IAGA V-MOD BUSINESS MEETING

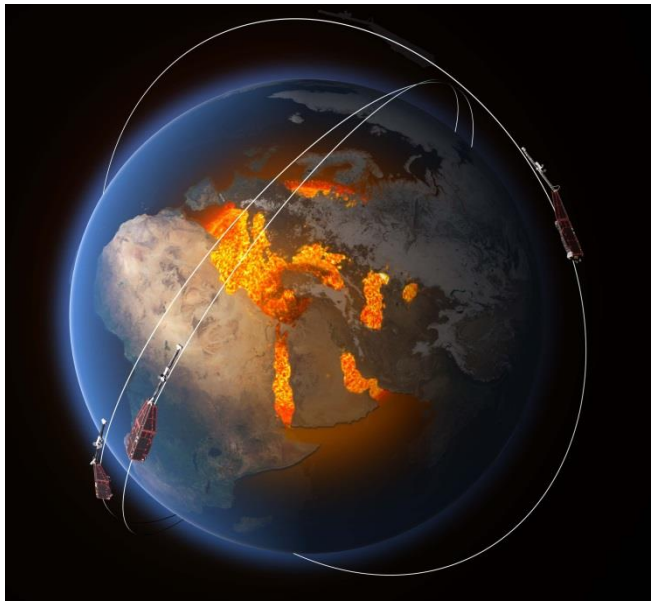
Cape Town, South Africa

Mon 28th September 2017

Draft Agenda

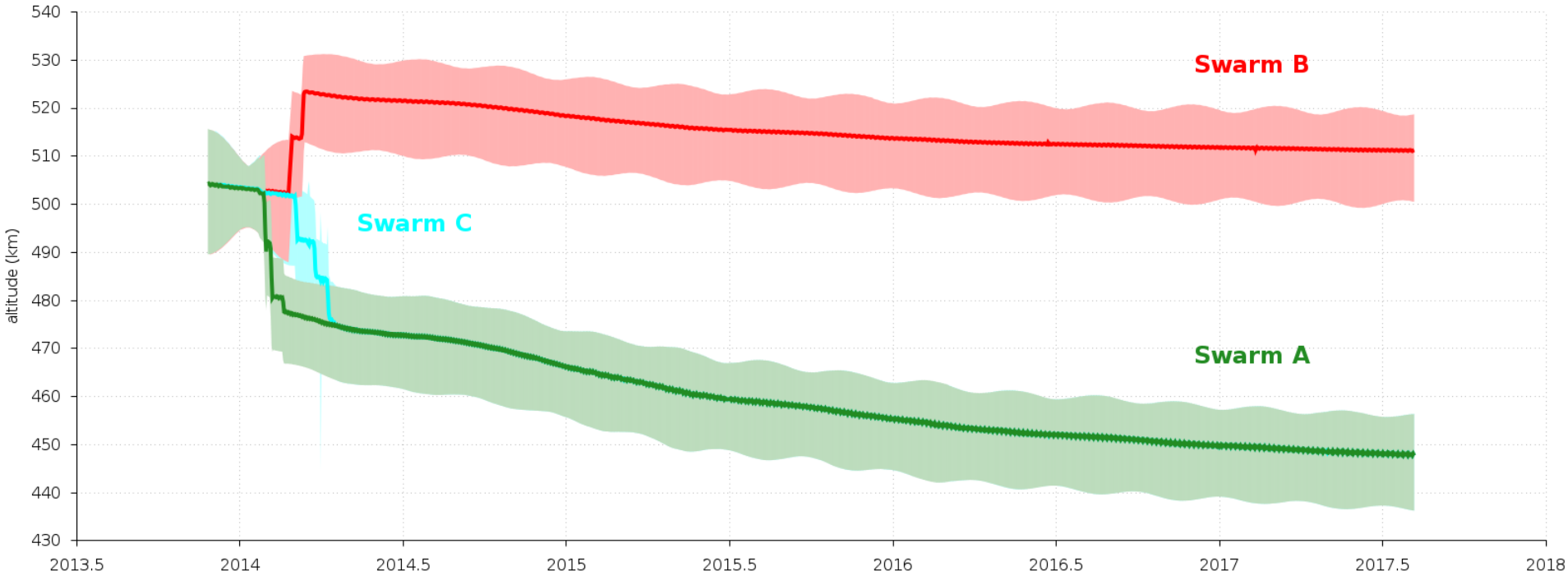
0. Acceptance of draft agenda
1. Status of data available for field modeling
2. Review of IGRF-12
3. Definition/evolution of IGRF-13
4. Plans for IGRF-13
5. WDMAM: status, task force, and ongoing revisions
6. Proposed sessions for IUGG in Montreal, Canada, 2019
7. Other/new business

