International Geomagnetic Reference Field : 11th Generation

IGRF-11 Task Force, IAGA Div V-Mod

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Report at Fall AGU Meeting, 2009

Teams contributing candidate models to IGRF-11

- IGRF is a global model of Earth's large scale internal magnetic field a revised every 5 years by an IAGA task force of field modellers.
- In the latest revision (11th generation) the teams submitting candidate models were lead by the following 8 institutions:
  - NGDC/NOAA USA (Led by S. Maus)
  - IPGP, France (Led by E. Thébault)
  - DTU Space, Denmark (Led by N. Olsen)
  - GFZ, Germany, (Led by V. Lesur)
  - IZMIRAN, Russia, (Led by T. Bondar)
  - EOST, France, (Led by A. Chambodut)
  - BGS, U.K., (Led by B. Hamilton)
  - NASA, GSFC, USA, (Led by W. Kuang)
- Candidates received by early November 2009 for:
  - Internal field (main field) in epoch 2005.0 to degree and order 13.
  - Internal field (main field) in epoch 2010.0 to degree and order 13.
  - Predicted average SV for 2010.0-2015.0 to degree and order 8.

Data sources

- All teams utilized data from the satellite CHAMP, some also used data from the Oersted and SAC-C satellites

Fig 1: CHAMP satllite operated by GFZ, Potsdam.

- Many teams also used observatory hourly, monthly or annual means and/or used observatory-derived indices for satellite data selection.

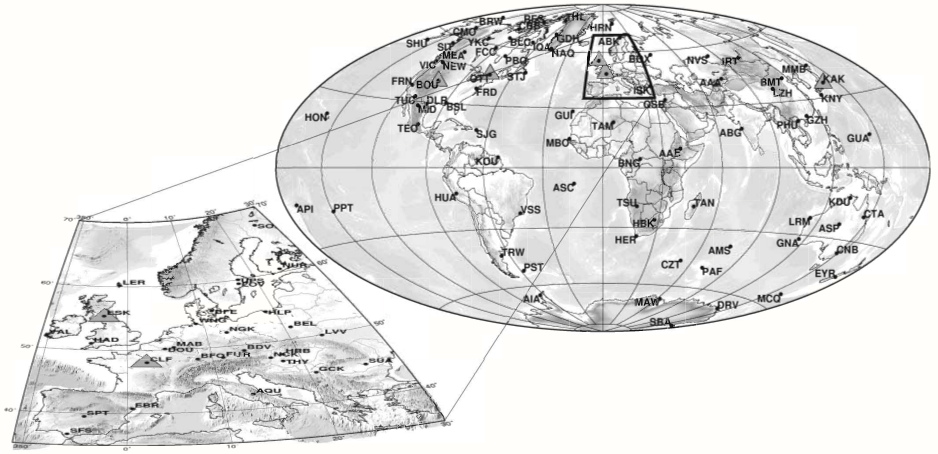

Fig 2: Worldwide network of INTERMAGNET observatories.

Evaluation and weighting of candidates in IGRF-11

- Evalautions and assessment carried out by C.Finlay, S. Maus, F. Lowes, N. Olsen, E. Thébault, C. Beggan, V. Lesur, M. Hamoudi, C. Beggan, B. Langlais, A. Chulliat and W. Kuang.
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- **DGRF epoch 2005**
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- **IGRF epoch 2010**
  Weighted mean of 7 candidates:
  (DTU Space, NGDC/NOAA, GFZ, BGS, IPGP) x 1
  (EOST,IZMIRAN) x 1/4
  (coefficients g10, h11 of DTU space candidate allocated zero weight)

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- **Predictive SV for epoch 2010-2015**
  Weighted mean of 8 candidates:
  (NGDC/NOAA, BGS, IZMIRAN, IPGP, NASA GSFC) x 1
  (DTU Space, EOST, GFZ) x 1/2
  (coefficients g10, h11 of DTU space candidate allocated zero weight)

