# IAGA V-MOD BUSINESS MEETING

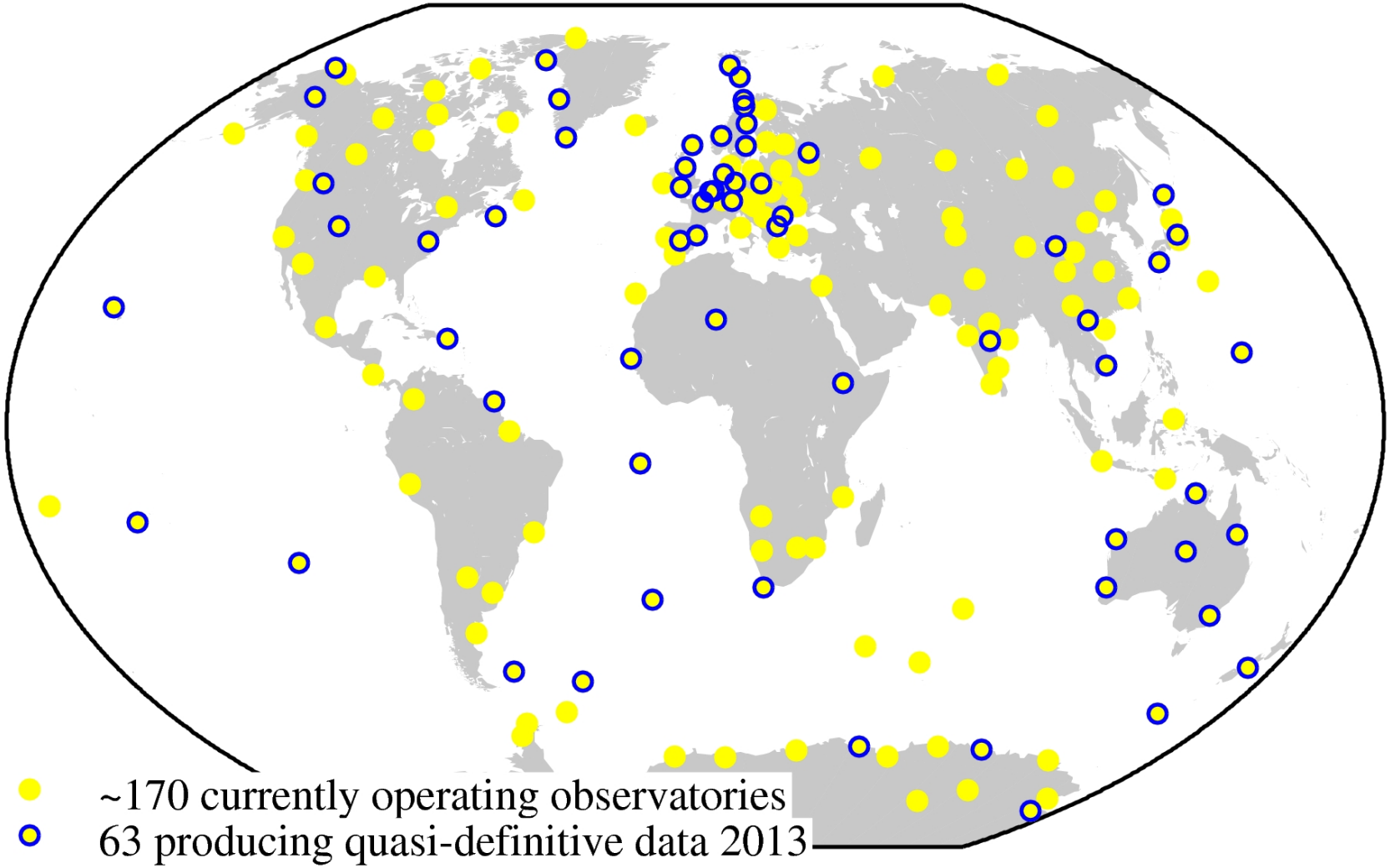
Merida, Mexico

Wed 28th August 2013

# Draft Agenda

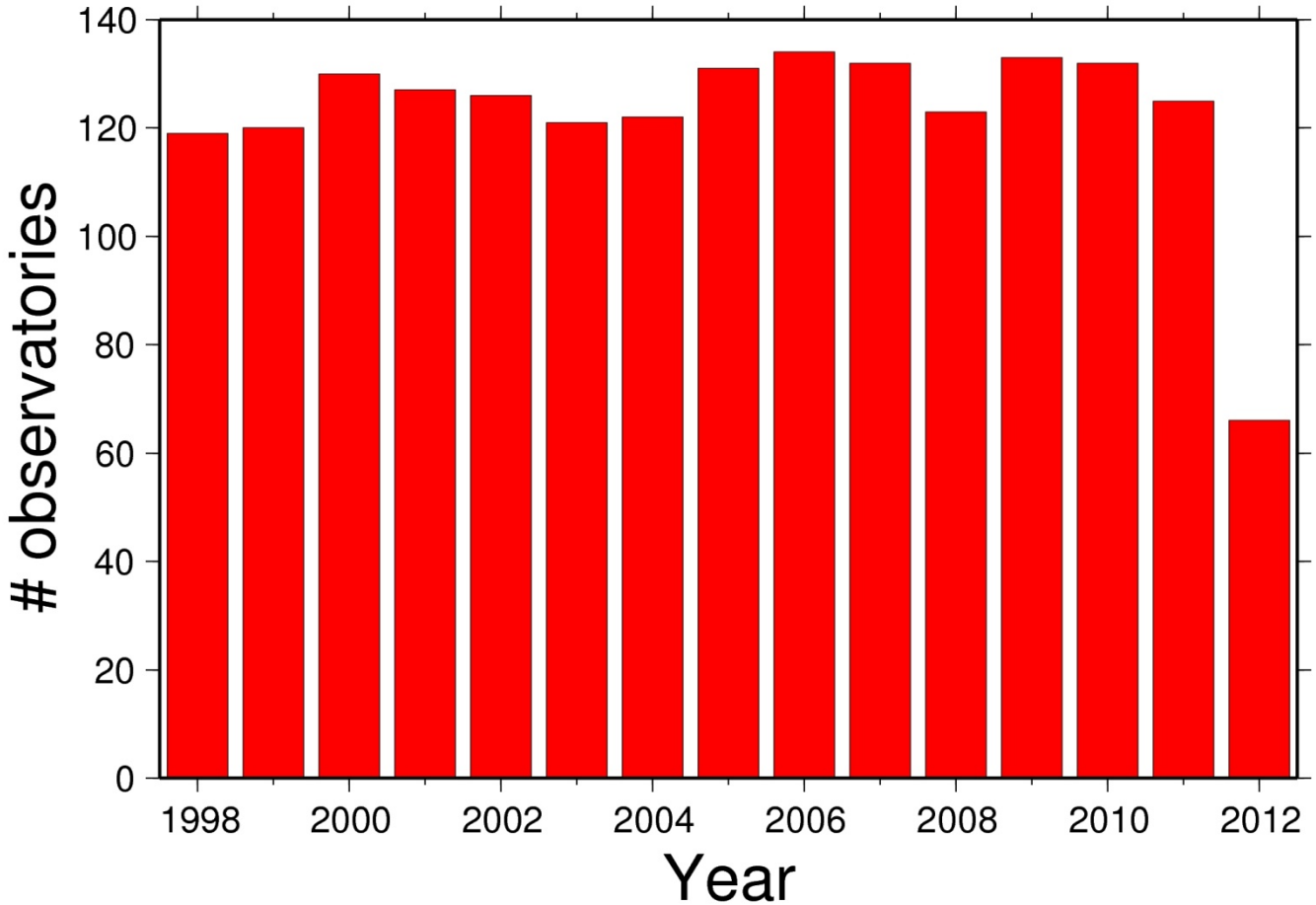
0. Acceptance of draft agenda
1. Status of data available for field modelling
2. Progress with draft ISO norm.
3. Brief review of IGRF-11 performance.
4. Plans for IGRF-12.
5. WDMAM: Election of new task force, Ongoing revision.
6. Suggestions for sessions at IUGG 2015 in Prague.
7. Any other business