1. Data available for field modeling



Swarm

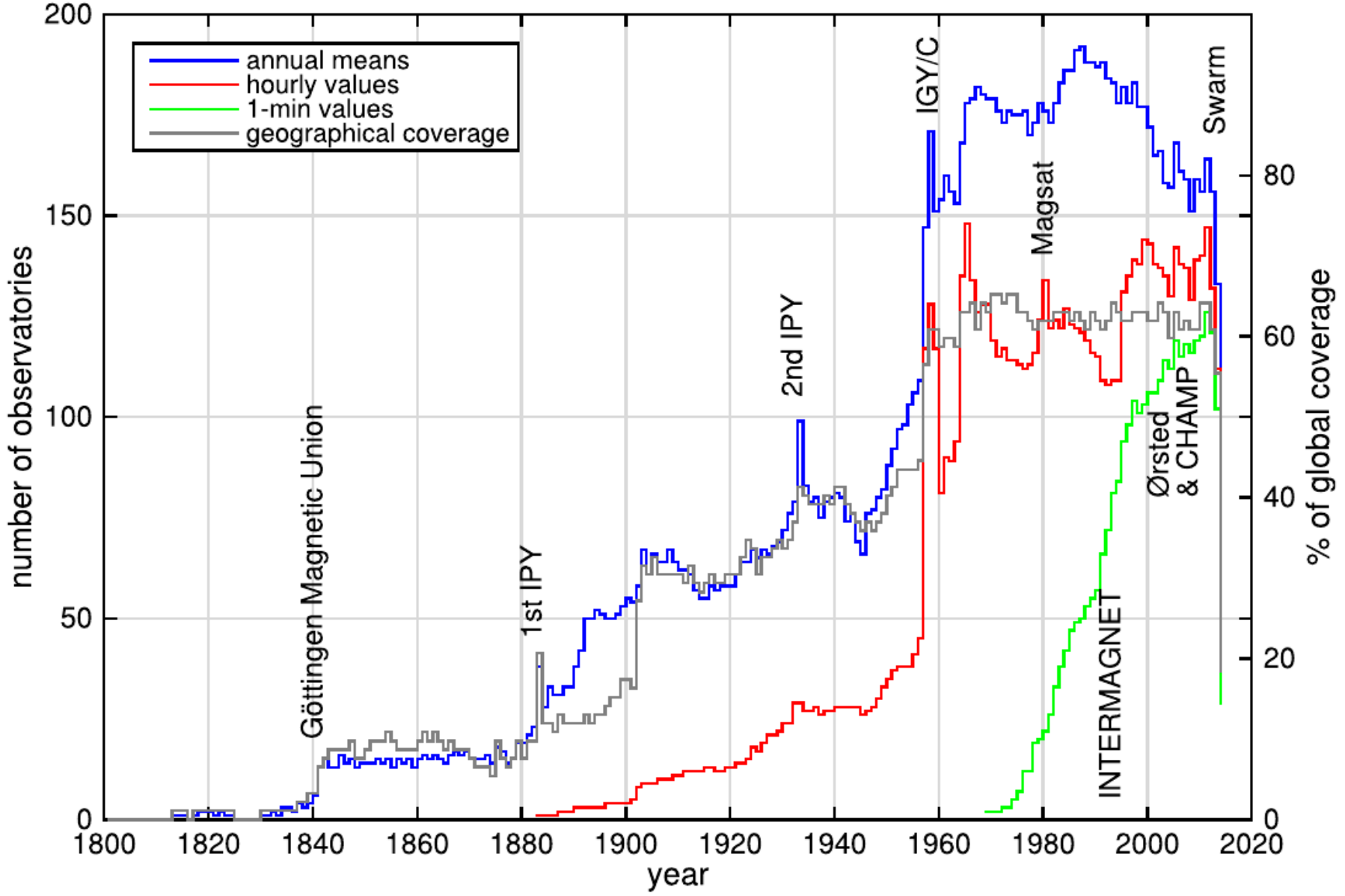
- Launched 22 November 2013
- Crucial for success of IGRF-12
- Used to derive high-quality core and crustal field models
- Level 1b and Level 2 products freely available from ESA
- See: **https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/swarm**



Other satellites

- DMSP
  - F-15: publicly available GPS-based ephemeris, but magnetometer failure in October 2013
  - F-16, F-17, F-18: continue to provide magnetic measurements, however high-accuracy ephemeris is not publicly available
- ePOP

Ground observatories



from Chulliat et al, Space Science Rev, 2017.

