zeros. Missing data for minute, hour, and day values are stored as "999999". Missing KIndex and Ak values are stored as "999".

*Comment: Flower, Simon M. 09 Nov 2016 "Move to appendix"*

#### 6.3.3.2.5 IAFV1.00 (2007 and before)

Words 1 to 16 comprise the header section containing a mixture of text and numeric fields, including a 3-letter observatory identification preceded with a space [hex20] (ID) code, the year concatenated with the day of the year, co-latitude, longitude, elevation, reported orientation, originating organization, a D-conversion factor, data quality, instrumentation, K-9, sampling rate and sensor orientation. From 1991 to 2005, the fourth component is the total field from either a scalar (independent) instrument or the

total field calculated from the main observatory instrument. INTERMAGNET has a list of which observatories supplied which type of total field value between 1991 and 2005 and this list is available as a spreadsheet in the archive viewer software. The conversion factor is a fixed value used only in the graphics portion of the access software to allow Declination to be plotted in minutes of arc and equivalent nanoteslas (nT). It is given as  $H/3438 \times 10000$ , where H is the annual mean value of the horizontal intensity. Example: If H is 16500 D will be 47993(Integer). This conversion factor only applies to HDZ observatory data supplied before 2005.

ASCII values, such as the observatory ID and orientation, are also stored as 32-bit words, but are coded as the hexadecimal byte-string corresponding to the ASCII string. For example, the string "HDZF" is coded as the sequence "48 44 5A 46". Word 11 is the K-9 value for the observatory in nT, word 12 is the digital sampling rate in msec, and word 13 is the sensor orientation. Sensor orientation could be XYZF, DIF, UVZ, HDZ, HDZF etc. and should indicate which components are actually measured. If a three component sensor orientation is used, a space must be added at the end. Word 14-15 are reserved for future use and padded with zeros. In version 1.10 and later, word 15 have been defined to represent the version number. Previously, it should have been coded to zero by IMOs, that is the reason this word was chosen for the version number (zero represents version 1.00). Word 16 is set aside for each contributing institution to use as they wish, provided it is coded as a 32-bit binary value.

Words 17-5776 contain the minute values of the 4 components (successively X,Y,Z,F or H,D,Z,F) for the day. Until 2005, the 4th component could contain "F" from either a scalar or calculated from the vector instrument. From 2006 onward, the 4th component contains "F" only if it is measured from a scalar instrument independent of the other 3 components otherwise it must be filled with 999999. The values of the 4 components are stored in tenth-units with an implied decimal point. Thus, an H value of 21305.6 is stored (in tenth-nT) as 213056 with a decimal point implied between the last and next-to-last digits and a D value of 527.6 is stored (in tenth-minutes) as 5276 also\* with a decimal point implied between the last and nextto- last digits. Words 5777-5872 are used for the hourly mean values of the successive 4 components. Words 5873-5876 store the 4 daily mean values. Prior to the 1994 CD-ROM, words 5877-5884 held the 8 (K-Index\*10) values for the day. The true IAGA K-Index could be obtained from these K-Index\*10 values by truncating the second (least significant) digit. From 1994 onward, words 5877-5884 contain the K-Index\*10. Until 1998, word 5885 contained the equivalent daily amplitude index (Ak). From 1999 onward, word 5885 is reserved for future use and padded with zeros.

The last 3 words (5886-5888) are reserved for future use and padded with zeros. Missing data for minute, hour, and day values are stored as "999999". Missing K-Index and Ak values are stored as "999".

*Comment: Flower, Simon M. 09 Nov 2016 "Move to appendix"*

### 6.3.3.3 INTERMAGNET DVD/CD-ROM DIRECTORY STRUCTURE

This section describes the structure of the current DVD (2011). The structure of older DVD/CD-ROMs is described in [REFERENCE NEEDED to appendix C-2].

The files on the INTERMAGNET DVD are set up in a particular directory structure. The root directory contains a "README.TXT" file, which is an ASCII file describing the DVD and where to obtain information about it, the software, and documentation;

On the 2011 DVD there are also three directories and a further file. The directory called "ERRATA" contains a file "ERRATA.TXT". This file lists errors on previous DVD/CD-ROMs. A second folder, called "SOFTWARE", holds the 'imcdview' programme, software, for visualising and working with the data on the DVD/CD-ROMs. This software is described in [REFERENCE NEEDED to section 6.3.3.4]. The file "imcdview\_install.txt" describes how to install the imcdview software.

The final directory, MAG2011, contains a sub-directory for each observatory identified by its 3-letter ID code. In addition, there are sub-directories labelled "2011MAPS", "CTRY\_INF", and "OBSY\_INF". The 2011MAPS directory contains the \*.PNG files that are the map images of each country for use in the access software. These are labeled by a 3-letter country ID with the PNG extension, and one labelled "ALL.PNG" for all countries. The CTRY\_INF directory contains a \*.PNG file for each country (and one for ALL) that are the images used to show the flag and organizational Logo for the different countries, and the README files that pertain to each country's geomagnetism program (including a README for the ALL option). The OBSY\_INF subdirectory is empty, but is required to identify to software that the this folder holds data in the INTERMAGNET DVD/CD-ROM structure.

