

IAGA V-MOD Business Meeting

M5, City Cube, Level 3
Berlin, Germany
IUGG, July 15, 2023 12:00-13:30

Agenda

- Acceptance of draft agenda
- Status of IGRF-13
- Status of WDMAM
- Data available for IGRF-14 field modeling
- IGRF-14 Task Force
- IGRF-14 Schedule
- Revisiting the 1945/1950 DGRF
- Election of VMOD chair and co-chair
- Suggestions for sessions at next IAGA
- Any other business

Status of IGRF-13

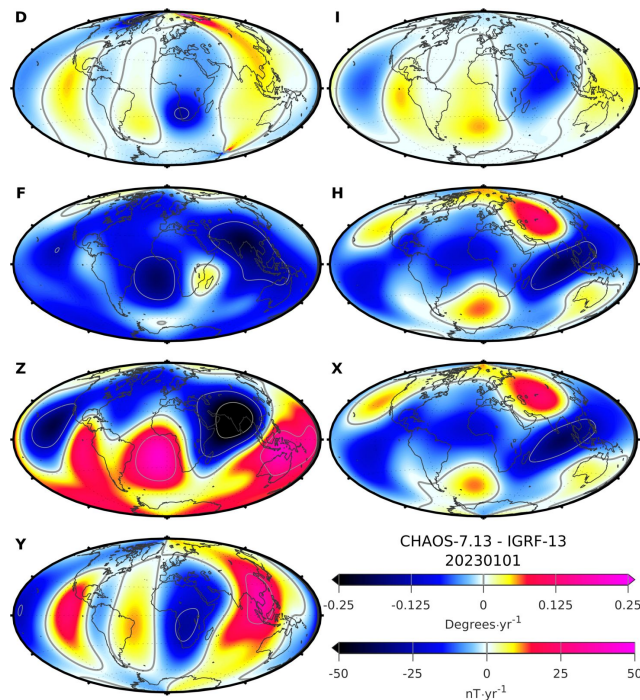
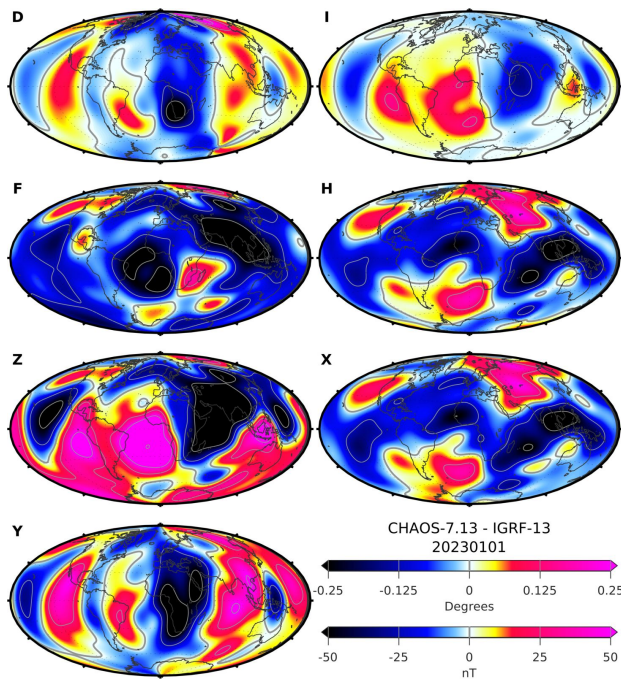
RMS difference
vs CHAOSv7.13:

2020: 4.4 nT

2021: 14.9 nT

2022: 28.5 nT

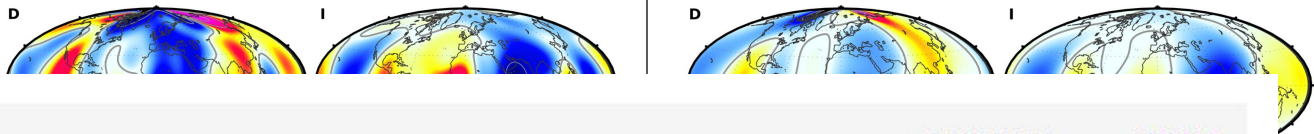
2023: 48.0 nT



Difference in Main Field (left) and SV (right) between
CHAOSv7.13 and IGRF-13 at 2023-01-01