Observatory spatial coverage

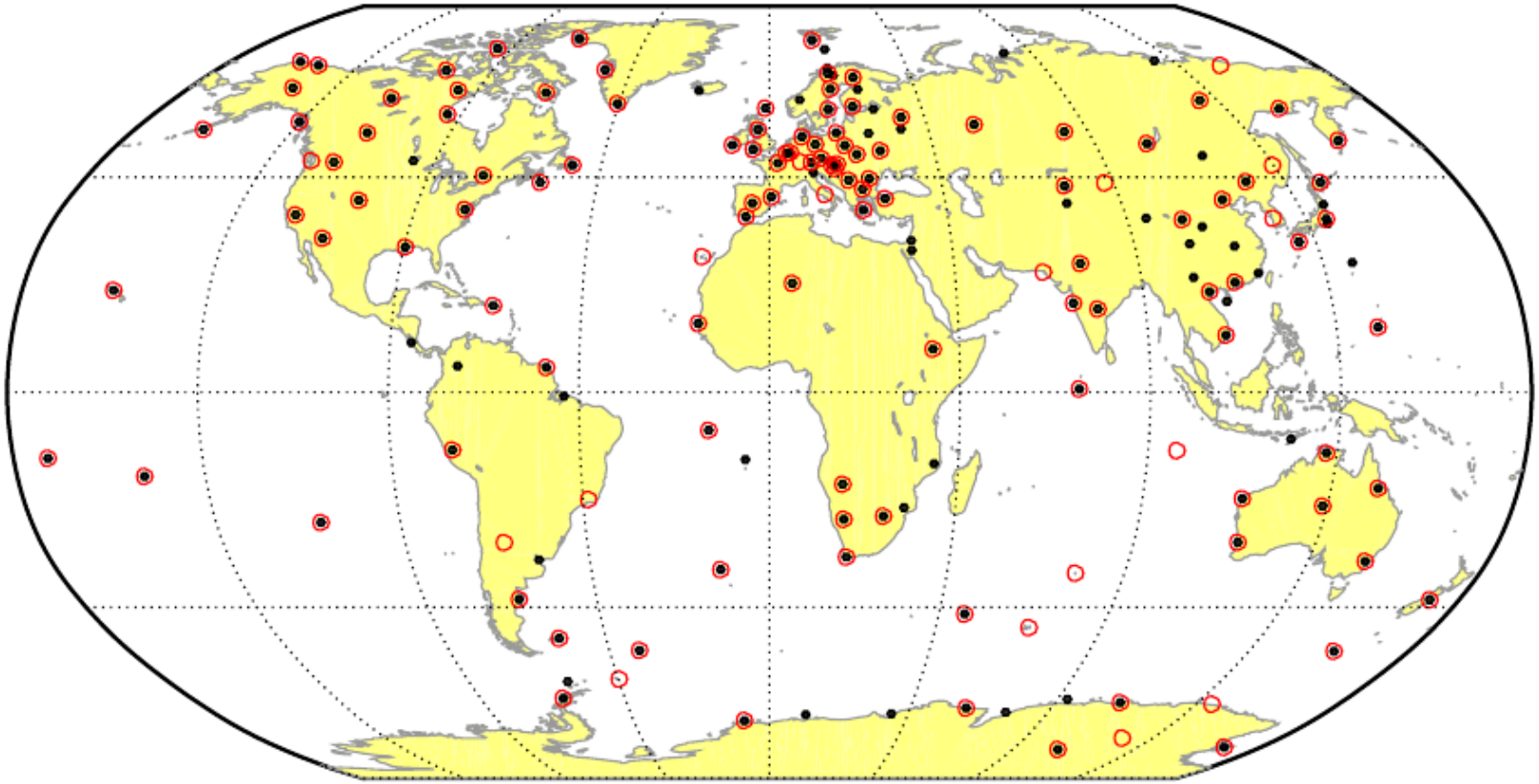


Fig. 3 Map of all magnetic observatories having distributed annual means for year 2012 through the WDC (*black dots*) and all INTERMAGNET Magnetic Observatories as of October 2015 (*red circles*)

from Chulliat et al, Space Science Rev, 2017.