# Observatory locations

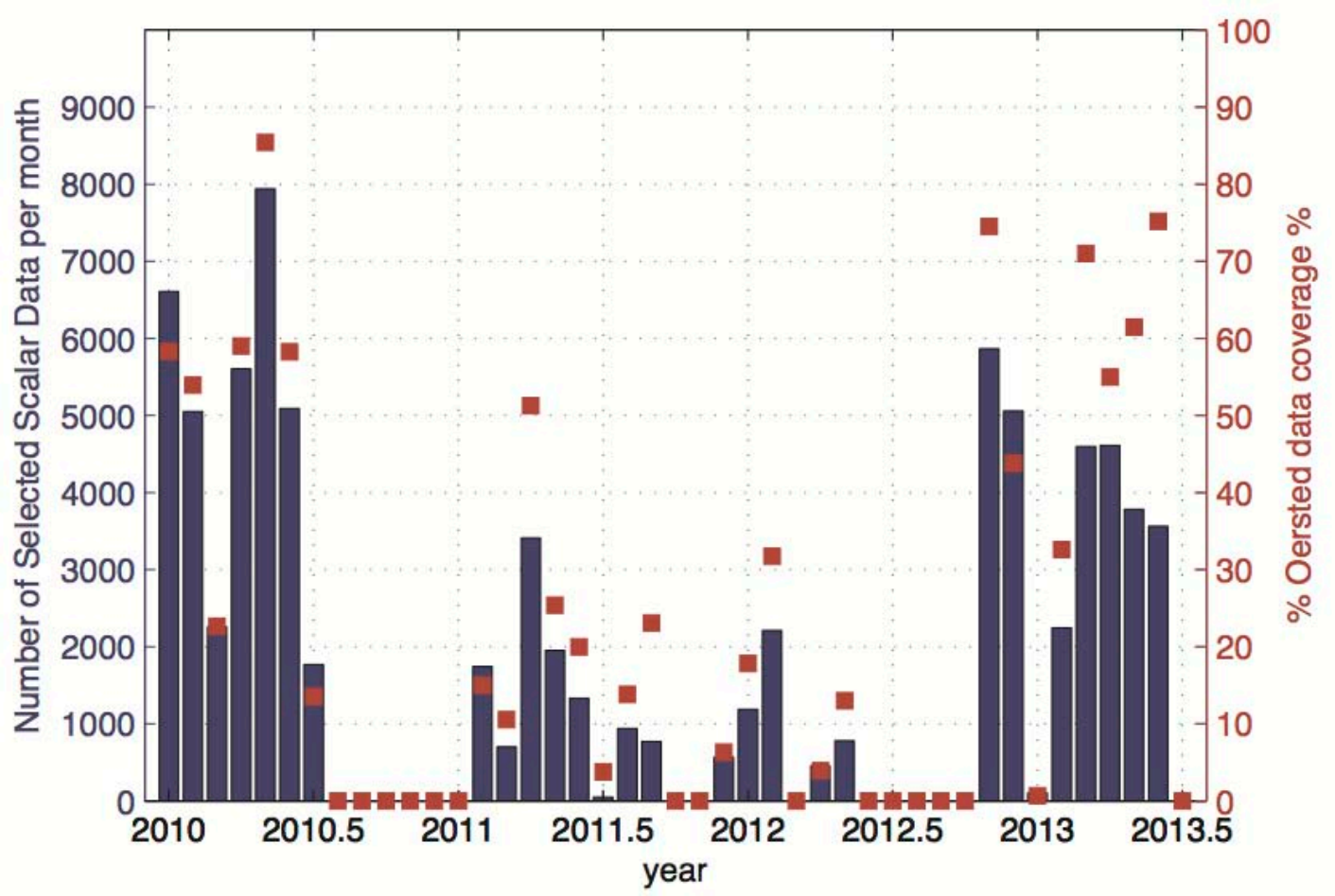


# Number of observatories with hourly means for given year

(after selection as detailed in Macmillan *et al* poster in 5.1)



# Ørsted scalar data: since 2010




Available from: ftp://ftp.space.dtu.dk/data/magnetic-satellites/Oersted/mag-f/

# Swarm

- ESA Earth observation mission
- Satellite trio with vector and scalar magnetometers.
- Now awaiting launch, scheduled for late 2013 (presentation by G. Ottavianelli on Monday in J1).
- Important data source for IGRF-12 revision in 2014.

# 2. ISO Standard 16695: Geomagnetic Reference Models

- Thanks to efforts of S. Maus this has now reached "Final Draft International Standard" (FDIS) stage.

- Expected to be published as an international standard by the end of 2013.

