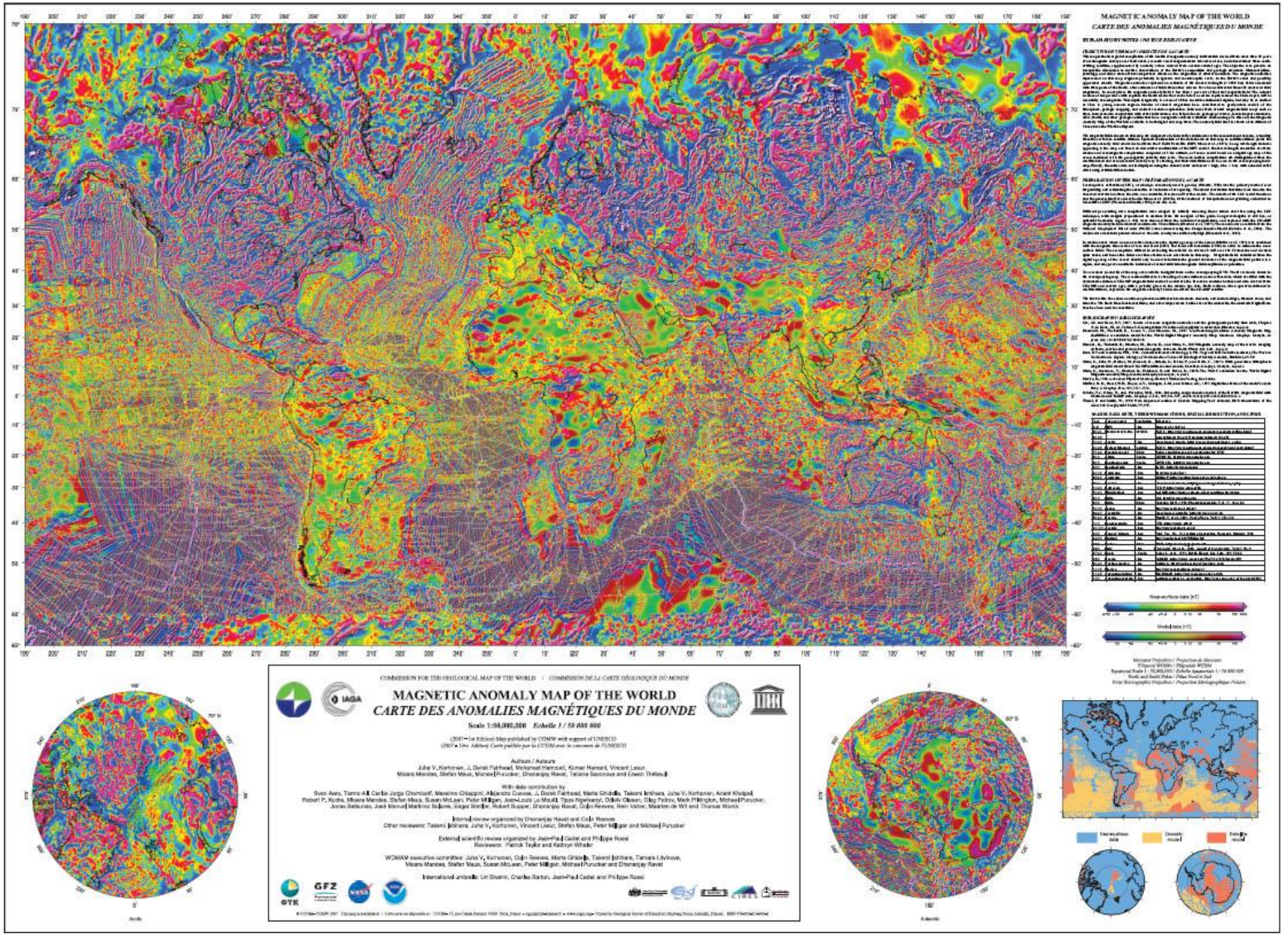
Magnetic anomalies - a review

J. Dyment

with free additions (and subtraction) from E. Thébault

World Magnetic Anomaly Map



Korhonen et al., 2007

Why a WDMAM version 2?

- Many gaps in WDMAM v.1

→ We needed to gather more data.

- A major issue that could be more easily addressed: the oceans

→ need to improve approach

➔ 3 applicants in 2010, 1 map delivered in 2013

Gamma (led by V. Lesur, GFZ, Potsdam)

MarMag-Fr (led by J. Dyment, IPGP-CNRS, Paris)

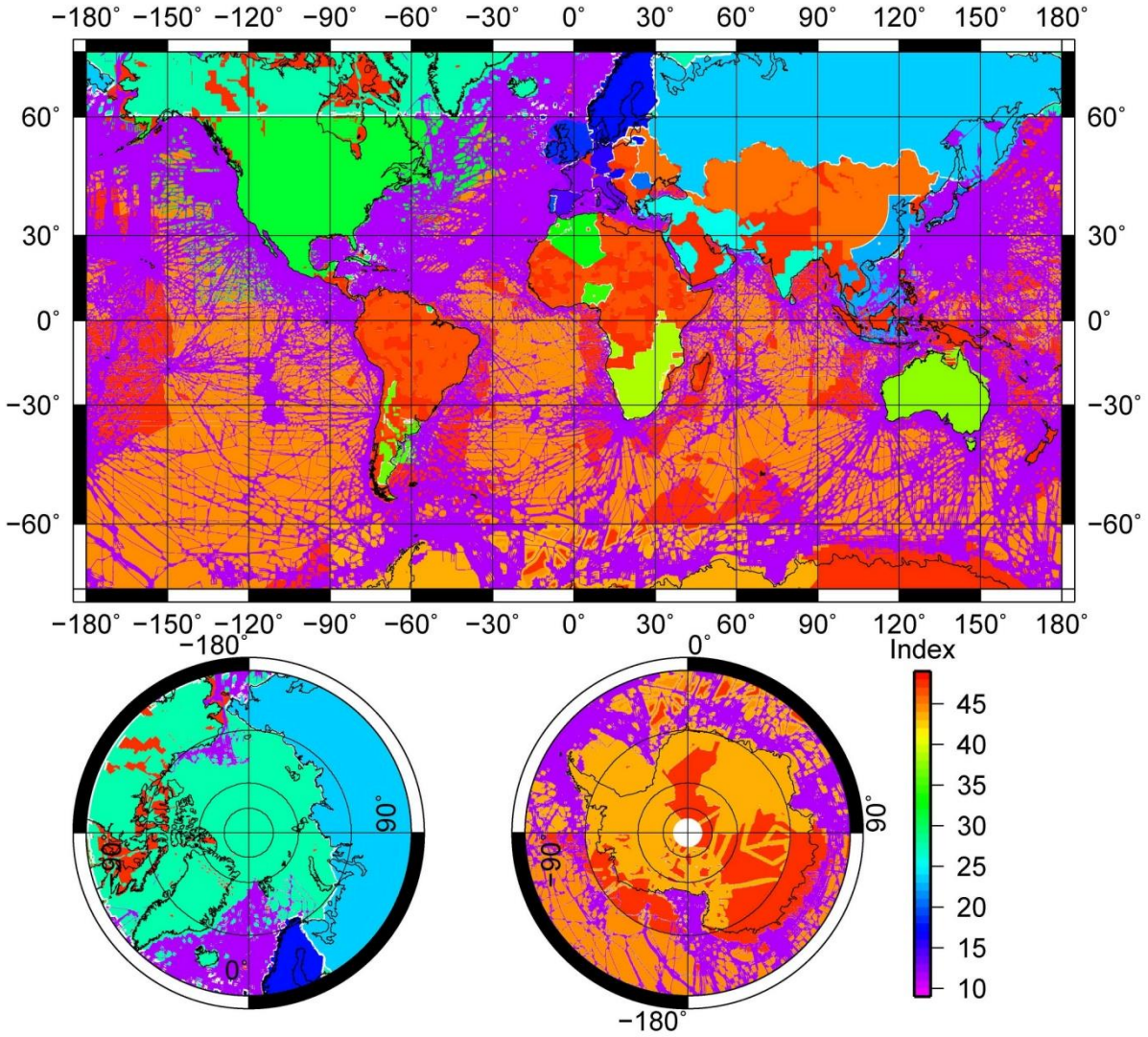
Teams merged 2012, Map delivered 2013

GTK Team (J. Korhonen, GTK, Helsinki)