Status of IGRF-13

RMS difference



<input type="checkbox"/>	TITLE	CITED BY	YEAR
<input type="checkbox"/>	International geomagnetic reference field: the 12th generation E Thébault, CC Finlay, CD Beggan, P Alken, J Aubert, O Barrois, ... Earth, Planets and Space 67, 1-19	1606	2015
<input type="checkbox"/>	International geomagnetic reference field: the eleventh generation CC Finlay, S Maus, CD Beggan, TN Bondar, A Chambodut, TA Chernova, ... Geophysical Journal International 183 (3), 1216-1230	1261	2010
<input type="checkbox"/>	International geomagnetic reference field: the thirteenth generation P Alken, E Thébault, CD Beggan, H Amit, J Aubert, J Baerenzung, ... Earth, Planets and Space 73 (1), 1-25	376	2021

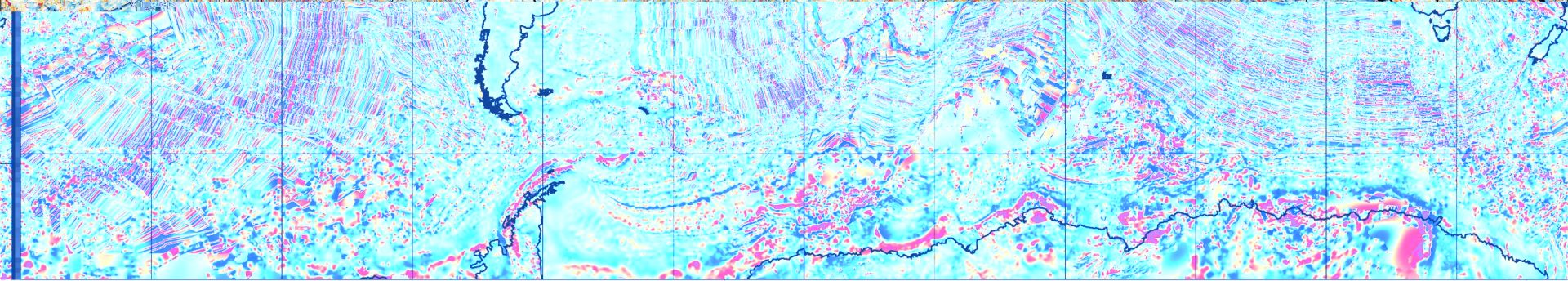
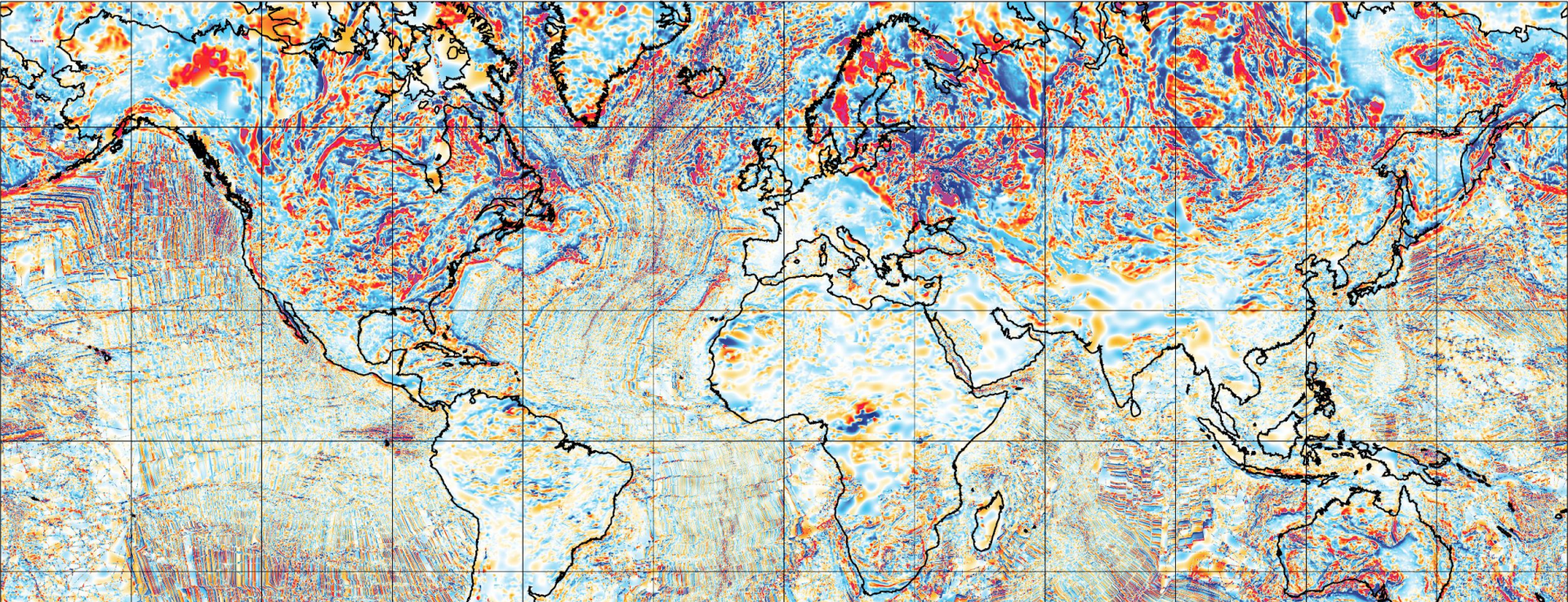