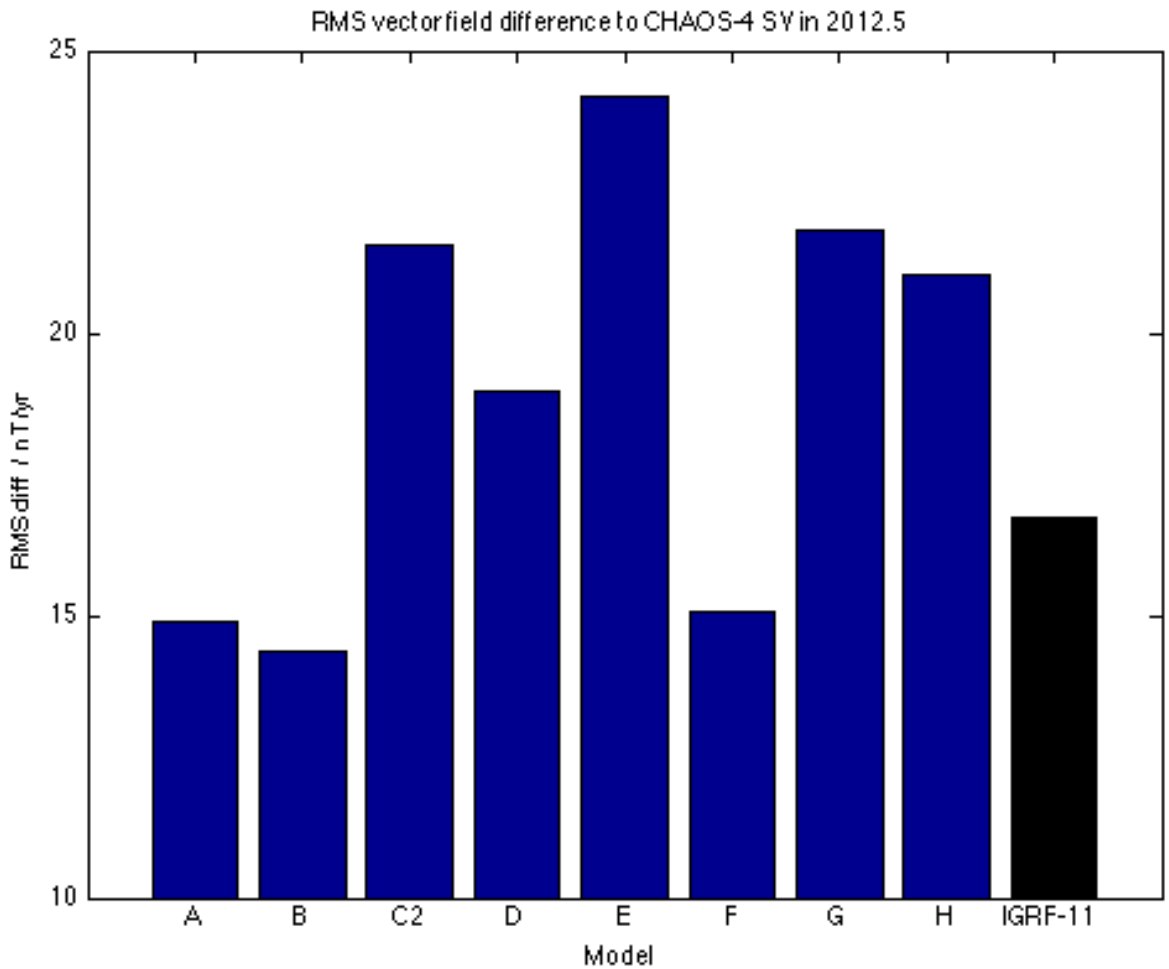
- http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?ics1=49&ics2=140&ics3=&csnumber=57448

- Contains annex explicitly describing IGRF

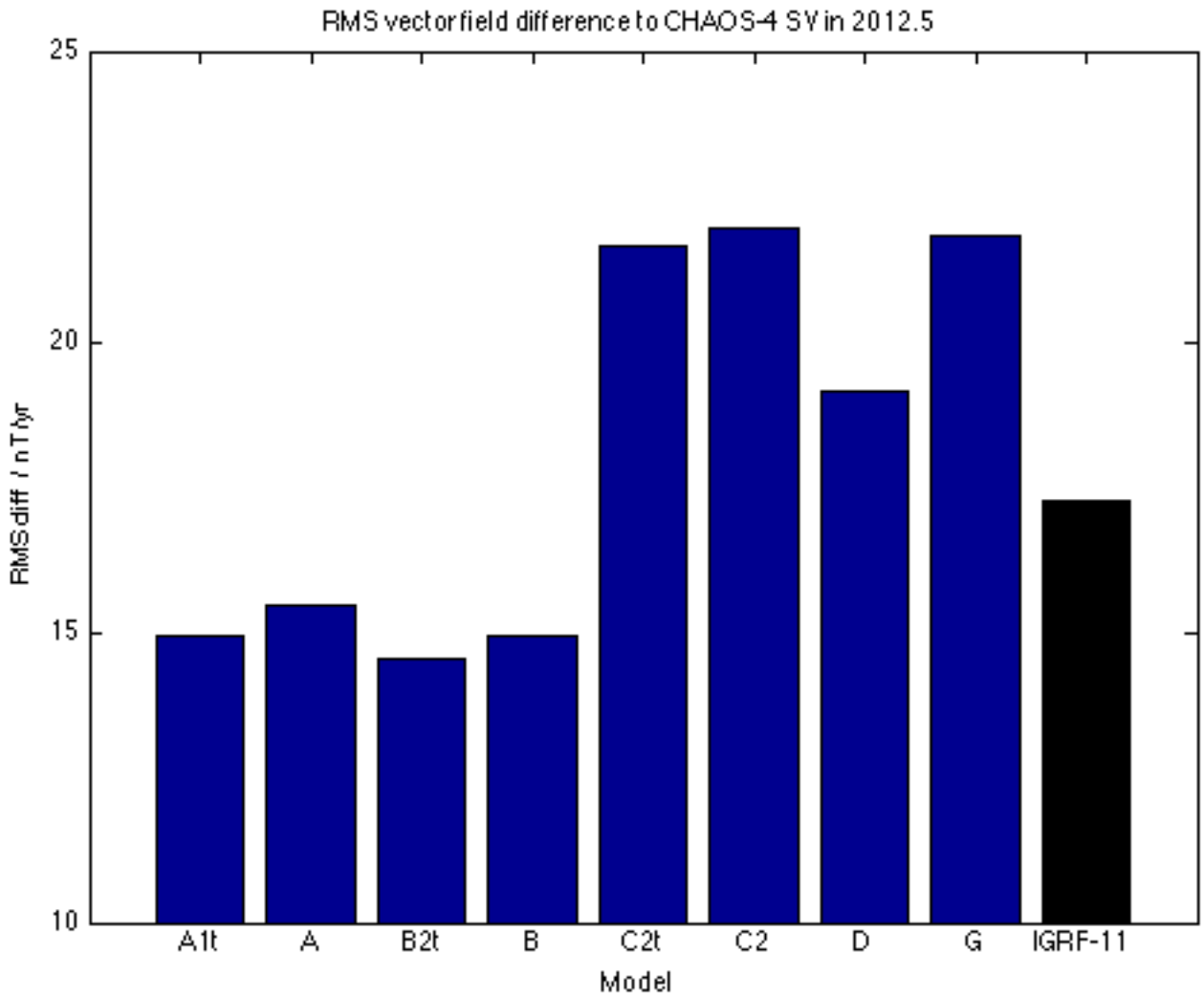
- Is "living document" which can be amended if required.