Map not delivered

➔ Evaluation process, corrections…

WDMAM v. 2.0

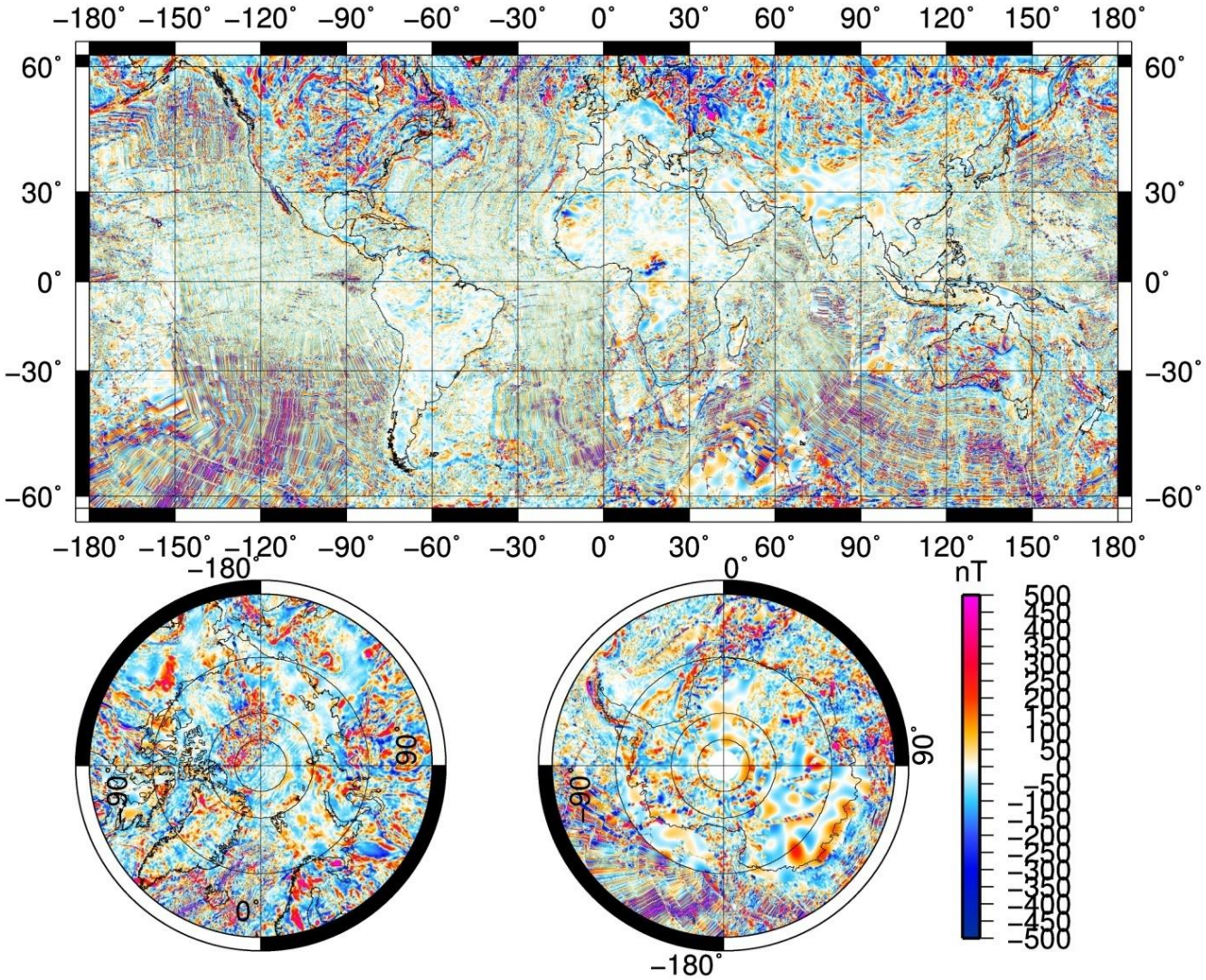


Sources:

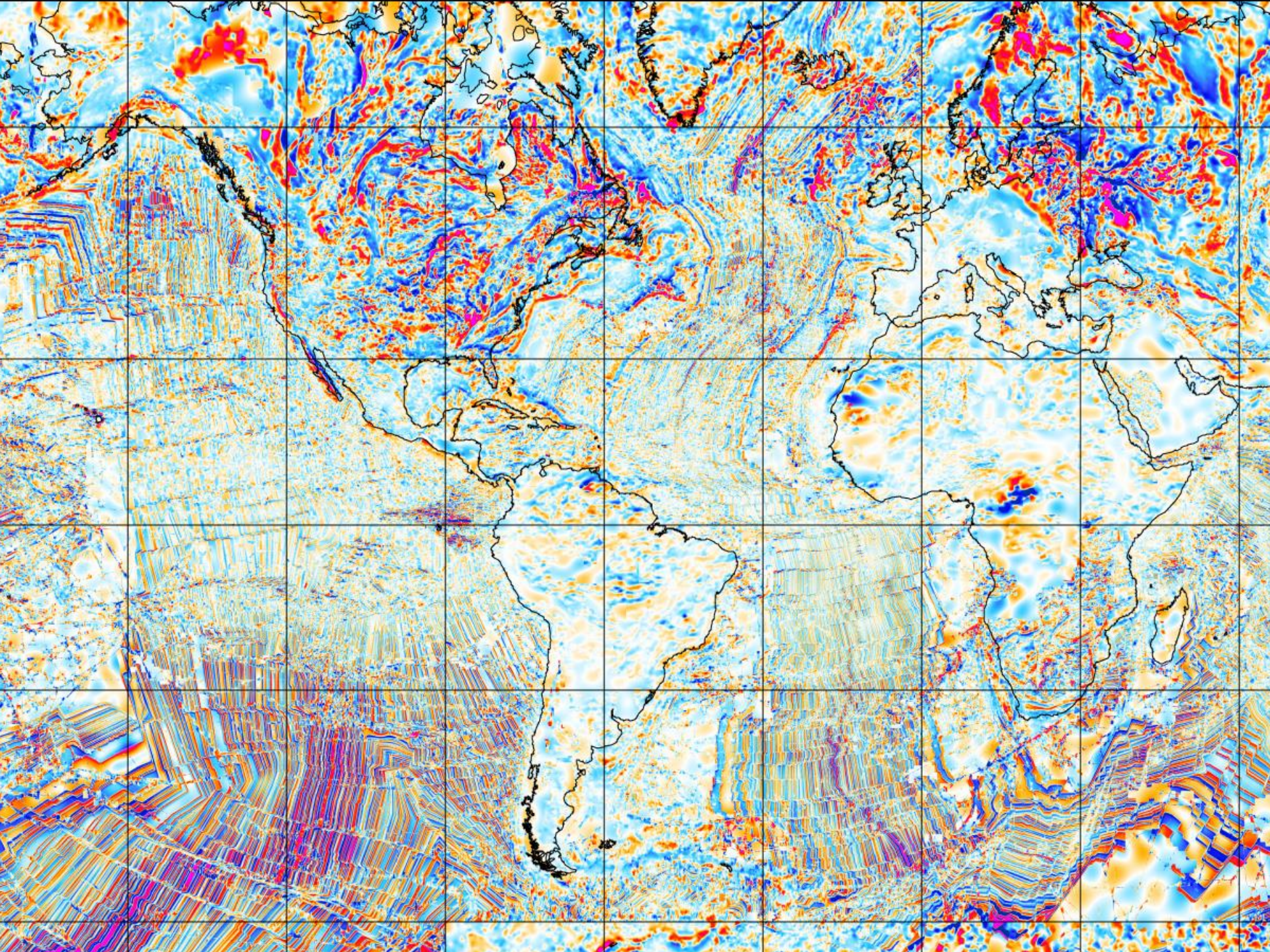
- Existing compilations (North America, Russia, Australia, Antarctica, Europe, Austral Africa…)
- Data provided by countries (Algeria, Morocco, Nigeria…
- Low-res data compiled in EMAG-2 (high-res is proprietary)
- At sea: marine data, adjusted model except CQZ and plateaus
- elsewhere: downward-continued satellite map