The individual sub-directories (e.g. BFE for Brorfelde, TUC for Tucson, etc.) contain the 12 months of data labeled with the 3-letter ID, 2-character year, 3-letter month abbreviation, and a "BIN" extension indicating they are binary files in the IAF format [REFERENCE NEEDED to section 6.3.3.2.1]. For example, "BFE91AUG.BIN" is a file of 31 sequential day-records for Brorfelde, for 1991, for August. In addition,

there are "README.XXX" files for the individual observatory, a YEARMEAN.XXX containing annual mean data in plain text format for all years that the observatory has operated (see [REFERENCE NEEDED to Appendix C-3] for details of the format) and an XXX2011.BLV file that contains absolute observation and baseline data in the INTERMANGET baseline format [REFERENCE NEEDED to appendix E-4] (where XXX indicates the 3-letter observatory ID).

This sub-directory may also contain a file labelled XXXYRK.DKA, where XXX is the 3-letter observatory ID, YR is the 2-character year value and K indicates a K-Index file. Originally the DKA extension was used to indicate that the data were generated from a digital algorithm in an ASCII format, however subsequently these files have been used to hold both digitally derived and hand-scaled K indices. Since the 2005 CD-ROM the DKA files have been created by INTERMAGNET using data from the binary IAF file (before 2005 these files were provided by the observatories). These ASCII K-Index files are used, even though the data are in the binary records, because they are much faster to access than paging through the binary records on the DVD/CD-ROM.

#### 6.3.3.4 INTERMAGNET DVD/CD-ROM SOFTWARE

INTERMAGNET provides software to work with the data on the DVD/CD-ROM. This software can be installed from the DVD, or downloaded from [REFERENCE NEEDED - to the *INTERMAGNET web site 'software' page* <http://www.intermagnet.org/publication-software/software-eng.php>]. The software is designed to be simple and easy to use. When the software starts for the first time on a new computer, a dialog is displayed describing how to tell the software where to find data. This same information, on how to find data, is available from the 'Help' menu under 'Help for New Users'.

The program has 3 main windows. The window that you see when the program starts shows a view of the World. The observatories that the program has discovered in its database(s) are shown as red dots on the world map. If you move your mouse over an observatory its name will be displayed. If you click on an observatory using the left mouse button then a popup-menu will appear with a list of data that you can view. If you use the right mouse button you will get the same menu, but in a permanent window that will not close when you select an item from the menu. The World Map window also holds the program's menu bar. The World Map window is always present while the software is running. If you close this window, the program will exit.

There is also an Explorer window, available from the 'View' menu. This window gives you an alternative view of data on a DVD/CD-ROM. The view of the data that the window presents is similar in structure to the directory structure used to hold the data on the DVD/CD-ROM. To view an object in the Explorer window, double click the object. For example, to plot data from an observatory using the Explorer window, expand the tree until the observatory is listed, expand the observatory, select and expand the

data file that you want to view then double click the 'Data Plot' icon. The Explorer window also shows you which databases the program is using. For more information about databases see the online help system.

The third main window, also available from the 'View' menu, is the Export Window. This window allows you to create data files in IAGA 2002 and other data formats from the INTERMAGNET archive data. The window has been designed so that you can convert as much data as you want with the minimum of work. Further details are available in the online help system.

The software also includes an import function, allowing you to convert data from IAGA 2002 and other data formats into the INTERMAGNET Archive Format. This function is available from the 'Database' menu. Using this software, observatories can convert their own data into IAF for delivery to INTERMAGNET. It's also possible to use the import and then export functions to convert between data formats (e.g. to convert INTERMAGNET minute mean format to IAGA-2002), but please note that between import and export the data will always be stored in IAF format and so the precision of the data will be that provided by the IAF format ( $1/10^{\text{th}}$  nT and  $1/10^{\text{th}}$  minute of arc). For most modern data this precision is unacceptably low, particularly for angular measurements.

Prior to the current software, INTERMAGNET distributed a DOS-based program for working with the DVD/CD-ROM data. For historical purposes this software is documented at [REFERENCE NEEDED – *move the description of the DOS-based software to an appendix*]

The INTERMAGNET CD-ROM software is a menu-driven program that allows the user to display data in both graphics and text modes. It also allows the user to Save the graphics in the form of \*.PCX files that can then be imported into other programs that accept the PCX format; and also Save the text in the form of ASCII files to the hard drive or floppy disk. Output may also be sent to an Epson compatible dot-matrix, or Hewlett-Packard Laserjet compatible printer for both plots and text.