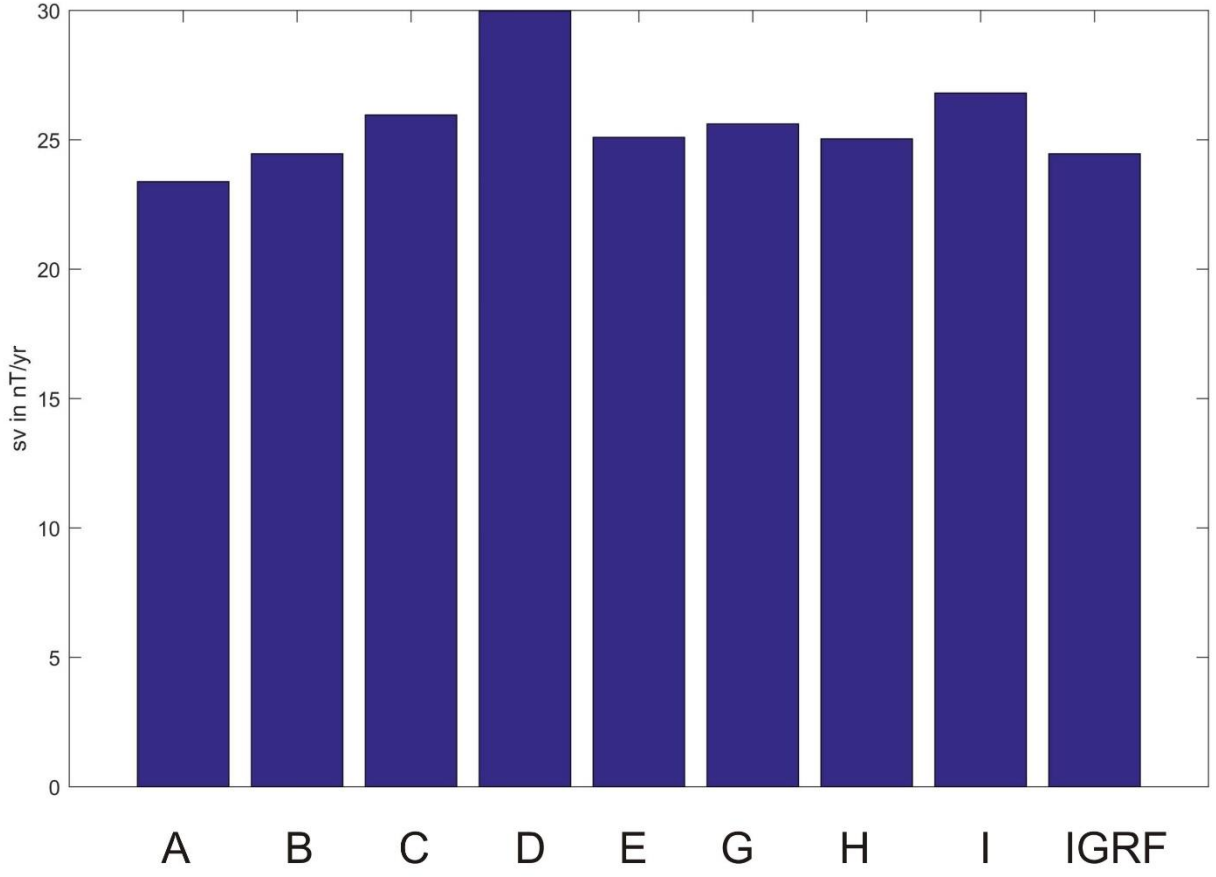
Status of USGS observatories

- Status unchanged since 18 July email from Carol Finn:

  "The U.S. House of Representatives has restored the cuts proposed by the Administration to the USGS Geomagnetism program and other Natural Hazards programs.

  Of course the Senate still needs to mark up its proposed budget, and then the House and Senate must reconcile, but this is an important first indication of where Congress stands with respect to funding for USGS natural hazards efforts. And it is positive news!"