Lesur et al., IUGG-2434

WDMAM v. 2.0



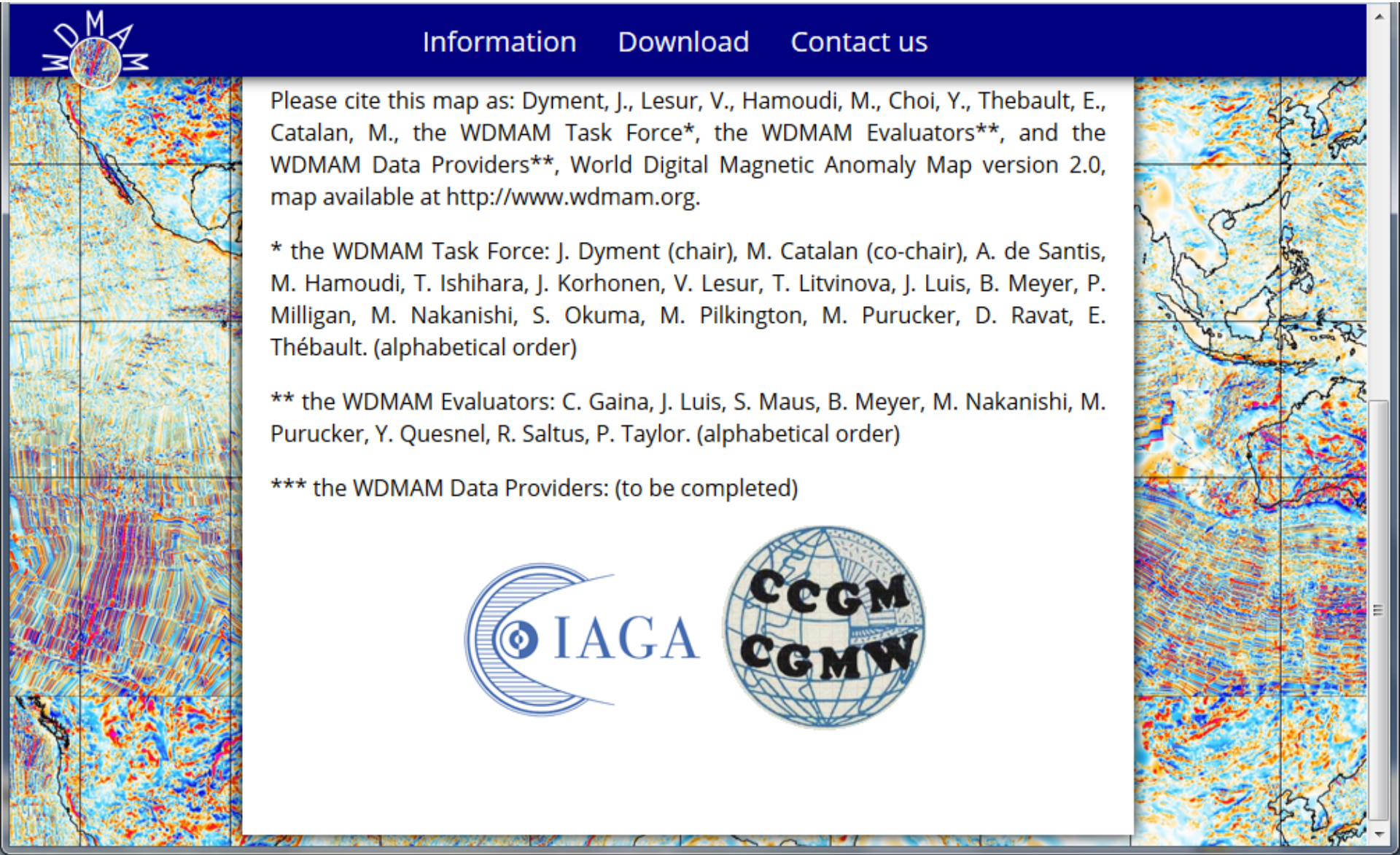
World international collaboration led by J. Dyment and M. Catalan.



What is next ?

- After evaluation and corrections the WDMAM 2.0 was adotped by a vote in DIV-VMOD working group. The map is available at : www.wdmam.org
- Future gradual improvements as new data are coming, through versions 2.1, 2.2… until official and voted WDMAM 3.0 in « some » years.
- Search for more data in academic, geological surveys and industry. Continuous efforts will always be appreciated!
- Collection of data in remote oceanic areas through a project involving oceanographic institutions, magnetometer builders and educational aspects.

wdmam.org


Information
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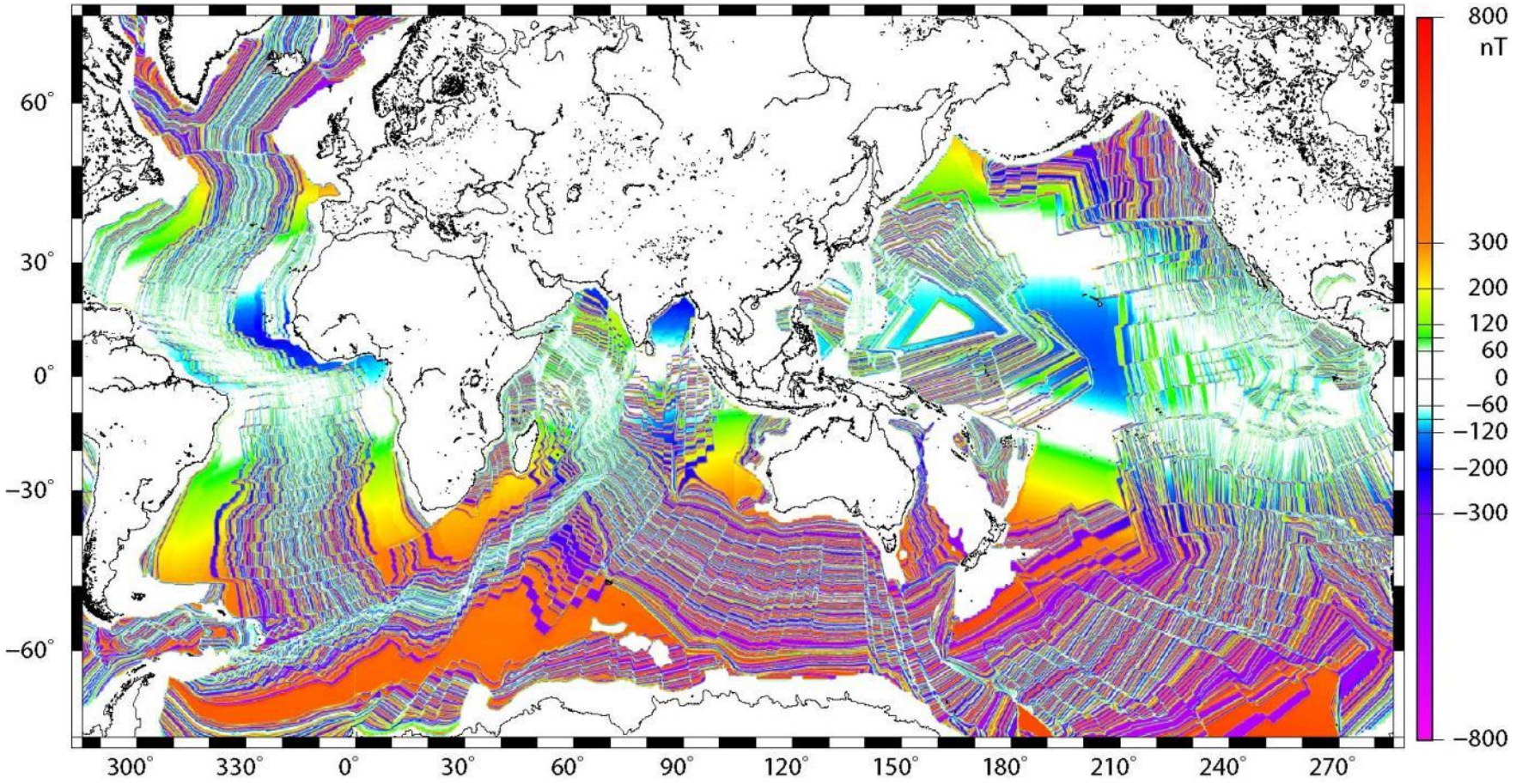
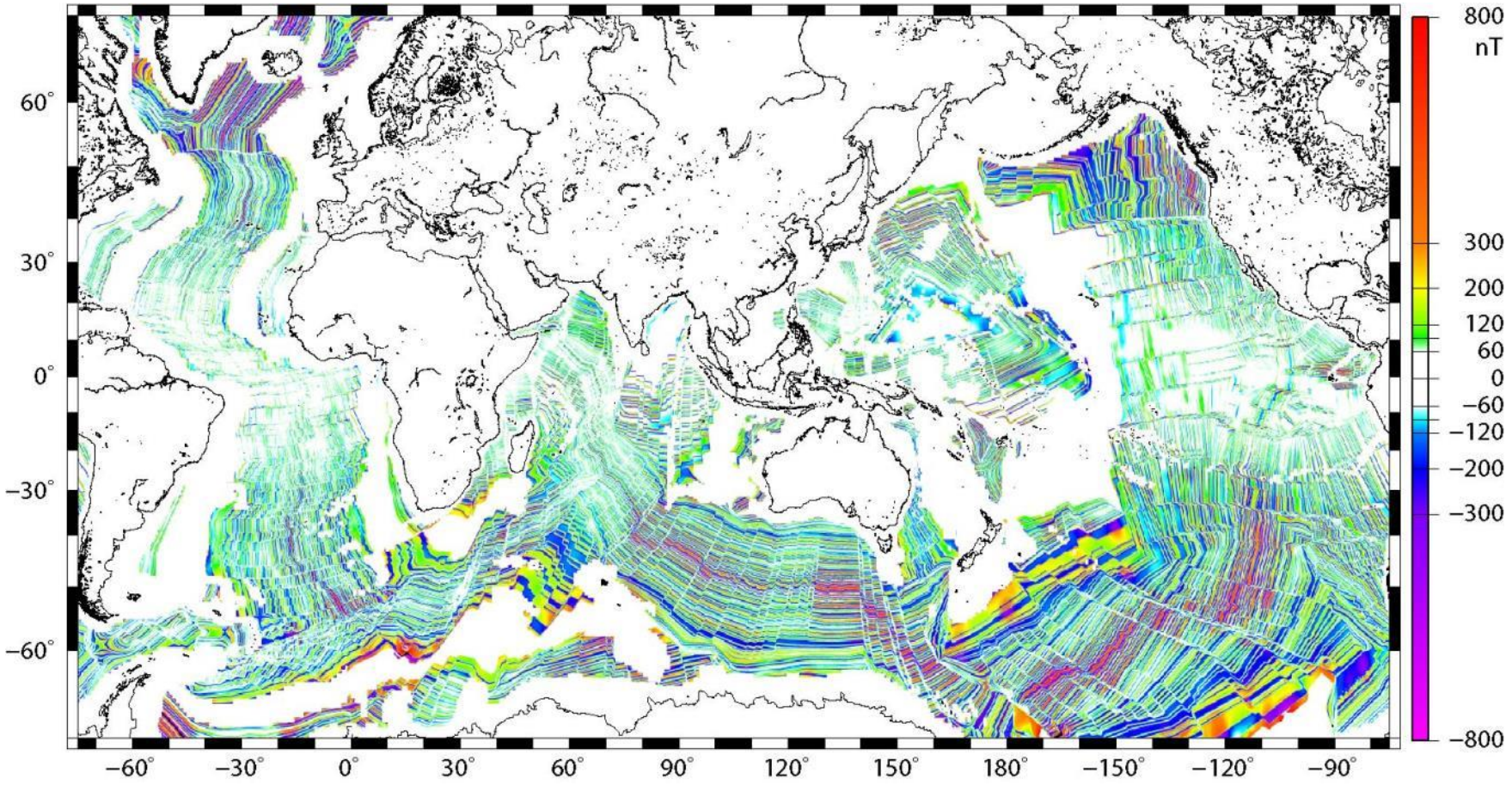
Please cite this map as: Dyment, J., Lesur, V., Hamoudi, M., Choi, Y., Thebault, E., Catalan, M., the WDMAM Task Force*, the WDMAM Evaluators**, and the WDMAM Data Providers**, World Digital Magnetic Anomaly Map version 2.0, map available at http://www.wdmam.org.
* the WDMAM Task Force: J. Dyment (chair), M. Catalan (co-chair), A. de Santis, M. Hamoudi, T. Ishihara, J. Korhonen, V. Lesur, T. Litvinova, J. Luis, B. Meyer, P. Milligan, M. Nakanishi, S. Okuma, M. Pilkington, M. Purucker, D. Ravat, E. Thébault. (alphabetical order)
** the WDMAM Evaluators: C. Gaina, J. Luis, S. Maus, B. Meyer, M. Nakanishi, M. Purucker, Y. Quesnel, R. Saltus, P. Taylor. (alphabetical order)
*** the WDMAM Data Providers: (to be completed)
IAGA
CCGM
CGMW