Starting the software brings up a "Welcome" screen, and an ENTER command brings the user into the HOME screen, with menu options for YEAR, COUNTRY, OBSERVATORY, DATE-RANGE, AND MODEOUTPUT. The "8" and "9" keys allow the user to scroll through the choices, which are highlighted as the user moves through them. Pressing the "ENTER" key selects the highlighted option, and activates pop-up menus with further options. All options may be selected using the 8, 9, and ENTER keys. Selections may also be made with the use of "Hot Keys", which are the first letter of each option, and indicated in the software by use of a different color in the menu choices. Pressing the particular Hot Key

activates that menu choice immediately. Hot Keys are indicated in this manual by the use of bold type, for example, **S**(ave) means that if the "S" key is pressed for the Save option, it is executed immediately. Once all selections have been made, the EXECUTE option retrieves and displays the chosen options. Pressing the "ALT" and "E" keys simultaneously will exit the user back to DOS at any time, and from anywhere within the program.

There are 6 MODE-OUTPUT options: a) minute value plots, b) minute values as text, c) mean hourly value plots, d) mean hourly values as text, e) KIndex values as text, and f) a conversion option that converts data from the 32-bit binary format into the World Data Center (WDC) ASCII format. The WDC format option was included to allow users with existing software designed for this format to output the desired data and import it into their existing programs.

Help screens are available throughout the program with the use of the "F1" key. When the user is in a particular highlighted menu item, the F1 key provides a help screen about that item. In addition, information screens are available about a particular country using the "F4" key, and about the particular observatory using the "F3" key. These option keys appear on a menu bar on the screen when the COUNTRY and/or OBSERVATORY option is highlighted. The user can scroll through these README screens using the "8" and "9" keys, once the F3 or F4 key has been pressed.

Within the program, menu bars located at the top and bottom of the screen, offer a variety of options. A map screen of each country is available, showing the observatories contributing to the CD-ROM from that country, by using the **V**(iew map) key once the particular country has been chosen. Also, an **A**(bout) screen is available for each country showing the organization's address and the names of persons to contact regarding their geomagnetism program. Users can change observatories (within a given country) and date ranges while in the output mode without having to return to the HOME screen. Individual components in the plot outputs may be selected and displayed at an enlarged scale using the **C**(omponent) option (Hot Key "C") from the menu bar. While in the Component mode, the **T**(oggle) key toggles on and off a histogram of hourly means and K-Index values (when available) for the minute plots, and the Ak values for the mean hourly values plots. **P**(rint) and **S**(ave) options are also available for both graphics and text modes. Starting with the 1992 CD-ROM, a **B**ase(l)ine option was made available that provides absolutes and baseline calibration data for each station. These data can be viewed either in the form of a plot for each component, or in text mode showing the observed and adopted values for the year. The plots also show a delta-F plot of the differences between the observed and computed total

field (F) for some stations; and the text mode contains a comments section pertaining to baseline jumps and other observatory adjustments.

Other options that are available from the menu bars include a B(eginning day) choice that resets the output to the beginning of the selected date-range, a F2(Flow) chart of the software program that indicates where the user is within the program and what outputs are available, and a R(escale) option that allows the user to set the scale of the plots. This feature disables the autoscaling of the plots, and enables a user to plot data at a fixed scale for comparison of different days and/or observatories on the same full-range scale. However, if the data cannot fit within the plot range, the Rescale option will override the user-selected scale and autoscale to fit the data. While in the HOME screen, the P(references) option allows the user to customize certain parameters including the text and background colors, the type of printer being used, and the CDROM and output drive letter designations, it is also possible to add CRLF (carriage return / linefeed characters) to the records in any data converted to WDC-files.

Comment: Flower, Simon M. 09 Nov 2016 "Move to appendix"

Copies of the DVD/CD-ROM may be obtained from:

INTERMAGNET DVD/CD-ROM distribution office

Observatoire Magnétique National

Carrefour des 8 routes

45340 Chambon la Forêt

FRANCE

Tel: 33 (0) 2-38-33-95-01

Internet: [intermagnet@ipgp.fr](mailto:intermagnet@ipgp.fr)

Individual (monthly) IAF data files are available from the INTERMAGNET web site.

*[I think we should add a section 6.6 on provision of 1-second definitive data. I've written the start of this below. Although we are still working out how this will work, we have already requested observatories to*

*provide this data. This section will change soon as we refine the way we work with 1-second data, but I think it's worth writing down how we are doing things now, so that observatories know what we want them to do*

*If this suggestion is adopted, section 6.3 should be renamed "Definitive 1-minute data"]*

## **6.6 Definitive 1-second Data**

Since 2014 INTERMAGNET has requested observatories to provide 1-second definitive data if they are able to do so. Calls for 1-second definitive data will be made at the same time as calls for 1-minute definitive data. It is not a requirement of INTERMAGNET membership that an observatory is able to provide 1-second data. Where possible, observatories should produce data that complies with the INTERMAGNET 1-second data standard [REFERENCE NEEDED – to 1-second data standard]. At present observatories are requested to provide baseline corrected 1-second definitive data whether or not it conforms to the standard, though this is likely to change in the future as more observatories become able to meet the standard.