# 3. IGRF-11

- RMS vector field difference of IGRF-11 SV in 2012.5 to CHAOS-4 update in 2012.5: 16.75 nT/yr.



# Assessment of IGRF-11 Test models



# 4. Plans for IRGF 12

## Persons who volunteered to be part of the task force

P. Alken and S. Maus (NGDC/NOAA; patrick.alken@noaa.gov, Stefan.Maus@noaa.gov)
C. Beggan (BGS; ciar@bgs.ac.uk)
A. Du (Chinese Academy of Sciences, amdu@mail.iggcas.ac.cn)
G. Hulot and E. Thebault (IPGP; ethebault@ipgp.fr; gh@ipgp.fr)
V. Lesur (GFZ; lesur@gfz-potsdam.de)
F. Lowes (Univ. Newcastle; f.j.lowes@newcastle.ac.uk )
N. Olsen and C. Finlay (DTU; nio@space.dtu.dk, cfinlay@space.dtu.dk)
V. G. Petrov (IZMIRAN, vpetrov@izmiran.ru)
T. Sabaka (NASA; terence.j.sabaka@nasa.gov)

# IGRF-12 Proposed specifications and rules

## SPECIFICATIONS

1) Internal field (main field) for 2015.0 to spherical harmonic (SH) degree and order 13.
2) Predicted average secular variation for 2015.0-2020.0 to SH degree and order 8 .
3) Internal field (main field) for 2010.0 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 2014.

## 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-12: Proposed deadlines

- March-April 2014: circulation of the formal call.

- August 2014: Participants are requested to provide a more extensive description of their products (one paragraph).

- October 2014: Deadline for submission of candidates.

- November 2014: Evaluation of candidates.

# 5. WDMAM
# Election of new task force, chair, and progress with revision

# Vote for a new chair and task force

Proposed board for WDMAM 2013-2015:
Jérôme Dyment (Chair, CGMW representative), jdy@ipgp.fr
Manuel Catalan (co-chair), mcatalan_roa.es<http://mcatalan_roa.es>

Proposed Task force for WDMAM 2013-2015
Juha V. Korhonen juha.korhonen@gtk.fihttp://juha.korhonen_gtk.fi
Mike Purucker, michael.e.purucker@nasa.gov
Erwan Thebault, ethebault@ipgp.fr
Mohamed Hamoudi, hamoudi@usthb.dz
Takemi Ishihara, t-ishihara@aist.go.jp and Shigeo Okuma, s.okuma@aist.go.jp
Vincent Lesur, lesur@gfz-potsdam.de
Tamara Litvinova, tamara_litvinova@vsegei.ru
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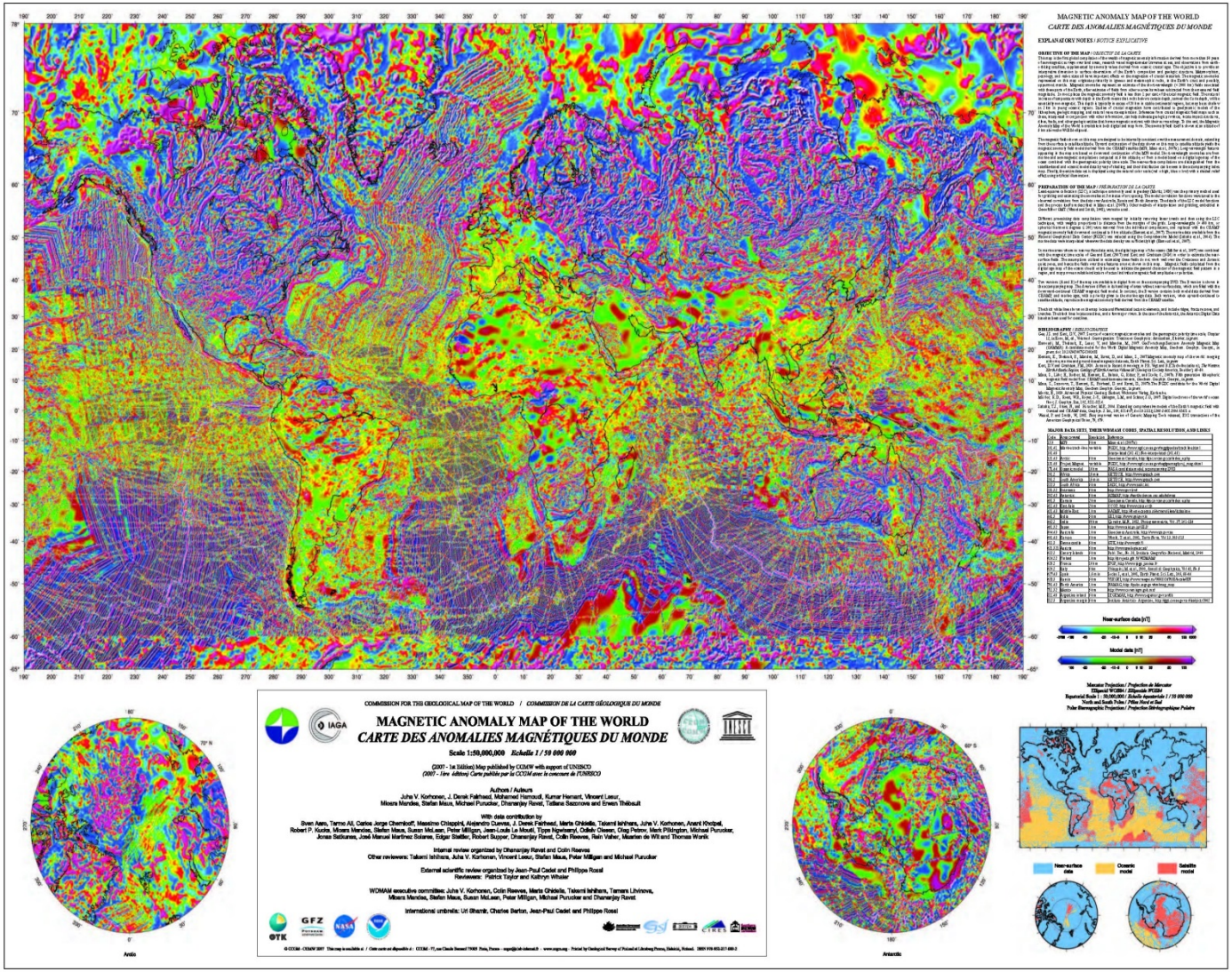
Dhananjay Ravat, ravat@geo.siu.eduhttp://ravat_geo.siu.edu
Joaquim Luis, jluis@ualg.pt
Angelo de Santis, angelo.desantis@ingv.it
Peter Milligan, peter.milligan@ga.gov.au
Mark Pilkington, mpilking@NRCan.gc.ca