Science from and for WDMAM



*(**Lesur, Dyment, et al.,*** IUGG-2434*)*

Science from and for WDMAM



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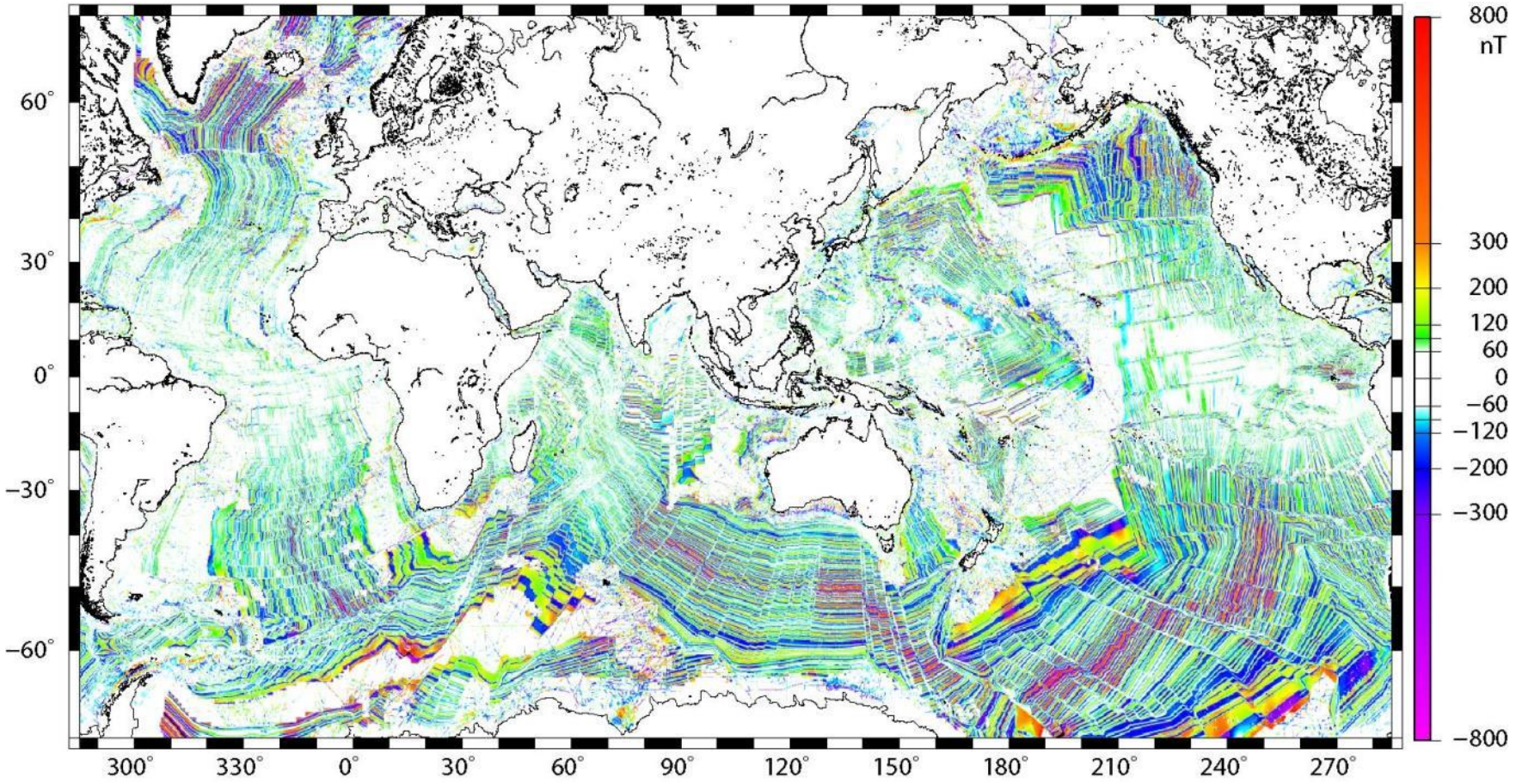
Science from and for WDMAM