INTERMAGNET has created a format for 1-second data [REFERENCE NEEDED – to 1-second data format] based on NASA's Common Data Format (CDF) software. At present observatories are asked to supply their 1-second definitive data in IAGA-2002 format for INTERMAGNET to perform the conversion to INTERMAGNET CDF format. This is likely to change soon. Observatories will be asked to supply data in the new INTERMAGNET CDF format. Software for conversion to the new format is available. For the most up to date details of what software is available please see [REFERENCE NEEDED – to software page on INTERMAGNET web site].

## **Appendix C2 INTERMAGNET DVD/CD-ROM DIRECTORY STRUCTURE**

The structure of files and folders on the INTERMAGENT DVD/CD-ROM has remained broadly the same since its inception in 1991, however there have been some differences. This appendix documents the structure for the current DVD (2011), then describes the structure of the first CD (1991) and lists year by year differences in the files and folders on the DVD/CD-ROM.

### **Structure of current (2011) DVD**

```
/errata/
  errata.txt
/imcdview_install.txt
/mag2011/
  2011maps/
    alg.png
    all.png
    arg.png
    ...
  ctry_inf/
    algsrn.prg
    argsrn.png
    ...
    readme.alg
    readme.arg
    ...
  obsy_inf/
  aaa/
aaa11jan.bin
aaa11feb.bin
...
aaa11k.dka
aaa2011.blv
readme.aaa
yearmean.aaa
aae/
aae11jan.bin
aae11feb.bin
...
aae11k.dka
aae2011.blv
readme.aae
yearmean.aae
...
/readme.txt
/software/
  disk1/
    InstData/
Linux/
  NoVM/
    Imcdview.bin
Mac/
  NoVM/
    Imcdview.app
MediaId.properties
Resource1.zip
Solaris/
  NoVM/
    Imcdview.bin
Windows/
  NoVM/
    Imcdview.exe
```

VM/  
Imcdview.exe

### Structure of first (1991) CD-ROM

```
\BROWSE.COM
\MAG1991\
  1991MAPS\
    ALL.PCX
    AUS.PCX
    CAN.PCX
    ...
  CTRY_INF\
    CTRYLIST.IDX
    ALLSRN.PCX
    AUSSRN.PCX
    CANSRN.PCX
    ...
    README.ALL
    README.AUS
    README.CAN
    ...
  OBSY_INF\
    91OBSDAT.DBF
  AMS\
  AMS91JAN.BIN
  AMS91FEB.BIN
  ...
  AMS91K.DKA
  README.AMS
  BFE\
  BFE91JAN.BIN
  BFE91FEB.BIN
  ...
  BFE91K.DKA
  README.BFE
  ...
  \README.EXE
  \README.TXT
  \VTOC.SYS
  \XTRAS\
    PRNSTRUC.EXE
  STRUCTUR.DAT
```

### List of changes to the structure since the first (1991) CD-ROM

Year	Change
1992	No change

1993	No change
1994	First CD-ROM with an ERRATA folder in the root of the disk IMAG21.EXE and INSTALL.EXE added to the root of the CD-ROM
1995	Annual means included in a YEARMEAN.obs file in each observatory folder
1996	IMAG22.EXE replaces IMAG21.EXE PLOTUTIL folder added to the root of the CD-ROM containing plotting source code and executables (for DOS)
1997	No change
1998	Republication of some data (folders in root of CD-ROM): <ul style="list-style-type: none"> <li>• CLF 1996</li> <li>• PPT, THY 1991</li> </ul>
1999	No change
2000	1st year of distribution on 2 CD-ROMs (the number of observatories meant that the data was too large to fit on a single CD-ROM) IMAG23.EXE replaces IMAG22.EXE INTRO00A.PCX and INTRO00B.PCX are include in CTRY_INF folder – these are splash screens for individual disks
2001	Republication of some data (folders in root of 1 <sup>st</sup> CD-ROM only): <ul style="list-style-type: none"> <li>• ABG 2000</li> </ul> Removed INTRO00A.PCX and INTRO00B.PCX from CTRY_INF
2002	IMAG24.EXE replaces IMAG23.EXE Republication of some data (folders in root of both CD-ROMs): <ul style="list-style-type: none"> <li>• TAN 2001</li> </ul> INTRO1.PCX and INTRO2.PCX are included in CTRY_INF folder
2003	Republication of some data (folders in root of both CD-ROMs): <ul style="list-style-type: none"> <li>• FRN, HON 1993</li> <li>• HON 2001, 2002</li> <li>• PPT 2002</li> </ul>
2004	Republication of some data (folders in root of both CD-ROMs): <ul style="list-style-type: none"> <li>• 2003 ABG, IQA, SJG</li> </ul> A new UTILITY folder is put into the root of the CD-ROM. It holds software for working with the data, including the first distributed version (V1.1) of the imcdview viewing software in CDVIEWER/CDVIEWER.JAR V1.1 The OBSY_INF folder includes a file OBS_V101.CSV – a list of observatories used by imcdview