2. Review of IGRF-12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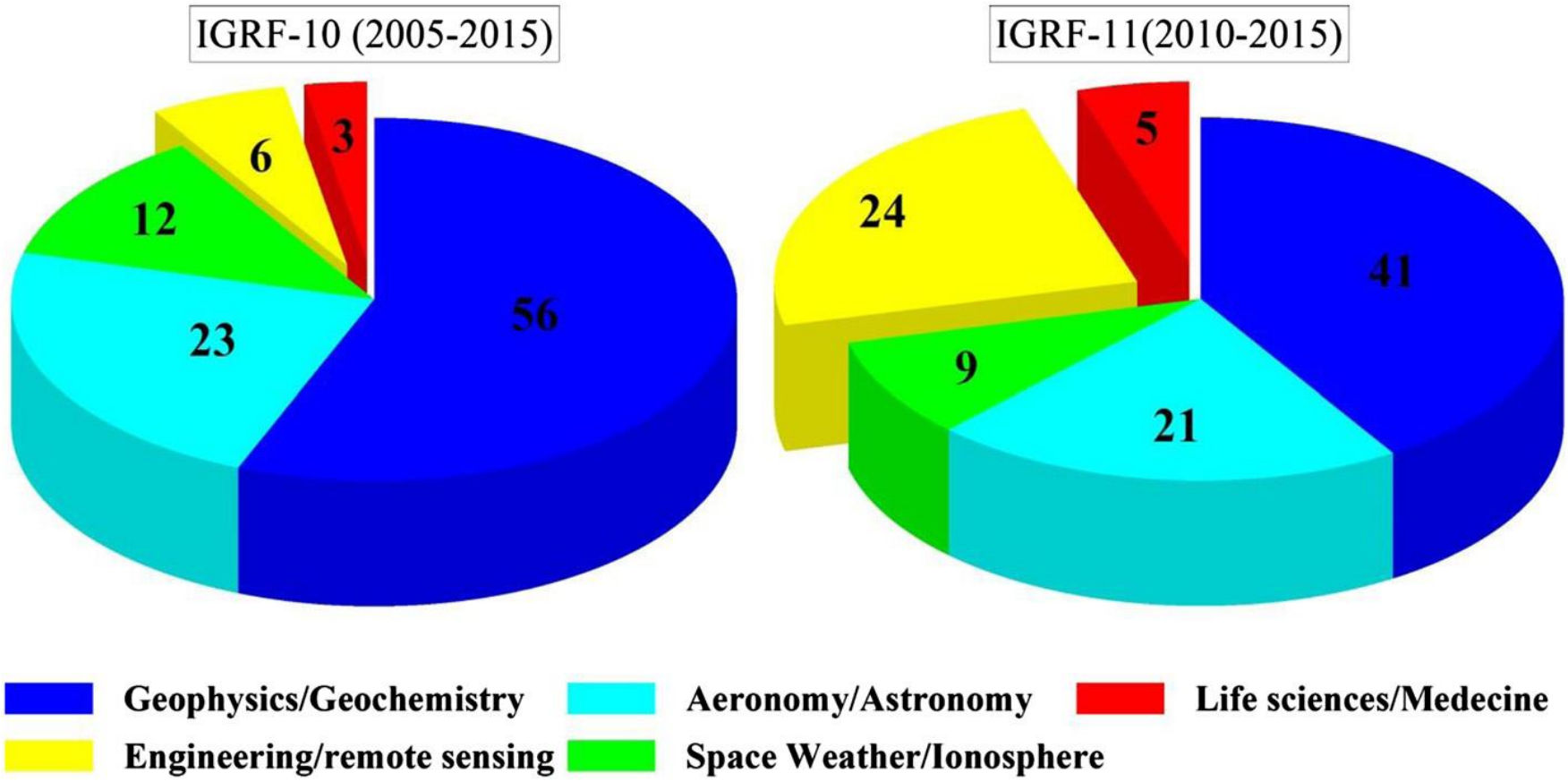
3. Definition/evolution of IGRF-13

Users of IGRF



After Thébault et al., 2015 (EPS)

Motivation for a clear definition of sources modeled by IGRF-13

- Magnetic fields recorded by satellites and ground observatories contain contributions from a number of sources:
  - Core field
  - Lithospheric field
  - Ionospheric field (primary and induced)
  - Magnetospheric field (primary and induced)
  - Oceanic field
- During IGRF-12, there was confusion among the teams as to which sources should be accounted for in the candidate models

Proposed definition from F. Lowes

- **Within its spatial and temporal truncations, the IGRF aims to model (only) those magnetic fields whose primary origin is inside the Earth, specifically the fields produced by the core, the lithosphere, and the (quasi-) steady motion of the oceans**

- This wording:
  - (i) Gives the two general source specifications - *within the Earth* (which excludes fields from the ionosphere and magnetosphere), and *primary* (which excludes the induced fields produced by the ionosphere and magnetosphere).
  - (ii) Explicitly names the three relevant sources (so clarifying that no attempt should be made to exclude the field coming from (quasi-) steady ocean currents), and
  - (iii) Through its mention of *truncation* (now expanded to include temporal truncation) explains to a knowledgeable reader that it excludes fields of small physical wavelength and of short temporal period. This phrasing would NOT need to be changed if either truncation level were increased in future.