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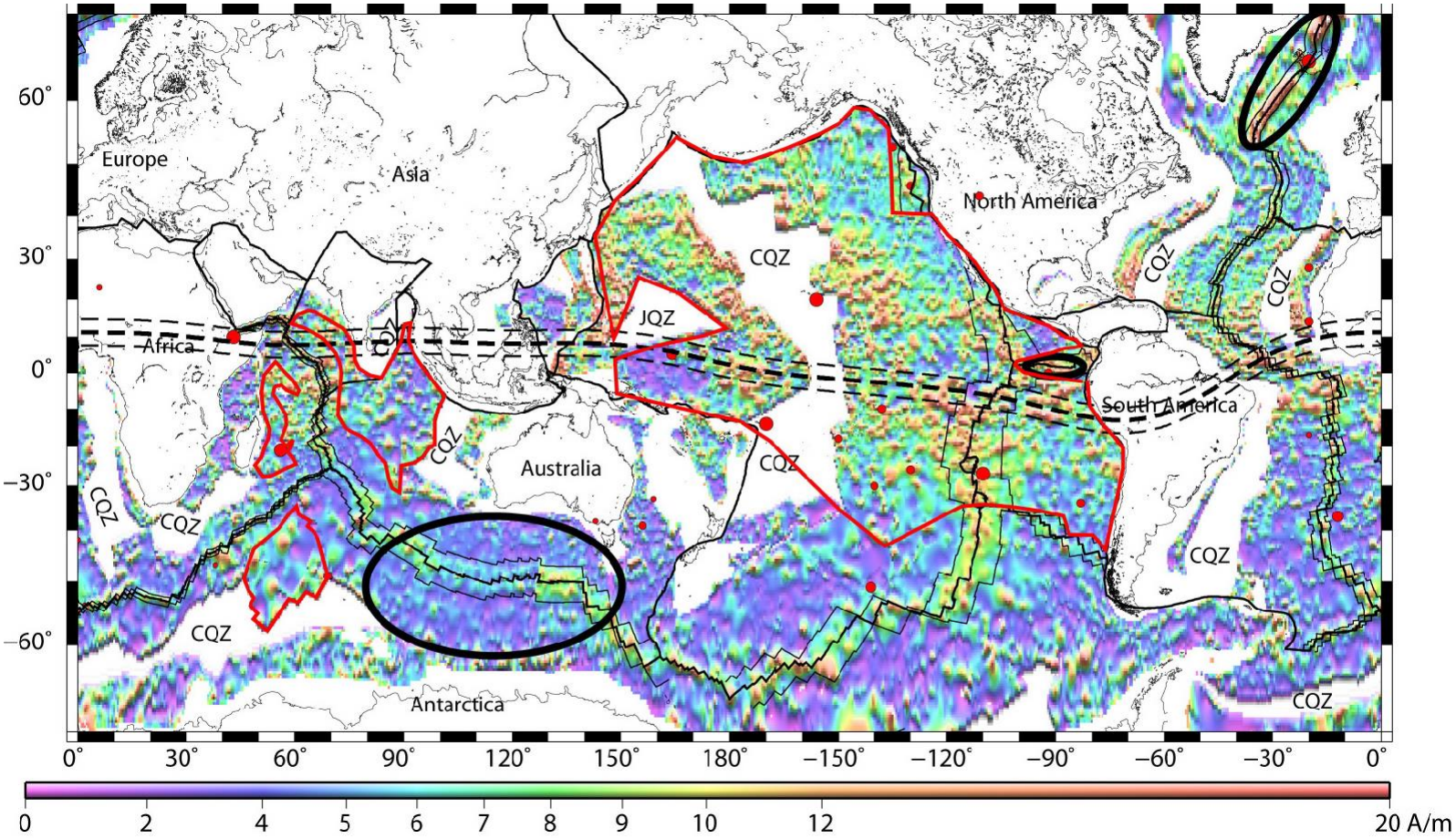


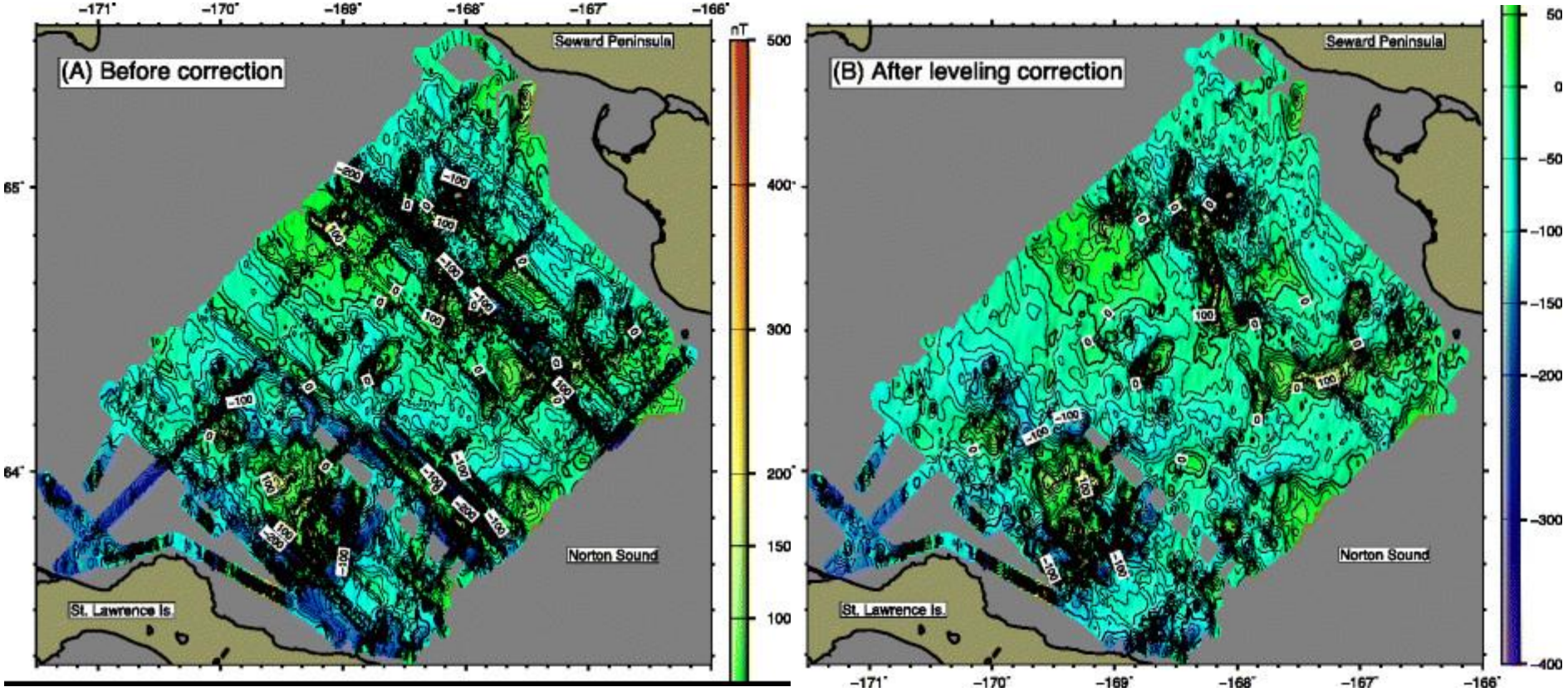
Equivalent magnetization over the oceans

(Choi et al., IUGG-26th **A41p-288***)*

Processing of data and new compilation

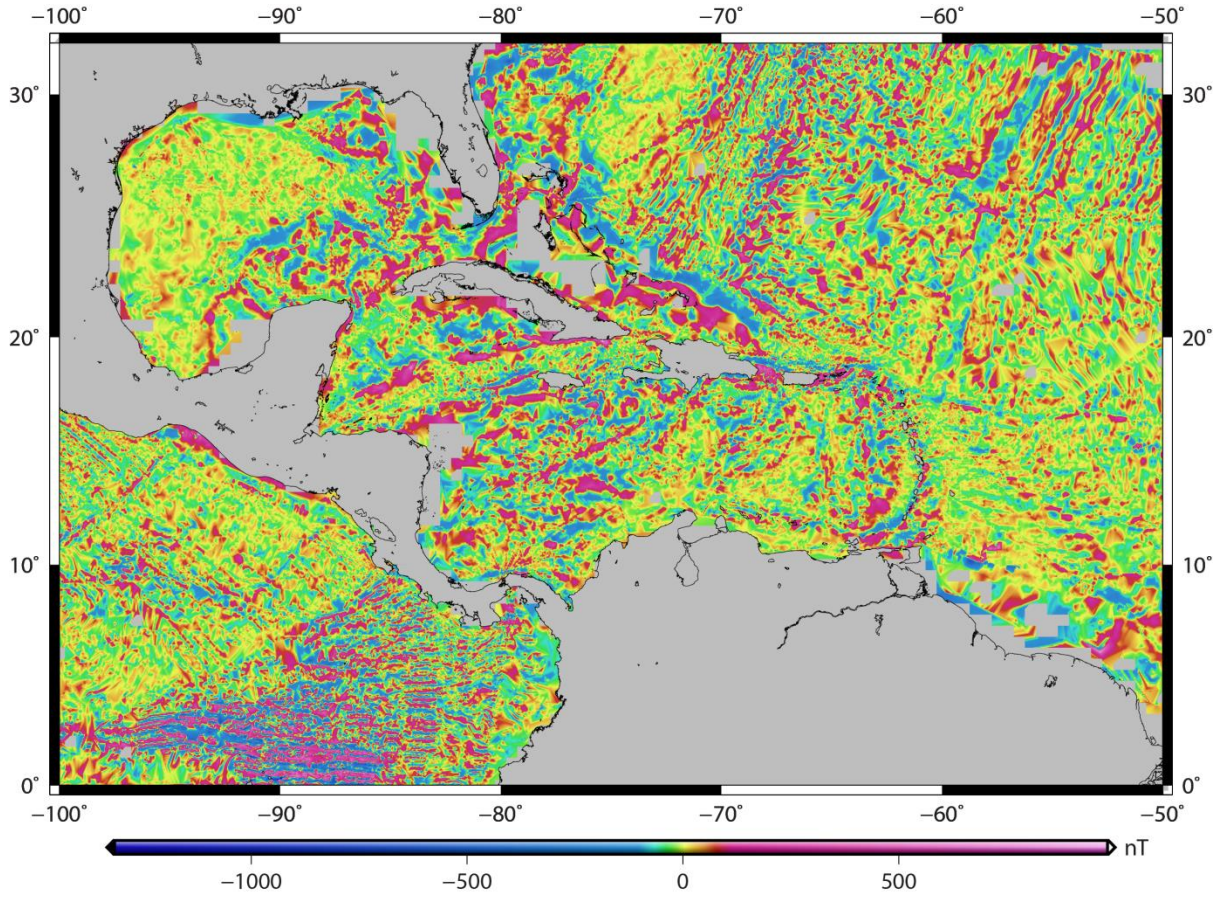
- *Okuma et al. (*IUGG-4623*):* **new acquisition in the northern Suruga Bay, central Japan**
- *Miligan et al. (pers. com.):* **updated compilation for Australia**
- *Litvinova et al. (pers. com.):* **updated compilation for Russia.**
- *Garcia et al., (IUGG26th A41p-287)***: magnetic anomaly map over the Caribbean plate.**
- *Ferraccioli et al., (IUGG-1820***): update of the Antarctic Digital Magnetic Anomaly Map**