2005	<p>Republication of some data (folders in root of both CDs):</p> <ul style="list-style-type: none"> <li>• 2003 NVS</li> <li>• 2004 WNG</li> </ul> <p>Filenames on the CD-ROMs are now in lowercase (this documentation will continue to show filename in uppercase for clarity)</p> <p>GIF files are used for some graphics files (alongside PCX)</p> <p>The UTILITY folder is removed</p> <p>A SOFTWARE folder is added to the root of the CD-ROM. It contains the CD viewer software, imcdview.jar V1.2 and associated installer software</p> <p>An AUTORUN.INF file is added to the root of the CD-ROM to run the imcdview installer when the disk is inserted (only works on Windows operating systems)</p> <p>The following files are removed from the CTRY_INF folder: INTRO.PCX, INTRO1.PCX, INTRO2.PCX, CTRYLIST.IDX</p> <p>The OBSY_INFO folder is retained, but is empty</p> <p>The IMAG24.EXE viewing software and its associated files are removed from the root of the disk</p> <p>The XTRAS folder is removed</p>
2006	<p>Publication moves from two CD-ROMs to a single DVD</p> <p>All graphics files are in PNG format</p> <p>The root of the DVD contains the following folders and files:</p> <ul style="list-style-type: none"> <li>\AUTORUN.INF</li> <li>\ERRATA\</li> <li>\MAG2006\</li> <li>\README.TXT</li> <li>\SOFTWARE\</li> </ul> <p>The software folder contains the imcdview visualisation software along with a simple installer</p>
2007	<p>A multi-OS “<i>Install Anywhere</i>” installer is included for the imcdview visualisation software. A Java Virtual Machine is no longer required to run the software, as this is include on the DVD</p>
2008	<p>No change</p>
2009	<p>A major republication of data from years 2005, 2006, 2007 and 2008</p> <p>The AUTORUN.INF file is removed from the root of the DVD</p> <p>The IMCDVIEW_INSTALL.TXT file is added to the root of the DVD</p>
2010	<p>No change</p>

2011	No change
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## Notes

Unless otherwise noted, where a change is shown in the structure, the change affects all years subsequent to the year where the change is described. The exception to this is republished data.

Republished data is put into a folder at the root of the DVD/CD-ROM. It is only put on for one year – the republished data is not repeated on subsequent DVDs. Because the data is not under the MAGyyyy folder, it will not be recognised by the imcdview viewing software (the exception to this is the 2009 DVD where a number of years were republished in a form that the software can access).

The OBSY\_INF folder is present in all DVD/CD-ROMs, though on some it is empty. It is used by software (along with the CTRY\_INF and yyyyMAPS folders) to indicate the presence of an INTERMAGNET DVD/CD-ROM folder structure.

The .com and .exe files on earlier CD-ROMs are programs that were designed to run on Microsoft DOS operating system. They will not work on more recent versions of Microsoft Windows.

The IMAGxx.EXE files on earlier CD-ROMs contained software to view the data on the CD-ROM. This software only ran on Microsoft DOS operating system. This has been superseded by a multi-operating-system program for viewing the data (imcdview, the INTERMAGNET CD viewer).

The .PCX files, that preceded the current .GIF and .PHG files, are graphics files. PCX stands for PiCtureXchange, a format created by the ZSoft corporation. PCX is no longer in widespread use. Convertors from PCX to more modern formats are available online.

The CTRYLIST.IDX file (no longer used on the current DVD) is a text list of countries and their 3 letter codes.

The yyOBSDAT.DBF file (no longer used on the current DVD) is a database listing the contents of the CD-ROM. This was used by the DOS-based IMAGxx software (but is not used by the more recent imcdview software). The database is in Dbase format.