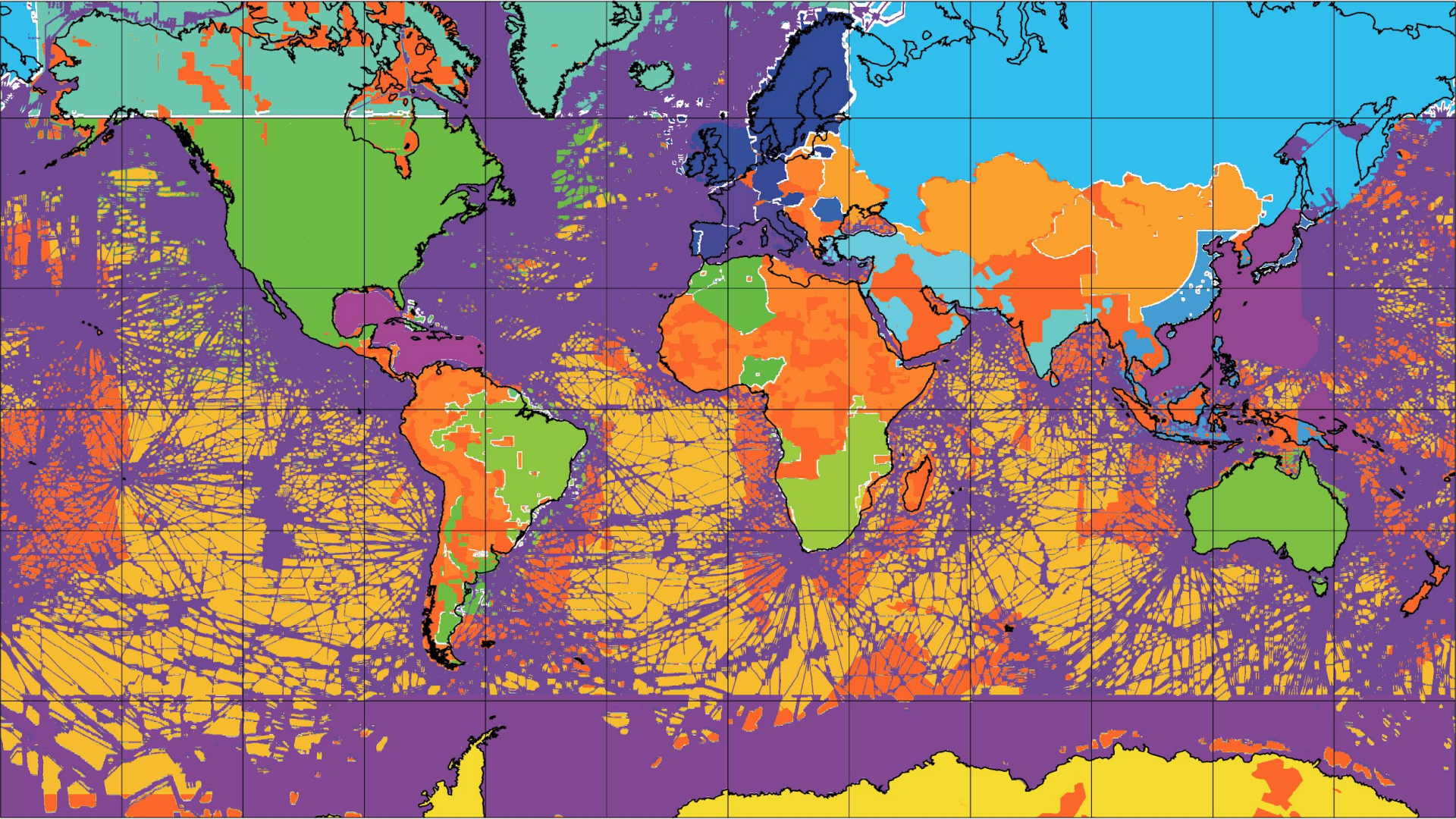
Difference in Main Field (left) and SV (right) between
CHAOSv7.13 and IGRF-13 at 2023-01-01