Full document available at:
https://www.ngdc.noaa.gov/IAGA/vmod/papers/PositionPaperRevised_FLowes.pdf

Some comments from DTU (C. Finlay and N. Olsen)

- **Challenging to achieve the proposed new definition**
  - Estimates of night-side induced fields often depend on an assumed mantle conductivity which is imperfectly known
- **Given uncertainties, should not influence evaluation of candidate models**
  - candidate models should not be preferred/downweighted based on the fact that they account (or not) for induced field contributions
- **Possible problem of backward-compatibility with earlier DGRF models**
  - Previous DGRF's were not corrected for induced ionospheric field. Implementing such a correction will introduce an undesirable step in the IGRF coefficients
- **A suggested way forward, for discussion**
  - Continue to include the ionospheric induced part in the IGRF-13 coefficients, but provide estimates of its size(e.g. as a function of local time and position), for example in an updated health warning
  - Users will thus be provided with our best current estimate of this known 'error' source.

4. Plans for IGRF-13

Current task force volunteers

- BGS: **W. Brown** (wb@bgs.ac.uk), C. Beggan (ciar@bgs.ac.uk)
- DTU: **C. Finlay** (cfinlay@space.dtu.dk), N. Olsen (nio@space.dtu.dk)
- GFZ Potsdam: M. Rother (rother@gfz-potsdam.de), C. Stolle (cstolle@gfz-potsdam.de), I. Wardinski (ingo.wardinski@gfz-potsdam.de)
- ISTerre Grenoble: N. Gillet (nicolas.gillet@univ-grenbole-alpes.fr)
- NOAA/NCEI: A. Chulliat (arnaud.chulliat@noaa.gov), P. Alken (alken@colorado.edu), M. Nair (manoj.nair@noaa.gov)
- University of Newcastle: **F. Lowes** (f.j.lowes@newcastle.ac.uk)
- Kyoto University: **H. Toh** (tou.hiroaki.7u@kyoto-u.ac.jp)
- IPGP: G. Hulot/P. Vigneron/A. Fournier/V. Lesur (gh@ipgp.fr)
- LPG Nantes: E. Thebault/B. Langlais (erwan.Thebault@univ-nantes.fr)

More volunteers are welcome! Please contact alken@colorado.edu

IGRF-13 proposed specifications and rules

SPECIFICATIONS

- Internal field (main field) for 2020.0 to spherical harmonic (SH) degree and order 13.
- Predicted average secular variation for 2020.0--2025.0 to SH degree and order 8.
- Internal field (main field) for 2015.0 to SH degree and order 13.
- The requested numerical resolution of the coefficients is 0.01 nT for all products. This will allow calculation of the final models to a resolution of 0.1 nT. Each group that plans to submit candidate models is requested to provide a list of the products they intend to submit and a brief description (one paragraph) of their methodology by August 2019.