## 16 Appendix

### 16.1 Meeting agenda

Day 1: Sunday, September 03, 2017			
Time	Topic	Duration	Rooms
	<b>Opening Plenary session</b>		
9:00	Welcome address by S Flower (local information)	5	Lecture theatre
9:05	Welcome by A Thomson	5	Lecture theatre
9:10	Approval and changes of/to main agenda	15	Lecture theatre
9:25	Presentation of 4 subcommittee meeting agendas + proposals	30	Lecture theatre
9:55	Guests present themselves; Guest's posting to subcommittees	5	Lecture theatre
10:00	New ways of working at this meeting: Tuesday afternoon	5	Lecture theatre
	<b>OPSCOM/EXCON 'in camera' session</b>		
10:05	How we work: do we want to make changes to our ways of working <sup>(1)</sup> ?	15	Lecture theatre
10:20	Do we need new officers? Is subcommittee membership appropriate?	5	Lecture theatre
10:25	Future of IDA subcommittee	5	Lecture theatre
10:30	<b>Coffee</b> <sup>[2]</sup>	30	
	<b>Plenary</b>		
11:00	Minutes of last meeting (errors of fact only, typographical errors to be sent to the Secretary by email)	30	Lecture theatre
11:30	Review of action items by subcommittee	60	Lecture theatre
12:30	<b>Lunch</b> <sup>[2]</sup>	60	
	<b>Plenary</b>		
	<b>'Big ticket' items for subcommittees</b> <sup>[3]</sup>		
13:30	How we communicate with our members: A Thomson	10	Lecture theatre
13:40	Technical manual progress: B St-Louis	5	Lecture theatre
13:45	One second data progress: J Reda	10	Lecture theatre
13:55	Licensing our data / DOIs: S Flower	20	Lecture theatre
14:15	Continue with DVD or have data only online: J Reda	10	Lecture theatre
14:25	INTERMAGNET web service: S Flower	5	Lecture theatre
	<b>Presentations</b>		
14:30	EPOS: A Thomson / S Flower	5	Lecture theatre
14:35	Geomagnetic metadata: S Flower	10	Lecture theatre
14:45	Update on NanoMagSat cube satellite proposal: G Hulot	15	Lecture theatre
15:00	INTERMAGNET global activity map: D Boteler	5	Lecture theatre
15:05	Observatories and Space Weather Modelling: R Friedel	15	Lecture theatre
15:15	WMO/OSCAR and INTERMAGNET: Larisa Trichtchenko	15	Lecture theatre
15:30	<b>Coffee</b>	30	
	<b>Subcommittee &amp; EXCON sessions</b>		
16:00	Subcommittee meetings: Tech Manual - WWW/Gins/Formats <sup>[4]</sup>	40	Lecture theatre / Boardroom / Committee room
16:40	Subcommittee meetings: IMO apps - Definitive Data <sup>[4]</sup>	40	Lecture theatre /

			Boardroom / Committee room
<b>End of day 1</b>			

Note 1: Are we working efficiently?

Does the way we record meetings suit our needs?

Do we want more online meetings?

Note 2: R350 per person will be collected onsite to cover catering costs

Note 3: These are items currently affecting INTERMAGNET that need discussion in both plenary and subcommittees. We will come back to them on the last day.

Note 4: Day 1 finished after the presentation on WMO/OSCAR - Subcommittee meetings started on day 2

<b>Day 2: Monday, September 04, 2017</b>			
<b>Time</b>	<b>Topic</b>	<b>Duration</b>	<b>Rooms</b>
<b>Subcommittee &amp; EXCON sessions</b>			
<b>9:00</b>	Subcommittee meetings: IMO Apps - WWW/Gins/Formats	90	Lecture theatre / R7
<b>10:30</b>	<b>Coffee</b>	30	
<b>11:00</b>	Subcommittee meetings: IMO apps - Definitive Data	90	Lecture theatre / R7
<b>12:30</b>	<b>Lunch</b>	60	
<b>Subcommittee &amp; EXCON sessions</b>			
<b>13:30</b>	Subcommittee meetings: Tech Man - WWW/Gins/Formats	60	Lecture theatre / R7
<b>14:30</b>	Subcommittee meetings: Tech Man - Definitive Data	60	Lecture theatre / R7
<b>15:30</b>	<b>Coffee</b>	30	
<b>Plenary</b>			
<b>16:00</b>	Reports from subcommittees	40	Lecture theatre
<b>16:40</b>	Report from EXCON	20	Lecture theatre
<b>17:00</b>	End of sessions		
<b>INTERMAGNET dinner</b>			
<b>19:00</b>	Beintangs Cave: <a href="http://www.bientangscave.com/">http://www.bientangscave.com/</a>	120	
<b>End of day 2</b>			

<b>Day 3: Tuesday, September 05, 2017</b>			
<b>Time</b>	<b>Topic</b>	<b>Duration</b>	<b>Rooms</b>
<b>Plenary session</b>			
<b>Reports</b>			
<b>9:00</b>	Report on IMOs: C Turbitt	30	Lecture theatre
<b>9:30</b>	Report on definitive data timeliness: J Reda	20	Lecture theatre
<b>9:50</b>	Present and future threats & how we face them: H Toh	20	Lecture theatre
<b>'Big ticket' items from subcommittees</b>			
<b>10:10</b>	How we communicate with our members	10	Lecture theatre
<b>10:20</b>	Technical manual progress	10	Lecture theatre
<b>10:30</b>	<b>Coffee</b>	30	
<b>11:00</b>	One second data progress	10	Lecture theatre
<b>11:10</b>	Licensing our data / DOIs	10	Lecture theatre
<b>11:20</b>	Continue with DVD or have data only online	10	Lecture theatre

<b>11:30</b>	Review and agreement on action items	50	Lecture theatre
<b>12:20</b>	Date and place of next meeting.	10	Lecture theatre
<b>12:30</b>	<b>Lunch</b>	60	
	<b>Working Sessions</b>		
<b>13:30</b>	Technical Manual, led by Benoit St-Louis	90	Lecture theatre
<b>15:00</b>	Missing data, led by Jurgen	30	Lecture theatre
<b>15:30</b>	<b>Coffee</b>	30	
<b>16:00</b>	Working with MagPy for data processing: J Fee	60	Lecture theatre
<b>17:00</b>	<b>End of day 3</b>		