Status of WDMAM

A few words on the World Digital Magnetic Anomaly Map (WDMAM)

- In Praha (2015) and Montréal (2019) it was decided to build WDMAM v.2.x by adding new data following the same methodology as used for v.2 (renamed v.2.0) of 2015.
- Due to lack of work force, the new WDMAM v.2.1 is only available now. The web site wdmam.org is having a major upgrade and v. 2.0 and 2.1 will shortly be available there.
- New data include Antarctica (ADMAP), Brazil, Caribbean and Gulf of Mexico, East and Southeast Asia (MAMEA), Marine data Worldwide, and revised map of Russia. See our presentation on July 18th!





A few words on the World Digital Magnetic Anomaly Map (WDMAM)

- For the future, the present team has served for 10 years (2013-2023) as for now and expects a transition to a new team, to be completed in IAGA Lisbon (2025).

- After release of WDMAM v.2.1, we will issue a call for manifestation of interest to

- (1) build WDMAM v.3.0 (i.e., involving new methodologies and digging for new data), and
- (2) take the leadership of the WDMAM Task Force.

Data available for IGRF-14

- Satellites
 - Swarm A, B, C, <https://swarm-diss.eo.esa.int>
 - CSES
 - Cryosat-2
 - GOCE
 - GRACE
 - ePOP
 - Macau-Sat (MSS-1)
- Ground observatories
 - INTERMAGNET, <http://intermagnet.org> (see web services)
 - ESA AUX_OBS_HMV (viresclient [python])
 - WDC for Geomagnetism (FTP)

IGRF-14 Task Force

- The Task Force will be responsible for evaluating candidate models, voting on how to construct the final IGRF-14 models, and preparing a manuscript for the IGRF special issue (in 2025)
- IGRF-13 Task Force
 - British Geological Survey (W. Brown, wb@bgs.ac.uk, C. Beggan, ciar@bgs.ac.uk)
 - DTU Space (C. Finlay, cfinlay@space.dtu.dk)
 - GFZ Potsdam (M. Rother, rother@gfz-potsdam.de)
 - IPGP (G. Hulot, gh@ipgp.fr)
 - Kyoto University (H. Toh, tou.hiroaki.7u@kyoto-u.ac.jp)
 - University of Colorado Boulder (P. Alken, alken@colorado.edu)
 - University of Leeds (P. Livermore, P.W.Livermore@leeds.ac.uk)
 - Universite de Nantes (E. Thebault, erwan.thebault@univ-nantes.fr)
 - Universite de Strasbourg (I. Wardinski, wardinski@unistra.fr)
 - Universite de Grenoble (N. Gillet, nicolas.gillet@univ-grenoble-alpes.fr)
- If interested in joining the task force, contact Ciaran, ciar@bgs.ac.uk