# WDMAM 1st Edition




The First WDMAM published in 2007 under the umbrella of the

# Some metrics

Hemant et al., 2007 ~ 30.
Hamoudi et al., 2007 ~30.
Maus et al., 2007 ~70.
Maus et al., 2009 (EMAG2) ~70.
Korhonen et al., (2007) > 20.

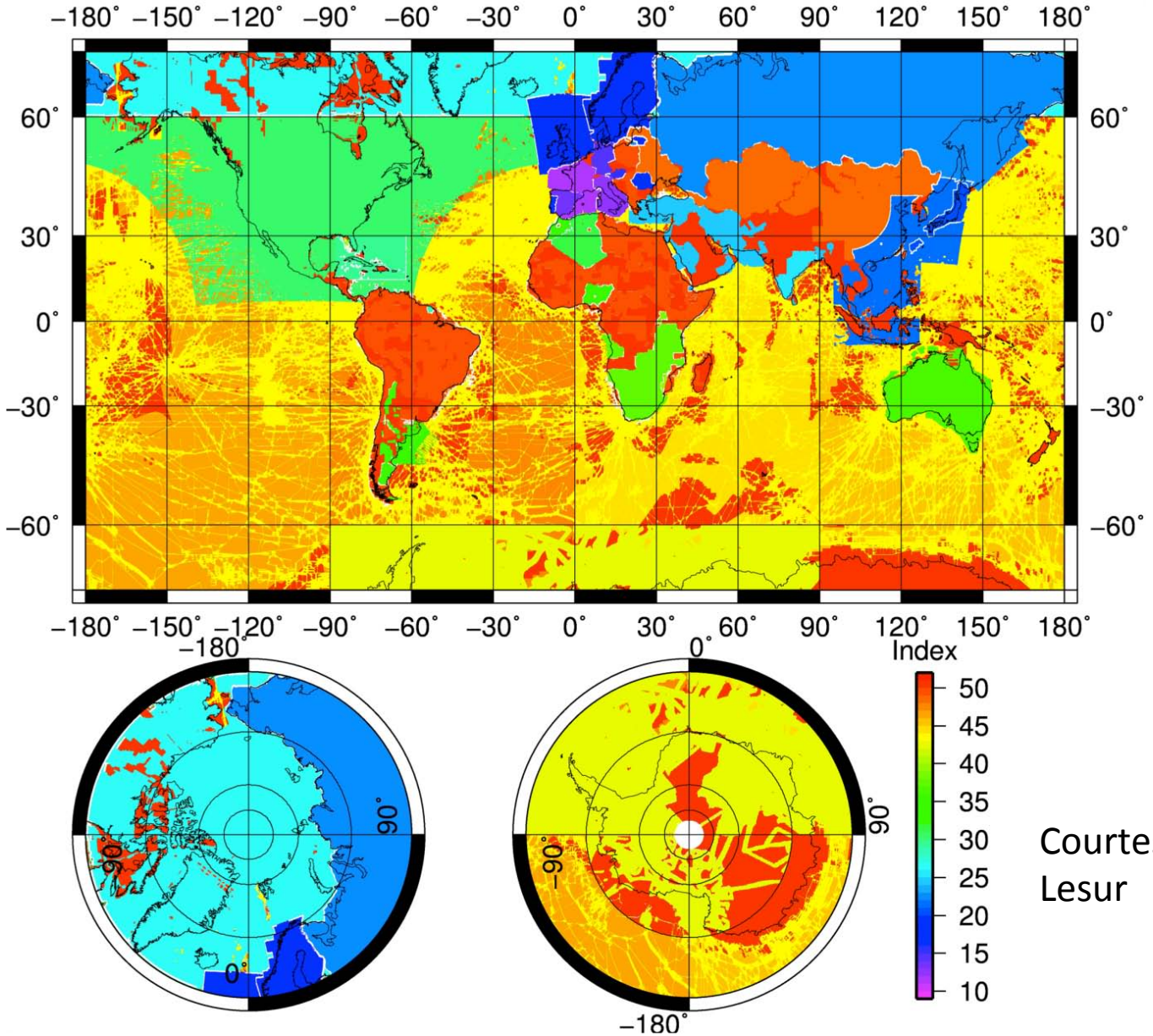
For comparison, IGRF ~ 140 times in three years.

The project continues prompting many scientific projects at international and national levels (tens of sessions on aeromagnetic compilations and merging with satellite data since 2007 at EGU, AGU, IAGA)

The project relies on many regional compilations involving hundreds of scientists around the world.

Many of these contributors keep improving the compilations adding new data, reprocessing old data, digitizing maps or records (see for instance the presentation by Ishihara et al., session 5.6 on Thursday),...