<b>Day 4: Wednesday, September 06, 2017</b>			
<b>TBC</b>	Observatory tour		
<b>TBC</b>	Transfers to Cape town		

## 16.2 Schedule for pre- and post-meeting tasks

### 16.2.1 Schedule before the meeting

Who	Event	Time before (weeks)
<b>OPSCOM chair</b>	Ask INTERMAGNET officers for any recommendations for targeted invitations to meetings, some of these people might be candidates for INTERMAGNET officers.	10
<b>EXCON chair</b>	Invite IAGA representative(s) to attend the meeting	10
<b>OPSCOM chair</b>	Send targeted invitations direct to invitees Send general invitation via imocontacts and worldobs mailing lists	8
<b>OPSCOM chair</b>	Finalise list of attendees so we can resolve any issues with people who cannot attend (funding for travel, deputies for those who cannot travel, ...)	6
<b>OPSCOM chair</b>	Publish draft agendas (to be finalised at meeting)	2

### 16.2.2 Schedule after the meeting

Who	Event	Time after (weeks)
<b>Subcommittee chairs</b>	Complete subcommittee reports including decision logs and action lists	6
<b>Subcommittee chairs</b>	Complete report to IMOs for their subcommittee and send to OPSCOM chair	6
<b>INTERMAGNET secretary</b>	Completes draft minutes, including meeting reports from subcommittees	12
<b>OPSCOM chair</b>	Complete report to IMOs (including individual subcommittee reports). Send to Imocontacts, Worlobs and post in INTERMAGNET web site	12

<b>INTERMAGNET officers</b>	Review the draft minutes	14
<b>INTERMAGNET secretary</b>	Period for corrections to be made. At end of this period meeting minutes are considered final and put in INTERMAGNET document archive	16
<b>OPSCOM Chair and Secretary</b>	Review minutes and remove any parts not suitable for general distribution	20
<b>INTERMAGNET officers</b>	Review 'public' minutes	22
<b>INTERMAGNET secretary</b>	Minutes put on INTERMAGNET web site and sent to IMO contacts	24

## 16.3 Post-meeting report to IMOs

### Highlights of the INTERMAGNET Meeting in Hermanus



The meeting was held between 3<sup>rd</sup> September and 5<sup>th</sup> September 2017 at the South African National Space Agency, Hermanus, South Africa.

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## Communications within and beyond INTERMAGNET

There was considerable discussion at the meeting about ways to improve communications, particularly with the observatories who provide data to INTERMAGNET.

**DECISION:** INTERMAGNET will publish the full minutes of this and future meetings on the INTERMAGNET web site for all to see. Any sensitive material in the minutes, such as discussions about individual observatories, will be removed before publication.

Work was done during the meeting on the next version of the INTERMAGNET technical manual. There have been a number of advances within INTERMAGNET since the last edition of the manual and it is now a priority to complete the new manual in order to adequately describe these changes.

## Digital Object Identifiers (DOIs)

The creation of DOIs for time series data is complicated by the ever-changing nature of time series data sets. However the advantages of DOIs (credit and acknowledgment to data providers, scientific reproducibility of data for users) are clear and INTERMAGNET needs to play its part in creating DOIs where it is appropriate to do so. An important consideration when creating DOIs is that INTERMAGNET does not own any data (data is owned by the institutes providing it) and that credit and acknowledgment for the data needs to be passed to these institutes.

To start with, INTERMAGNET will concentrate on the relatively easy task of creating DOIs for definitive data before tackling more complex data types. INTERMAGNET wishes to encourage institutes to create DOIs for their own data sets and will create and publish guidance on this.

**DECISION:** INTERMAGNET will create DOIs for each of the annual INTERMAGNET CDs and DVDs published since 1991.

## Publication of 1-minute definitive data

INTERMAGNET has published its members' definitive data since 1991, first on CD and more recently on DVD. DVD devices are becoming less frequently used; modern computers are unlikely to have a DVD drive. With this in mind, INTERMAGNET discussed the medium on which 1-minute definitive data should be published.

Publishing creates an incentive for institutes to provide data in a timely manner. However publication could take place in other ways, such as online, with incentives such as DOIs. The physical DVD is a useful object for some institutes to help justify work to their funding agencies; however, other objects, such as DOIs or certificates that INTERMAGNET might publish, could replace the DVD.

**DECISION:** INTERMAGNET will stop publishing data on DVDs. Data from 2014 may be published on either DVD or USB memory stick. 2015 data will be published on USB stick. For 2016 data and onwards publication will move to an online publication method, but also be published on USB stick every couple of years.

The primary place of publication for 1-min definitive data is the INTERMAGNET web site and definitive data from IMOs will continue to be published on-line as soon as they are accepted and without the delay required to publish data on DVD or USB.