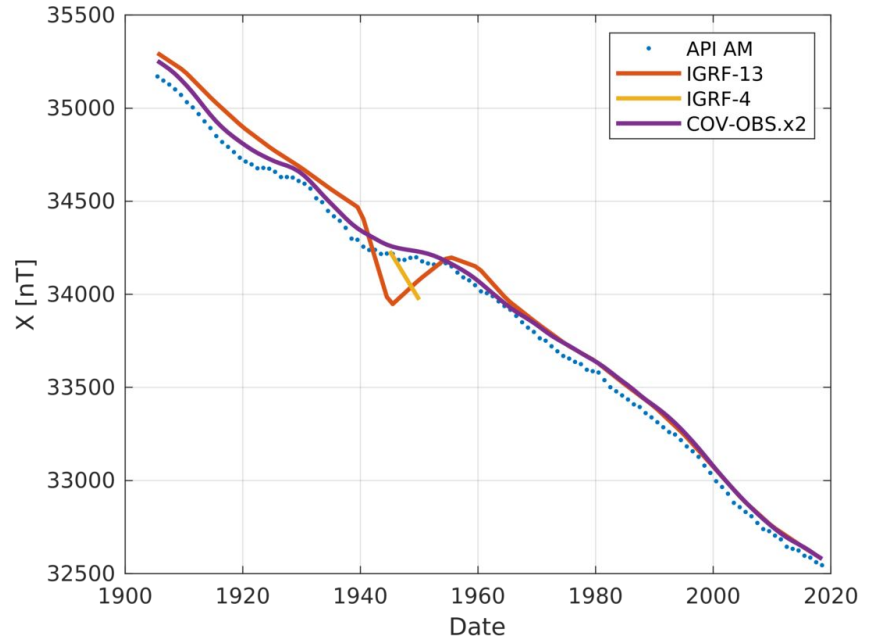
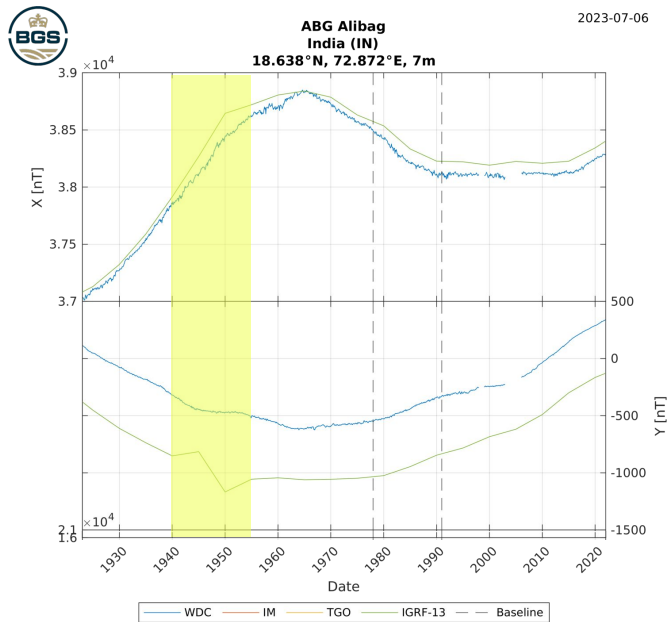
IGRF-14 Schedule

- Spring 2024: call for candidate teams to note their intentions (by email)
- May 2024: official invite to candidate teams
- September 2024: deadline for candidate model submissions to Task Force along with short description of the methodology
- October-December 2024: Evaluation of candidate models and voting
- December 2024 / January 2025: release of IGRF-14 coefficients, maps and web services
- Q3 2025: submit candidate papers to IGRF special issue
- Q4 2025: Publication of all IGRF papers to special issue

Any suggestions for improving the efficiency of evaluation or administration using new tools (e.g. GitHub)?