# Recent improvements

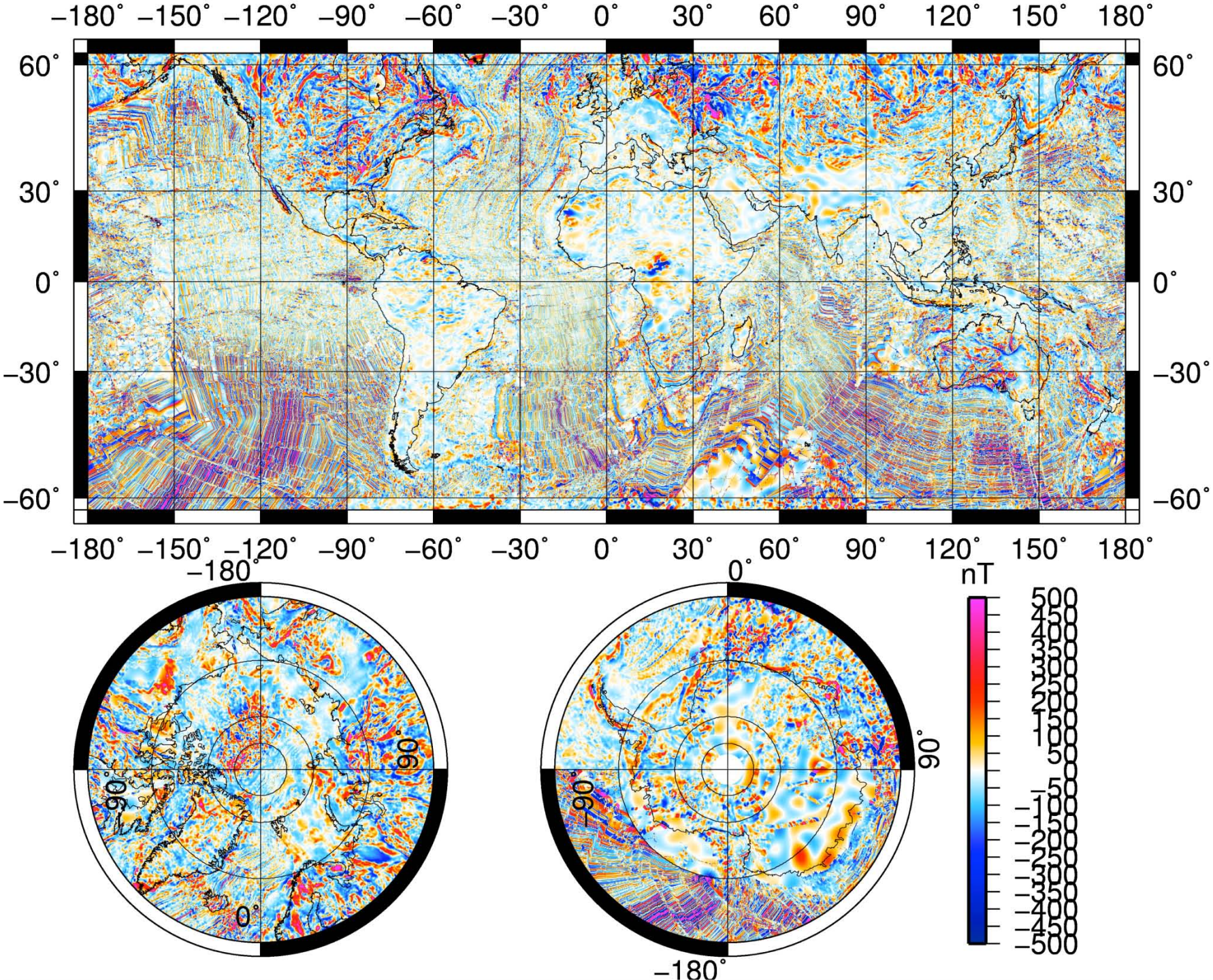



Courtesy of V. Lesur

# Recent improvements

| *Name* | *N* | *Mean* | *Stdev.* | *Min/max* | *Index* | *Sources* |
|---|---|---|---|---|---|---|
| French-data | 1488585 | 0.54 | 32.00 | -156/396 | 11 | Le Mouël., *Ann. Geophys.*, 26(2), 1970 & Courtillot et al., *Earth Planet Sci. Lett.*, 47, 1980 |
| Italy | 439320 | 11.8 | 59.02 | -435/588 | 12 | Chiappini et al., *Annali di Geophysica*, 45(5), 2000 |
| Spain | 494171 | 0.02 | 16.66 | -62/184 | 13 | Socias, *Earth Planet Sci. Lett.*, 105, 1991 |
| Germany | 20815 | -2.62 | 36.70 | -96/171 | 14 | Gerald.Gabriel@liag-hannover.de |
| Austria | 5294 | 12.6 | 26.12 | -35/137 | 15 | GSA, http://www.geologie.ac.at/ |
| Fennoscandia | 3505857 | -30 | 154 | -580/1500 | 16 | http://info.gtk.fi/info/ |
| United Kingdom | 119509 | -2.71 | 121 | -962/1342 | 17 | British Geological Survey, NERC, IPR/132-01CT |
| Portugal | 151142 | -10 | 33 | -111/219 | 18 | Miranda et al., *Earth Planet Sci. Lett.*, 9, 1989 |
| Romania | 100092 | 19 | 70 | -144/418 | 19 | Dr. L. Beşutiu, Institute of Geodynamics, Romania (http://www.geodin.ro/ ) |
| Japan (2007) | 91094 | -42 | 73 | -401/416 | 20 | http://www.ccop.or.th/ |
| East Asia | 958040 | -28 | 68 | -509/763 | 21 | http://www.ccop.or.th/ |
| Russia (vsegei) | 1688415 | 0.9 | 158 | -2274/5658 | 22 | Litvinova, T. VSEGEI |
| Djibouti | 266171 | -2.8 | 85 | -293/241 | 23 | Courtillot et al., Earth Planet Sci. Lett., 47, 1980 |
| Middle-East (2007) | 1812464 | 0.56 | 73 | -904/690 | 24 | http://members.casema.nl/errenwijlens/itc/aaime/ |
| India | 92784 | 18.5 | 82 | -341/427 | 25 | GSI, http://www.gsi.gov.in/ |
| Circum-Arctic | 3258710 | -4 | 99 | -699/2754 | 26 | Gaina, C., Werner, S.C. and the CAMP- GM group, NGU Report 2009.010 |
| Guadeloupe | 353672 | 24 | 46 | -76/190 | 27 | IPG Paris |
| French Guiana | 99066 | -3.9 | 72 | -283/143 | 28 | BRGM, France |
| Bahama-Cuba | 329975 | 0.9 | 75 | -410/681 | 29 | Batista-Rodríguez, et al., *Geophysics,* 72(3),(doi: 10.1190/1.2712425) |
| Nure-Namag | 2012238 | -11 | 123 | -3667/3998 | 30 | Ravat, D. et al., *USGS Open-file Report* 2009-1258 |
| Algeria | 2126820 | 0.2 | 48 | -189/274 | 31 | Ministry of Energy and Mines, Algiers, Algeria |
| Morocco | 394179 | -1.4 | 43 | -194/207 | 32 | Ministry of Energy and Mines, Rabat, Morocco |
| Nigeria | 132407 | 26.3 | 40 | -163/177 | 33 | Nigerian Geological Survey, Abuja, Nigeria |
| Argentina-Shelf | 1497947 | -9 | 45 | -150/318 | 34 | Max et al., *Marine Petroleum Geology*, 16, 1999.. |