RULES

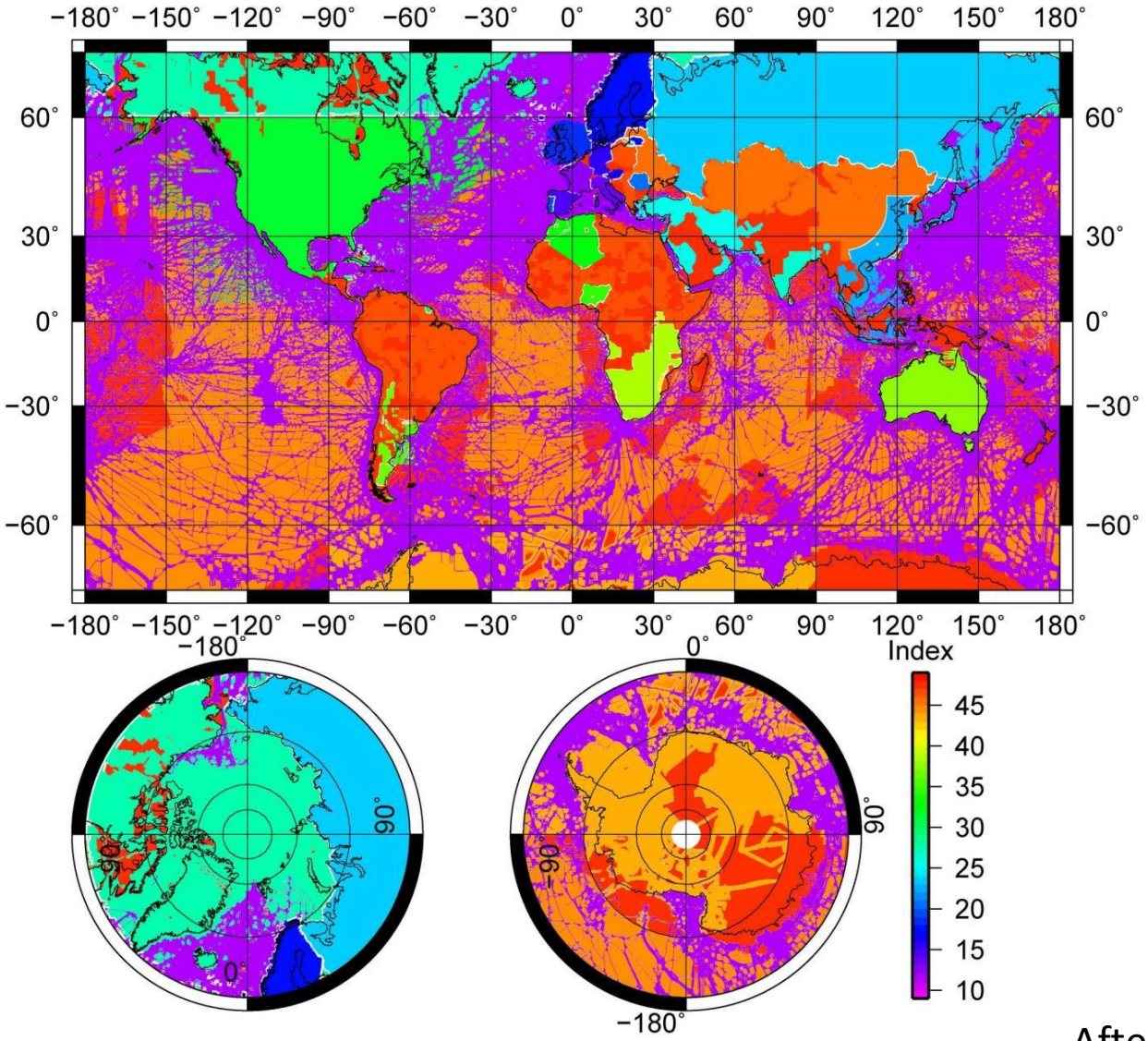
- --
- Each team of workers should submit only one candidate model per product.
- --
- Every lead institution can have only one team, and every individual can lead only one team.
- --
- In order to facilitate collaboration (for example sharing of pre-processed data), it is possible for an individual to be a member of several teams.

IGRF-13 proposed deadlines

- March/April 2019: circulation of formal IGRF-13 call
- August 2019: participants are requested to provide a description of their products (one paragraph for each product).
- October 2019: candidate submission deadline
- November 2019: evaluation of candidates