Processing of data and new compilation



Ishihara et al. (IUGG-2819): "Compilation and leveling of a new global marine magnetic anomaly data set". **A complete reprocessing of the world marine data base was presented using a novel line levelling technique.**

Processing of data and new compilation



After Garcia et al., (IUGG26th A41p-287)

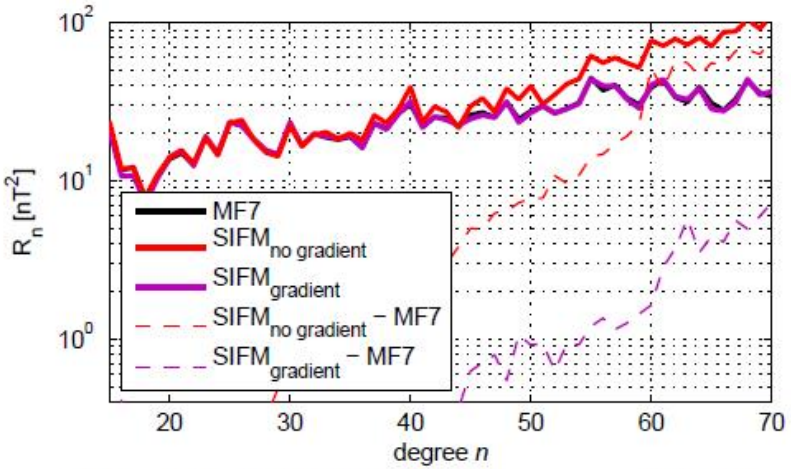
Regional magnetic anomaly interpretation

- *L. Besutiu et al. (*IUGG-0632*):* magnetic interpretation of East Carpathians.
- *Ferraccioli et al., (IUGG-1820)*: nice overview of magnetic interpretation in Antarctica
- *Catalan et al., (IUGG-0985)*: Curie isotherm map of Scotia Arc.
- *Martyshko et al.: Interpretation in Northern Eurasia.*
- *Pastore et al. (*IUGG-4006*): gravity and magnetic comparisons in Norway.*
- *Korte et al. (IUGG-2110): gravity and magnetic comparisons in South Africa and Germany.*

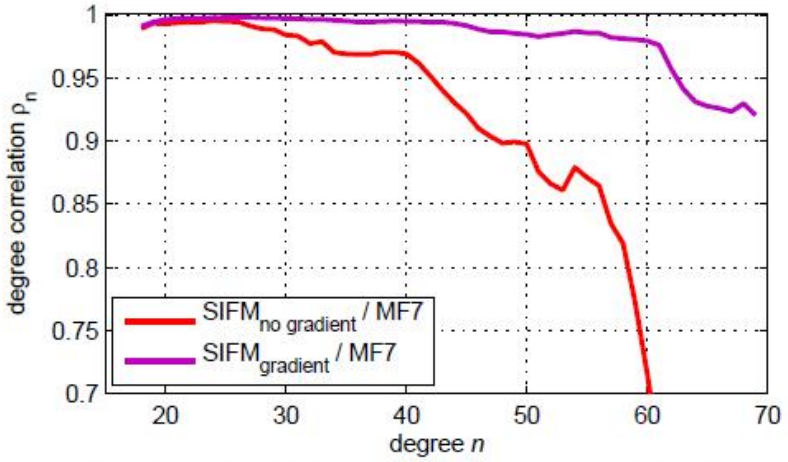
Satellite data processing and model

Swarm gradients for lithospheric field mapping

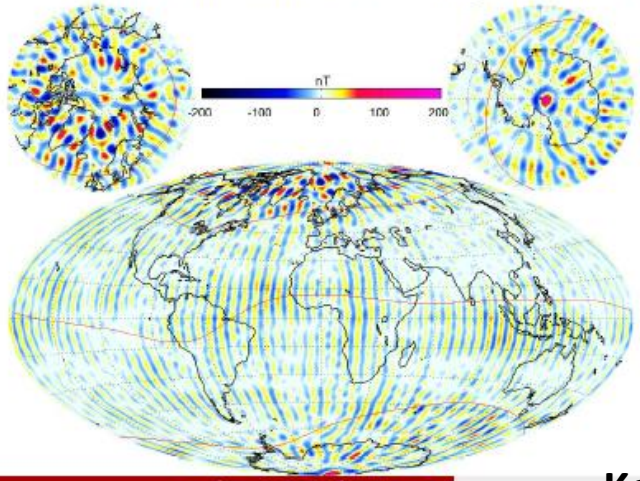
Power spectrum



Degree correlation



ΔB_r at ground between $\mathrm{SIFM}_{\text{no gradient}}$ and MF7



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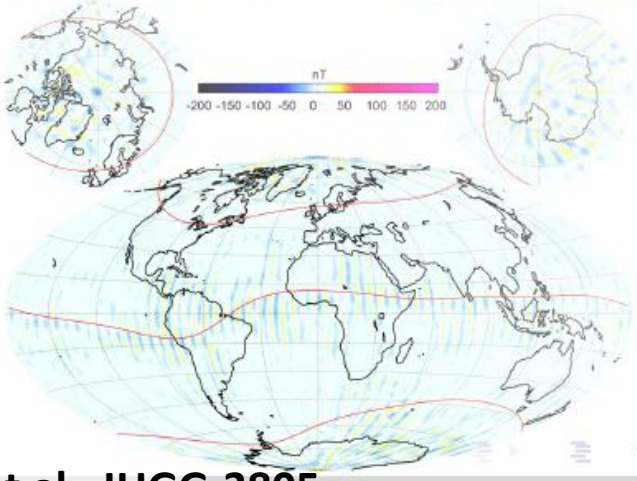
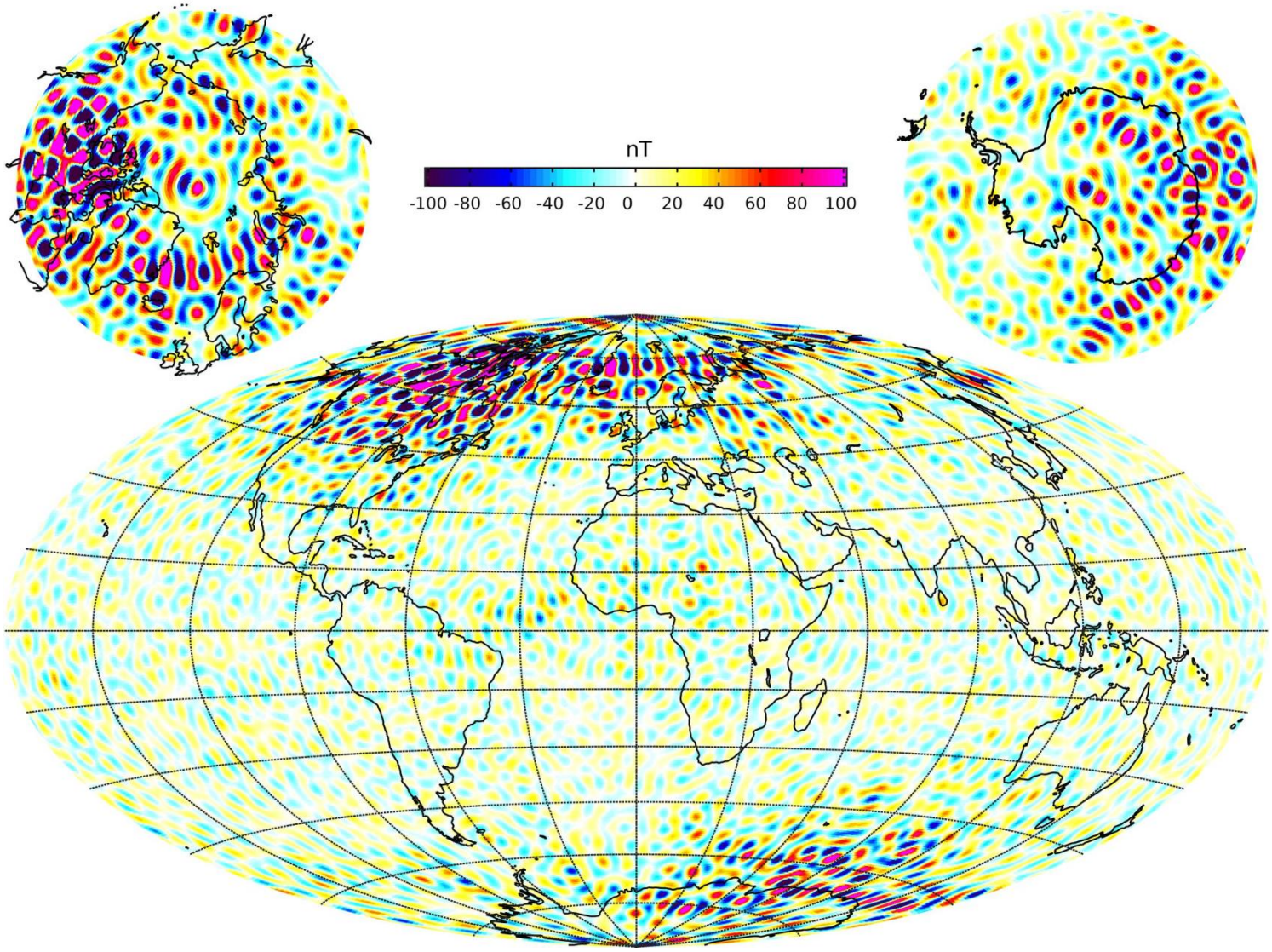