| Argentina-Inland | 34134 | -1.5 | 104 | -3152/1173 | 35 | SEGEMAR, http://www.segemar.gov.ar/ |
| Australia | 7089164 | -41.2 | 137 | -1674/3360 | 36 | Geosciences Australia, http://www.agso.gov.au/map/magnetics_info.html/ |
| South African DC | 427270 | -3.2 | 120 | -1788/2030 | 37 | SADC : http://www.sadc.int/ |
| Uganda | 123020 | -83 | 116 | 673/301 | 38 | Ministry of Energy and Mineral Development, Uganda |
| Mozambique | 419248 | 159 | 171 | -409/1007 | 39 | Geologian Tutkimuskeskus, Espoo, Finland |
| SaNaBoZi | 83380 | 77 | 109 | -203/756 | 40 | http://www.sadc.int/ |
| Acad Vernadsky | 69123 | 170 | 166 | -180/426 | 41 | Orlyuk et al., St Petersburg, July 8$^{th}$-11$^{th}$, Russia, 2008 |
| Admap | 56125472 | 15 | 104 | -776/1371 | 42 | http://www.antarctica.ac.uk/about_antarctica/geography/maps/admap.php/ |
| Marine data | 7193664 | -4 | 110 | -2057/2627 | 43 | Ishihara, T., J. Luis, M. Catalan and Y. Quesnel (t-ischihara@aist.go.jp) |
| Marine_Ano_0_90_n70_70 | 901539 | -0.7 | 142 | -1466/1365 | 44 | Choi et al. (this session) |
| Marine_Ano_90_180_n70_70 | 664798 | -7 | 149 | -778/738 | 45 | Choi et al. (this session) |
| Marine_Ano_180_270_n70_70 | 1658249 | -6 | 152 | -1662/1639 | 46 | Choi et al. (this session) |
| Marine_Ano_230_360_n70_70 | 871306 | -5 | 100 | -944/1047 | 47 | Choi et al. (this session) |
| Eurasia | 540898 | -2 | 102 | -891/819 | 48 | GSC, http://gsc.nrcan.gc.ca/ |
| Getech (2007) | 1038080 | 1 | 59 | -1024/536 | 49 | GETECH, http://www.getech.com/world_data.php/ |
| GRIMM_L | 3645256 | 8 | 55 | -235/580 | 50 | Lesur et al., *Solid Earth*, 4, 2013 |

WDMAM candidate is made of 40 different data sets and compilations. Largest data gaps are in Africa & South America.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−500

# A WDMAM candidate over the oceans

**MagMar.Fr** : a proposal to **build a better WDMAM over the oceans**
(later combined with the GFZ proposal, mostly focused on continents)

**How to fill reasonably the areas with low data coverage in the oceans?**
Two approaches, based on the same map of the age of the ocean
(incidentally built from the same limited marine magnetic anomaly data)
- Use the age map to model the marine magnetic anomalies (WDMAM v.1)
- Use the age map for directional interpolation between existing data (EMAG 2)

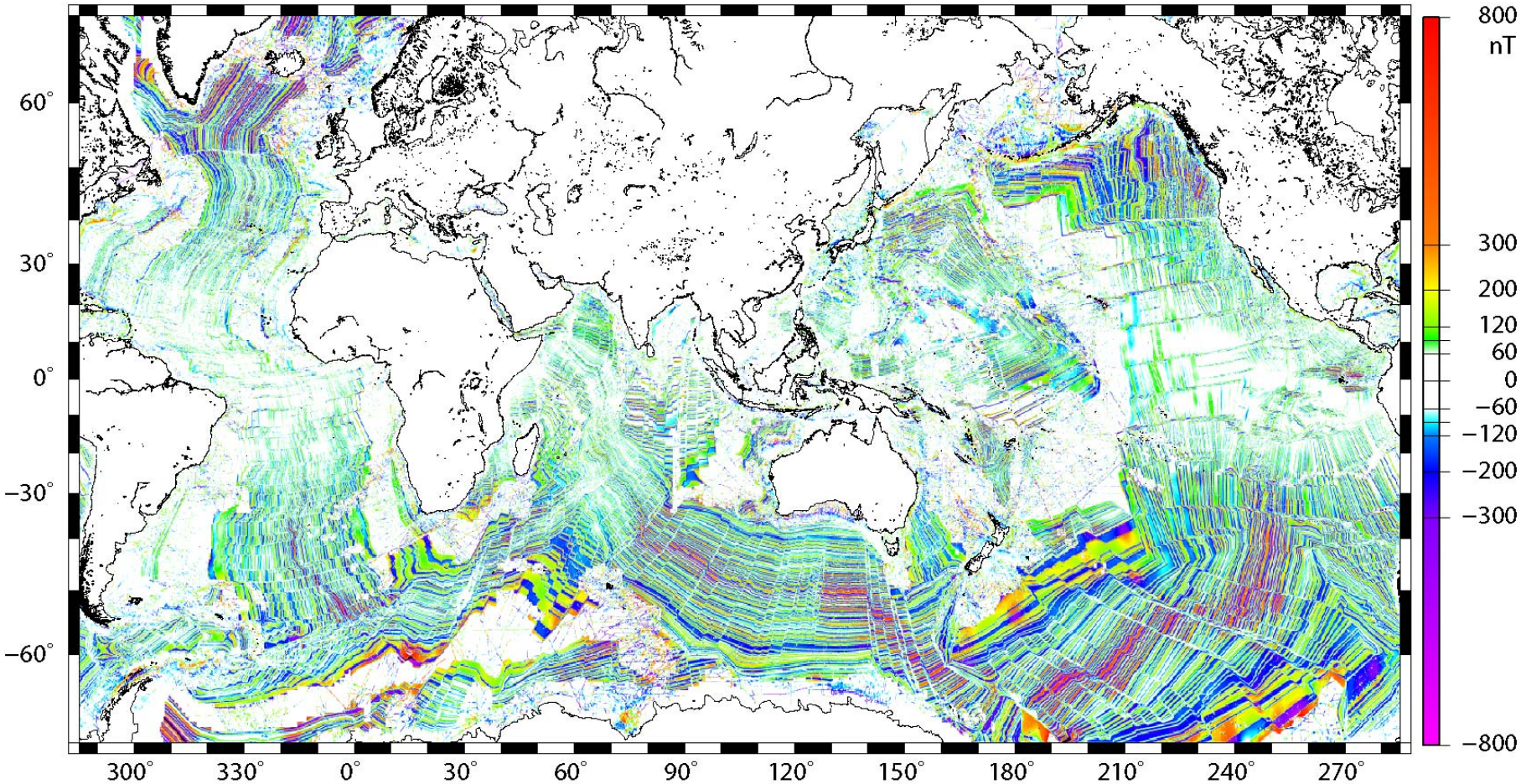
• We adopted the first method and **built a better mode**l taking into account remanent magnetization and the plate motions.