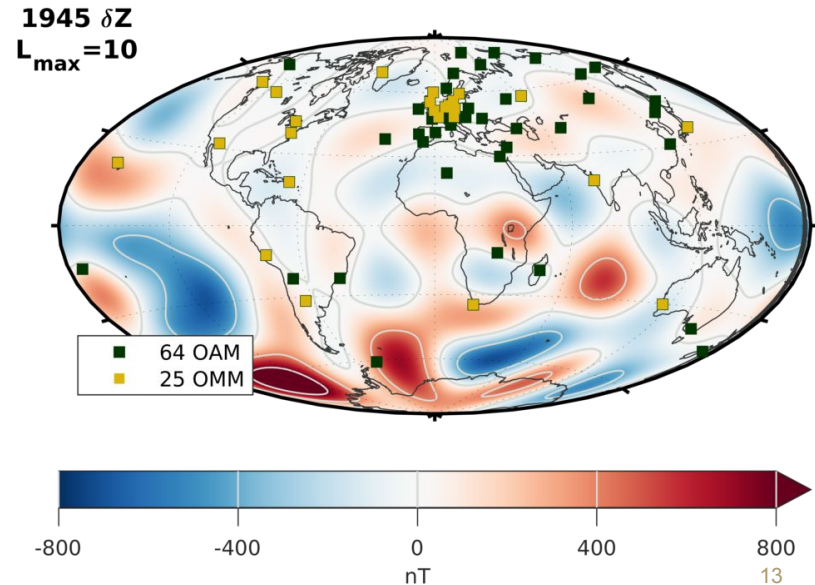
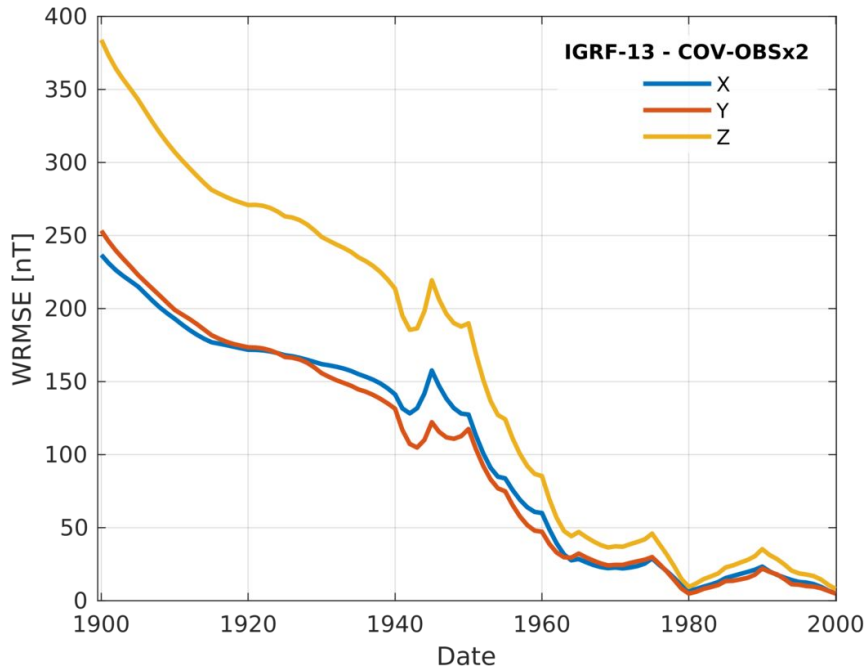
Discrepancies in the 1945-1955 Definitive Geomagnetic Reference Field

- QC of monthly means showed discrepancies with DGRF – worst between 1940 and 1955
- Notably large discrepancies at observatories providing data for DGRF
- DGRF introduced in IGRF-5 is worse fit to data than initial IGRF-4 model