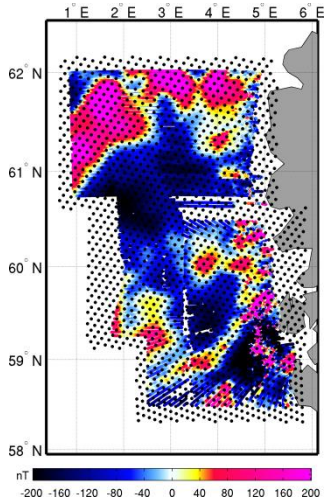
Kotsiaros et al., IUGG-3805

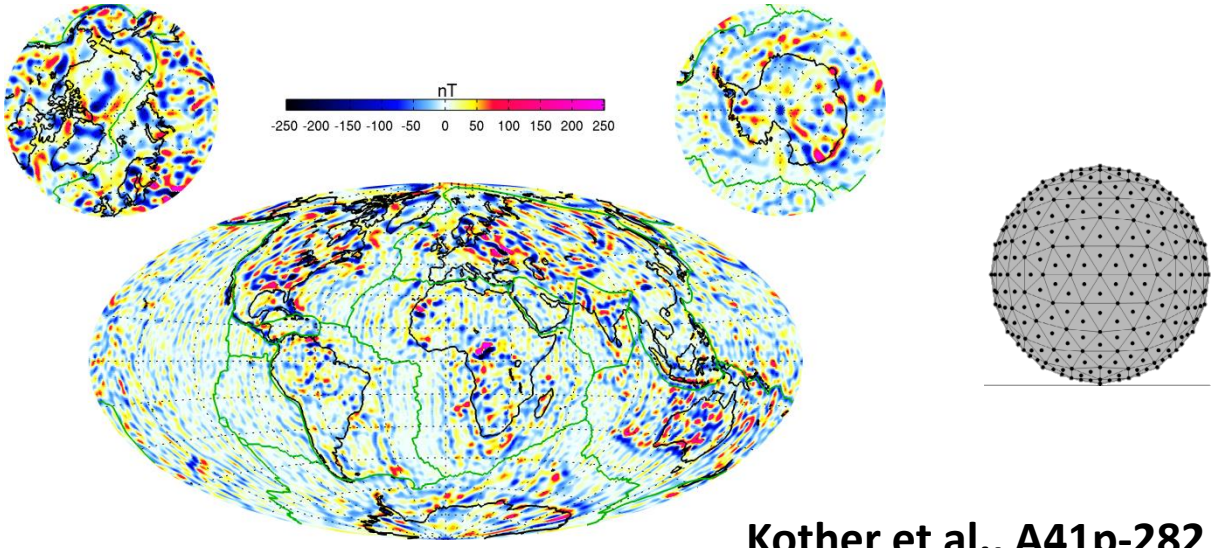
Satellite data processing and model



Thebault et al., IUGG-3215

Satellite data processing and model

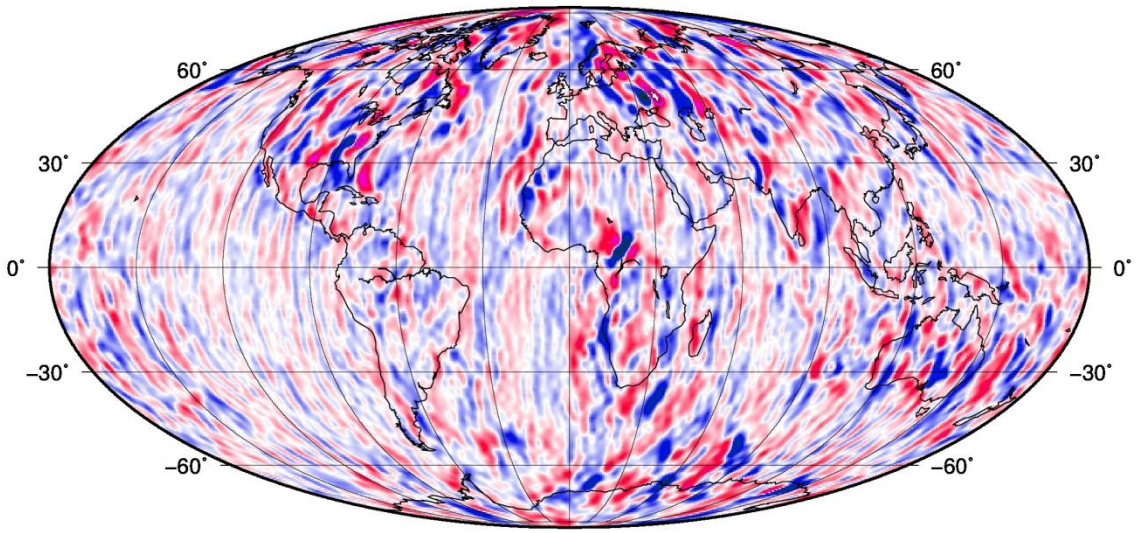


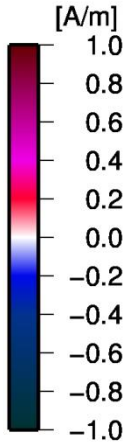


Kother et al., A41p-282

- **But also:**
- *Oliveira Jr et al. (*A41p-280*):* total magnetization direction of approximately spherical bodies
- *Jiang et al. (*A41p-275*): regional modelling with Taylor polynomials*

Global magnetization map



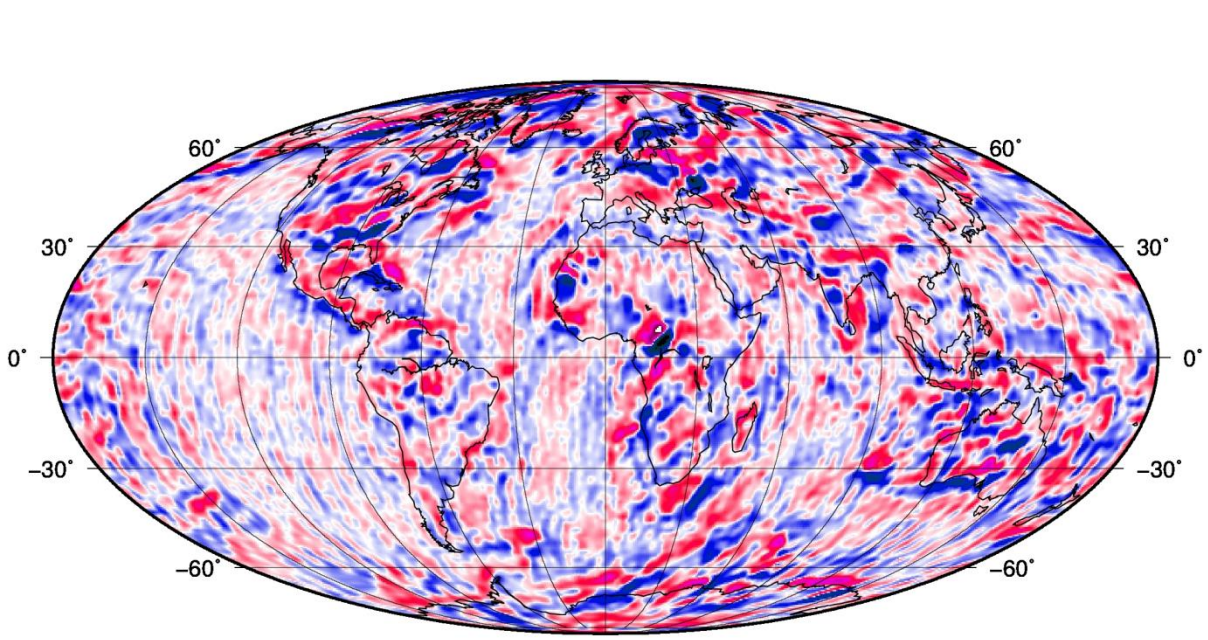


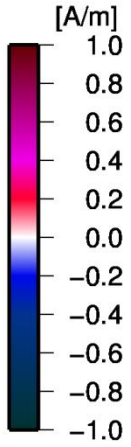
Vervelidou et al., A41p-285

Also:

*Baykiev et al. (*IUGG-1676*):* **Sensitivity of satellite and airborne data to synthetic models of magnetization**

Global magnetization map





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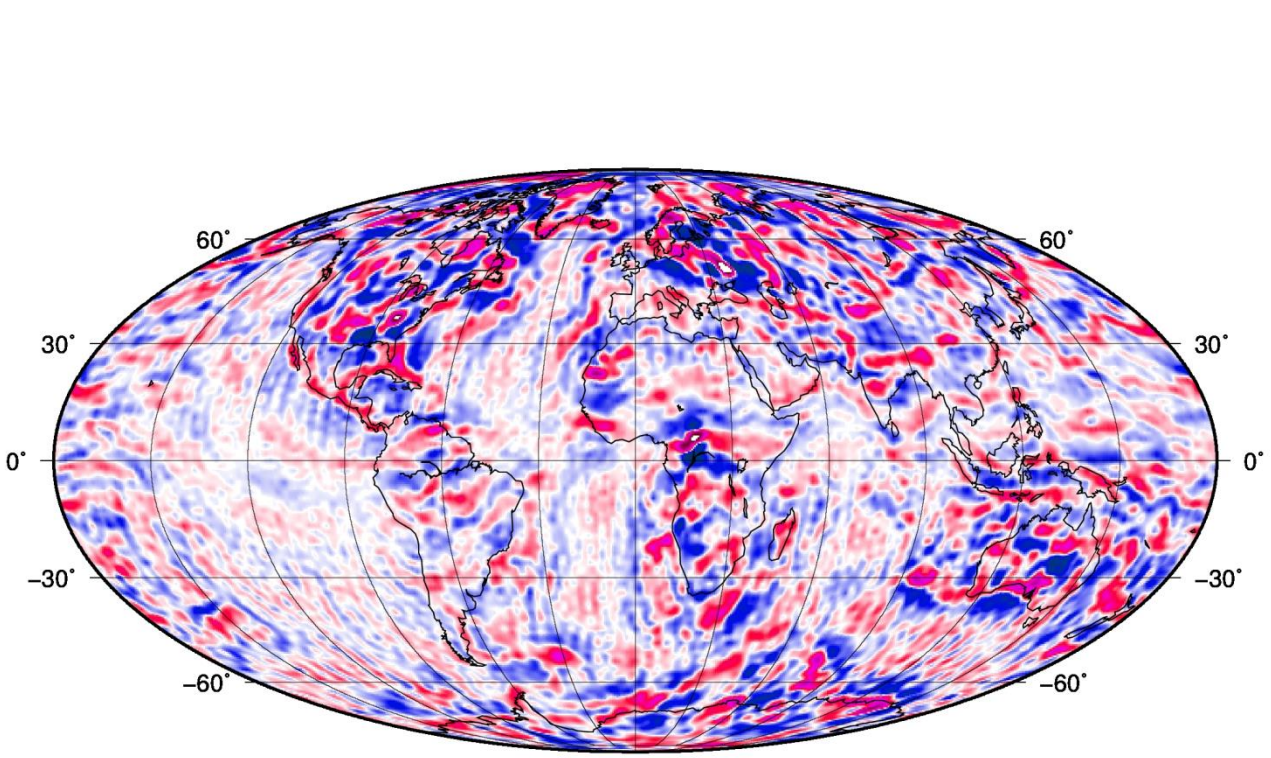

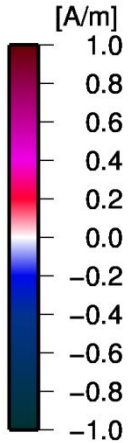

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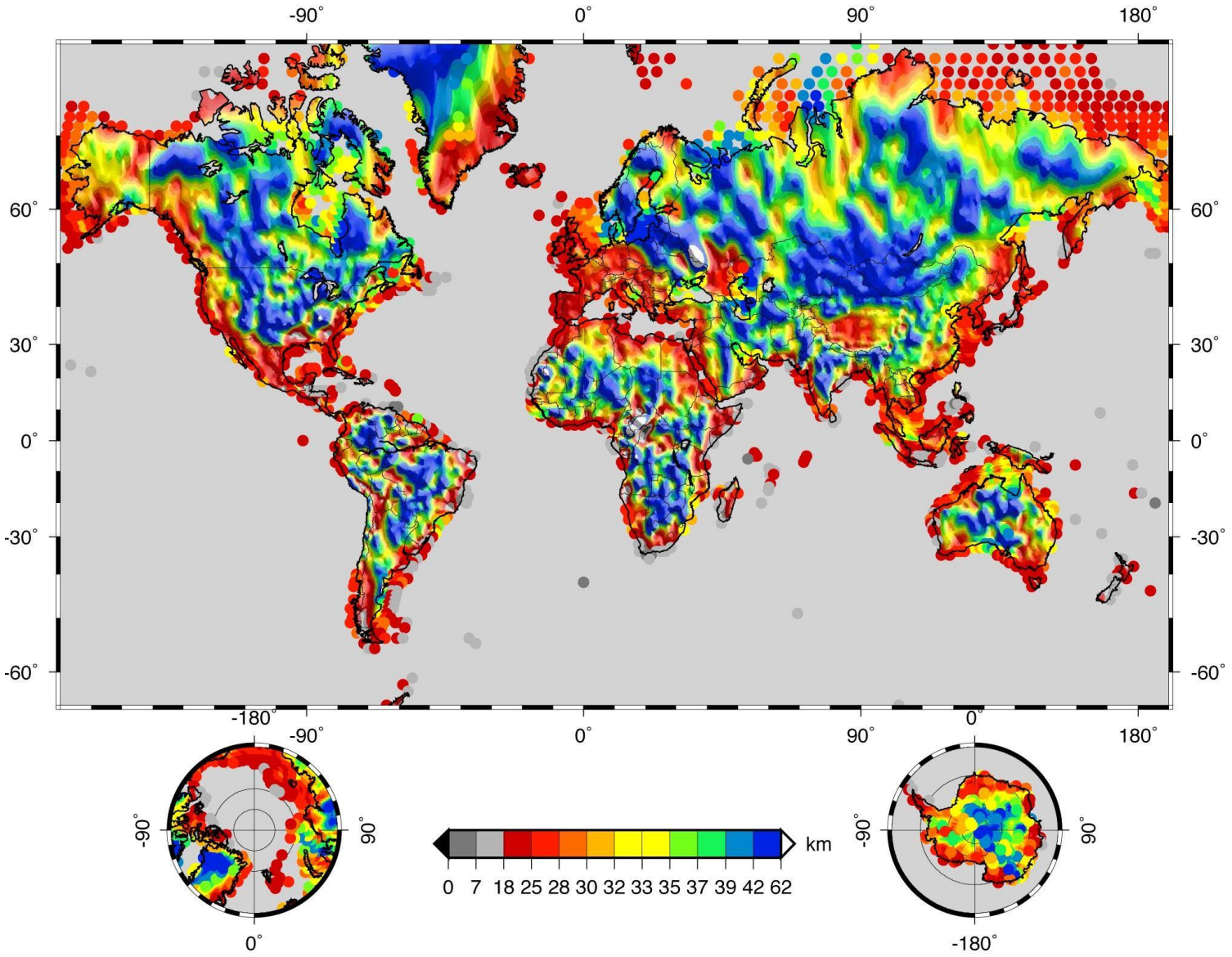
*Baykiev et al. (*IUGG-1676*):* **Sensitivity of satellite and airborne data to synthetic models of magnetization**

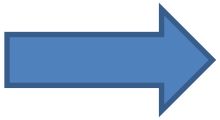
Global susceptibility map



Purucker et al., IUGG-2695

Summary

- The sessions about “lithospheric magnetic field anomalies” was successful (14 talks, 17 posters).
- Studies range from local to global scales.
- A very good coordination between scientists building regional compilations and WDMAM task force.



The future is bright !