5. WDMAM: status, task force, ongoing revisions

WDMAM v. 2.0

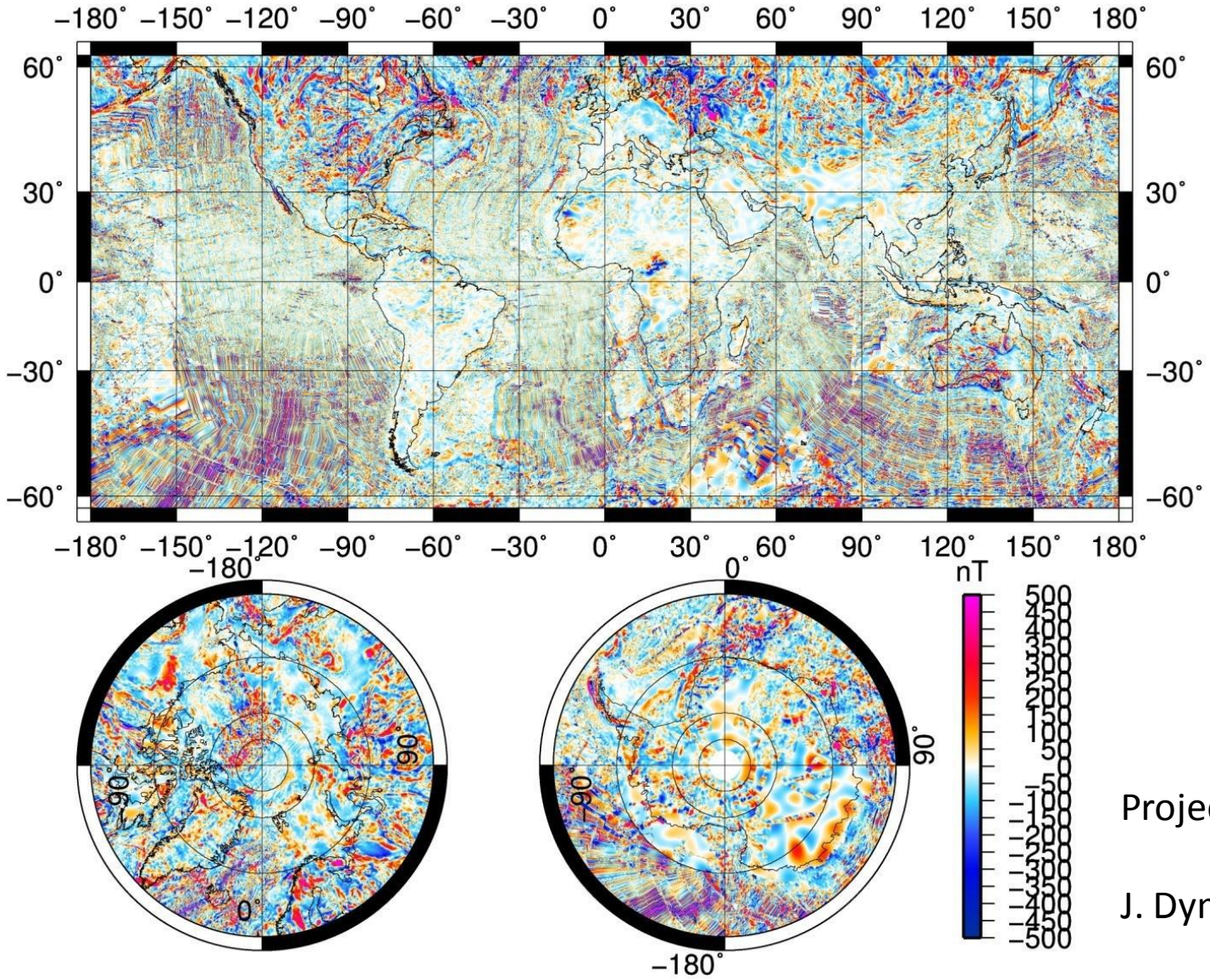


Sources: - Existing compilations (North America, Russia, Australia, Antarctica, Europe, Austral Africa…)

- Data provided by countries (Algeria, Morocco, Nigeria…
- Low-res data compiled in EMAG-2 (high-res is proprietary)
- - At sea: marine data, adjusted model except CQZ and plateaus - elsewhere: downward- continued satellite map

After Lesur et al., 2015

WDMAM v. 2.0



Project led by

J. Dyment and M. Catalan

WDMAM v. 2.0

Towards V2.1 : New compilations for Russia, Brazil, Afganistan, Antarctica + new marine tracklines…

WDMAM v. 2.0, vote for the task force and board

Proposed board for WDMAM

- Jérôme Dyment (Chair, CGMW representative), jdy@ipgp.fr
- Manuel Catalan (co-chair), mcatalan@roa.es

Current task force

- Mike Purucker, michael.e.purucker@nasa.gov
- Erwan Thebault, erwan.thebault@univ-nantes.fr
- Mohamed Hamoudi, hamoudi@usthb.dz
- Takemi Ishihara, t-ishihara@aist.go.jp and Shigeo Okuma, s.okuma@aist.go.jp
- Vincent Lesur, lesur@ipgp.fr
- Tamara Litvinova, tamara_litvinova@vsegei.ru
- Brian Meyer Brian.Meyer@noaa.gov
- Dhananjay Ravat, ravat@geo.siu.edu
- Joaquim Luis, jluis@ualg.pt
- Angelo de Santis, angelo.desantis@ingv.it
- Peter Milligan, peter.milligan@ga.gov.au
- Mark Pilkington, mpilking@NRCan.gc.ca
- Yoan Quesnel, yoan.quesnel@cerege.fr
- Foteini Vervelidou, foteini@gfz-potsdam.de

6. Proposed sessions for the next assembly

Planetary Magnetic Fields and Secular Variation (Ingo Wardinski, Vincent Lesur)

Lithospheric Field Modeling and Tectonic Implications (Foteini Vervelidou, Stavros Kotsiaros)

+ one with DIV1

7. Other/new business ?

Next IAGA-IASPEI assembly (2021):

- Lisbon, Portugal
- Hyderabad, India

    - Decision will be made by vote during the conference of national delegates.