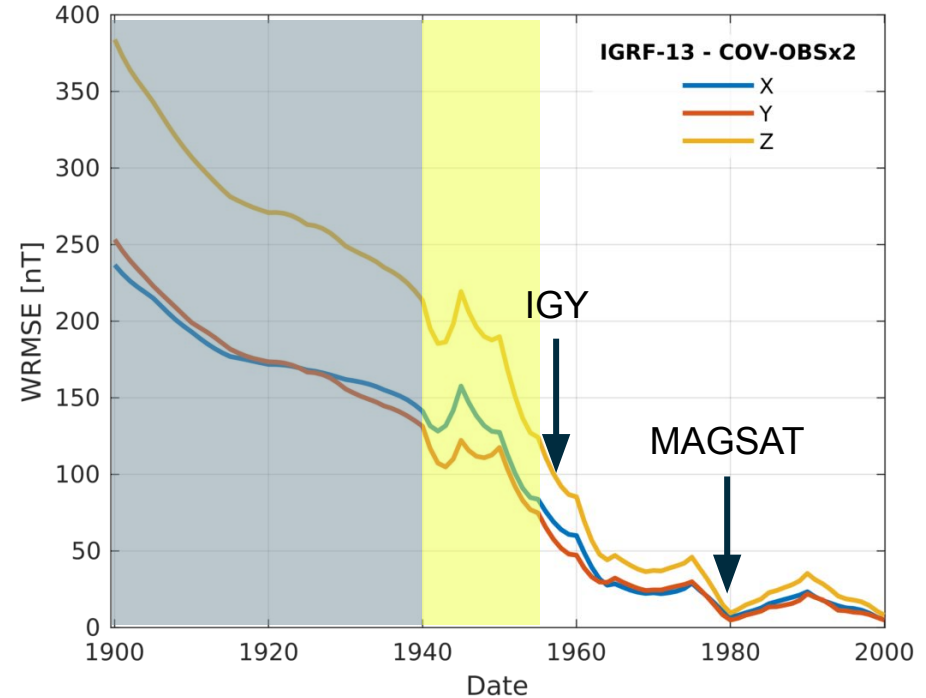
Discrepancies between data and DGRF

- Data is limited in this period due to WWII, but not significantly more so than at similar times
- Misfit to time-continuous COV-OBS.x2 (Huder et al, 2020, EPS, <https://doi.org/10.1186/s40623-020-01194-2>) shows abrupt changes



Should DGRF be consistent with time-continuous models?

- Behaviour noted by Xu, 2000, EPS, <https://doi.org/10.1186/BF03352355>
- Higher degree coefficients are anomalous
- 1900–1940 from continuous B-spline model
- 1945–1960 are models of discrete 5-year windows centre on each epoch
- Recent model candidates variously constructed but often derived from time-continuous models
- Time-continuous models fit same data, but constrain smooth time variation



Revisiting the 1945/1950 DGRF

With thanks to Will Brown for analysis - from his talk in A23b

- Do we wish to invite IGRF-14 candidate models for revisions to MF coefficients for 1945, 1950 and 1955?
- Similarly should we consider revising 2010 in light of new platform magnetometer data?
- Should 'definitive' mean never changes or just fixed in that release of the model (e.g. generation 14)?
- From Miora's talk (A22): should IGRF-14 extend SV from 8 to degree 13 to facilitate core field studies?

Election of VMOD Chair

Candidates:

Ciaran Beggan (BGS)

Election of VMOD Co-Chair

Candidates:

Clemens Kloss (DTU)

Suggestions for sessions at next IAGA (Lisbon in 2025)

IUGG-2023:

A21 - Satellite-Based Geomagnetic Field Measurements and Modeling

A22 - Planetary Magnetic Fields and Secular Variation at All Temporal Scales (with DIV I)

(Joint session with WDMAM and seismic community)

1. Modelling, ground and space-based data and innovations from the IGRF-14 generation and for the future
 - a. Convenor: Ciaran Beggan, Clemens Kloss, Naomi, Frederik
2. The future of WDMAM and crustal magnetic anomaly mapping
 - a. Convenor: Jerome Dyment, Will Brown
3. Joint session with V-OBS and data based modeling

Any Other Business

- Swarm 10th Anniversary science meeting in Copenhagen, April 2024
- Thank you to Patrick for his contribution over the past 8 years



Thank you