Delay in the publication of 1-minute definitive data is a concern that was discussed at the meeting. We kindly ask IMOs to provide all files that are necessary for compilation on or before the deadline. We would also be grateful if the volunteer data checkers could work with IMOs to speed up the quality control and data acceptance process.

## [INTERMAGNET format for 1-second data - ImagCDF](#)

It is finally here! INTERMAGNET is proud to announce the publication of the ImagCDF data format standard. We invite the community to read the documentation found under the INTERMAGNET website ([http://www.intermagnet.org/publications/im\\_tn\\_8\\_ImagCDF.pdf](http://www.intermagnet.org/publications/im_tn_8_ImagCDF.pdf)) and contribute any feedback. In the coming year, INTERMAGNET will start distributing data on the FTP in IAGA2002 and ImagCDF; we will convert your data for you.

## [Progress on 1-second definitive data](#)

38 observatories provided 1-second data for 2014. These data have been checked and data from 36 out of the 38 accepted. Work is ongoing to publish this data.

Although providing 1-sec definitive data is not compulsory, we encourage IMO's to collect and submit 1-second data where possible. 1-sec definitive data should be provided in ImagCDF format. The format is described here: [http://www.intermagnet.org/publications/im\\_tn\\_8\\_ImagCDF.pdf](http://www.intermagnet.org/publications/im_tn_8_ImagCDF.pdf)

A presentation from Reiner Friedel outlined the usefulness of high-resolution ground-based magnetic data to the space physics community in constraining radiation belt models. This community is exploring the transfer function between ground-based data and what is observed in space. There was also discussion of the INTERMAGNET real-time activity map and the importance of observatories providing real-time data to populate this useful tool.

## [Analysis of Geomagnetic data](#)

The MagPy software (<https://github.com/geomagpy/magpy>) has made great steps forward to help the scientific community in regards to data analysis. The creator of MagPy will instruct data checkers on how to use this package for definitive data validation. We invite the community to try the library and provide any feedback to the contributors on the GitHub environment.

## [Licensing our data](#)

The license that is used when distributing data via INTERMAGNET was created many years ago: <http://www.intermagnet.org/data-donnee/data-eng.php#conditions>. Licensing ideas have moved on since that time and it is becoming increasingly important that the licenses we use are internationally accepted and "machine readable", meaning that a computer can understand and make decisions about distribution of an asset based on the associated license. IAGA has created a task force to look into this issue. INTERMAGNET will not mandate that any particular license be used with the data it distributes on behalf of observatories, but it is likely to make a recommendation on licenses that it thinks observatories would be prudent to adopt and also to adopt a default license for observatories that have not expressed a preference. A candidate for INTERMAGNET to adopt as a default license is the Creative Commons Version 4 Attribution-Non-Commercial license. INTERMAGNET welcomes your opinions on this proposal. You can see more about the Creative Commons Version 4 Attribution-Non-Commercial license here: <https://creativecommons.org/licenses/by-nc/4.0/>

## [Other items of interest](#)

INTERMAGNET will contribute data to the European Plate Observing System (EPOS): <https://www.epos-ip.org/>. An update on the status of EPOS was given at the meeting.

The INTERMAGNET web service, ftp service and data archive, currently held at the Geological Survey of Canada, need to be moved to a new host. Work is ongoing in INTERMAGNET to identify an institute who can host these services.

### INTERMAGNET officers

There was no change in the membership of the INTERMAGNET Executive Council.

Before this meeting Simon Flower was elected as chair of the INTERMAGNET Operations Committee following the resignation of Jean Rasson. Before this meeting Simon resigned from his role as chair of the GIN/World Wide Web/Data Formats subcommittee and Charles Blais was appointed to replace him. Tim White (USGS) resigned as an INTERMAGNET officer before this meeting.

The current organisational structure can be seen on the INTERMAGNET website:

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

### Next meeting

The next INTERMAGNET meeting will be held in Vienna following the IAGA workshop at Conrad observatory. The provisional dates for the meeting are 2<sup>nd</sup> to 4<sup>th</sup> July 2018. Guest are welcome at the meeting – please get in touch with the Operations Committee Chair, Simon Flower (smf@bgs.ac.uk) if you would like to attend. Your contribution at the meeting will be welcome!

### Thanks to...

The meeting was organized by the South African National Space Agency (SANSА) at its Hermanus observatory. We were welcomed at the beginning of the meeting by Mike Kosch, Chief Scientist at SANSА. The SANSА staff provided valuable support: airport pick-ups and drop-offs, transport, meals and equipment as well as much needed facilities and help for the participants in the preparation and execution of their tasks. A meal at the restaurant "Bientangs Cave" on the waterfront in Hermanus was a highlight of the meeting. Many thanks to Mike and the staff at Hermanus for the great hospitality and support.

Simon Flower (INTERMAGNET Operations Committee Chair), smf@bgs.ac.uk, 22<sup>nd</sup> November 2017