• Then we **ajusted this model to the data** by comparing data and model along ship track, on sliding windows.

• Finally we overlapped the model with the existing marine magnetic anomaly data to obtain the marine magnetic anomaly map of the World.

→ *See the poster on Thursday, session 5.6, Choi et al.*

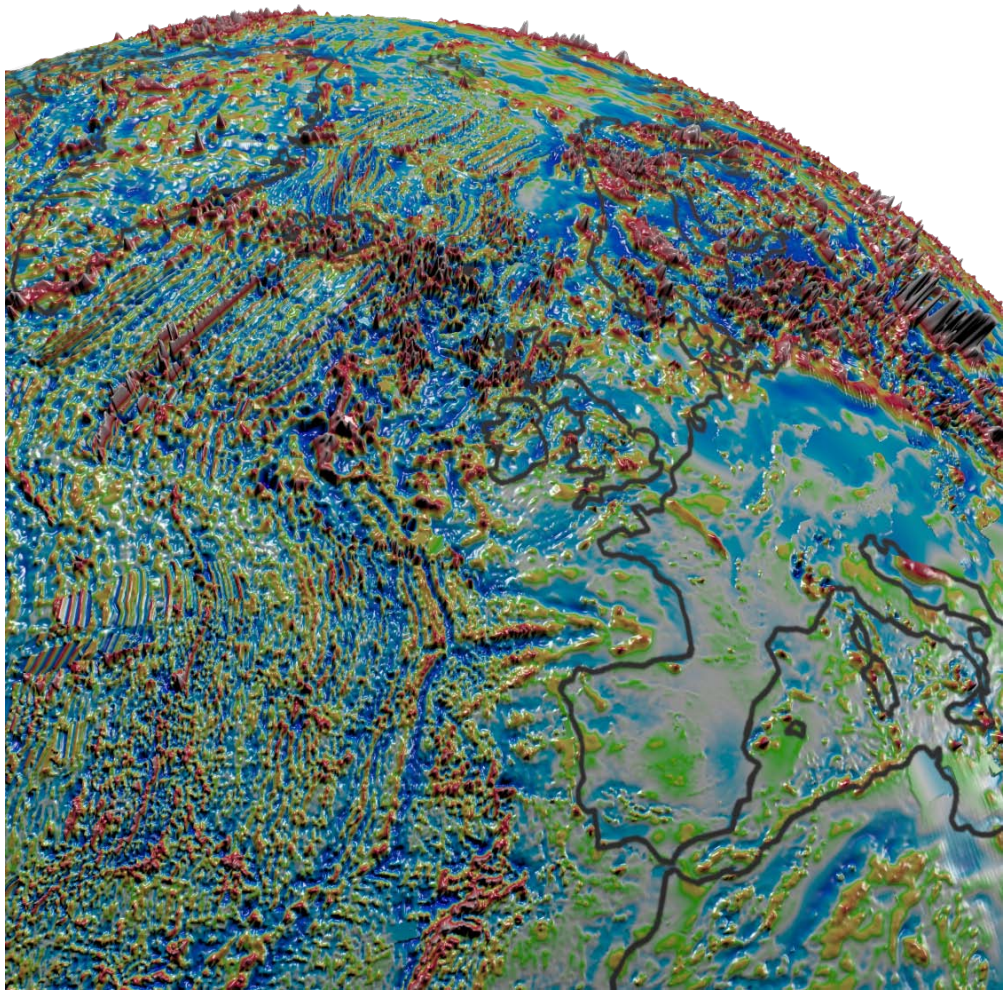
# A WDMAM candidate over the oceans




*(Choi et al., this meeting, poster session 5.6, Thursday)*

Courtesy of Y. Choi

# Second generation…



Courtesy of M. Rother, GFZ.

Two candidates:
1 joint candidate by GFZ/ IPGP/USTHB
1 candidate by GTK.

The Evaluation of candidates will be carried out by the task force members with assistance from outside experts in certain regions.

Release schedule for the end of the year (electronic form).

# 6. Proposed sessions for IUGG:

1. Results from Swarm and preceding missions: In honour of Eigil Friis-Christensen.
   Conveners: Claudia Stolle, Nils Olsen, Gauthier Hulot, David Knudsen, Rune Floberghagen
   (Joint with DIV-1, 2, and 3)

2. Lithospheric field modelling and tectonic implications
   Conveners: Mike Purucker and Jérôme Dyment

3. Data Assimilation using magnetic measurements (Joint with DIV-1 and DIV-2)
   Conveners: Joshua Rigler, Alex Fournier, Tomoko Matsuo, ….

4. Planetary magnetic fields and geomagnetic secular variation (Joint with DIV-1 and SEDI )
Converners: Chris Finlay,…