DGRF for Epoch 2005

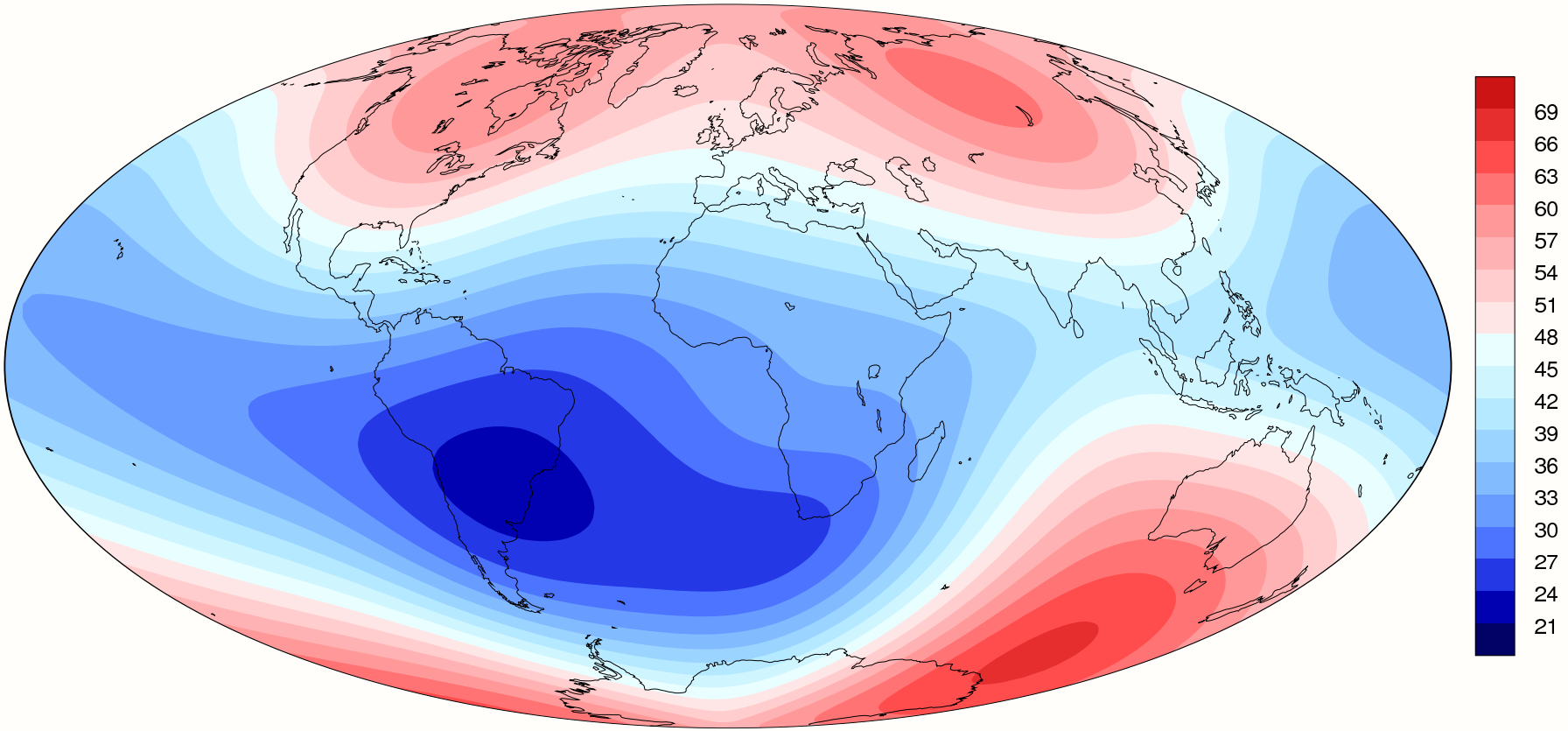

Fig 3: Field intensity (F) at Earth's surface in 2005 : units micro Tesla.

- Error in the mean model (DGRF in 2005) computed from the 3 contributing candidates is very small: 1.02nT.
- DGRF-2005 is of such unprecendented accuracy that final model is quoted to 0.01nT to avoid rounding errors.
- The high quality of DGRF-2005 stems from the availability of high quality satllite data, particularly from CHAMP.

IGRF for Epoch 2010

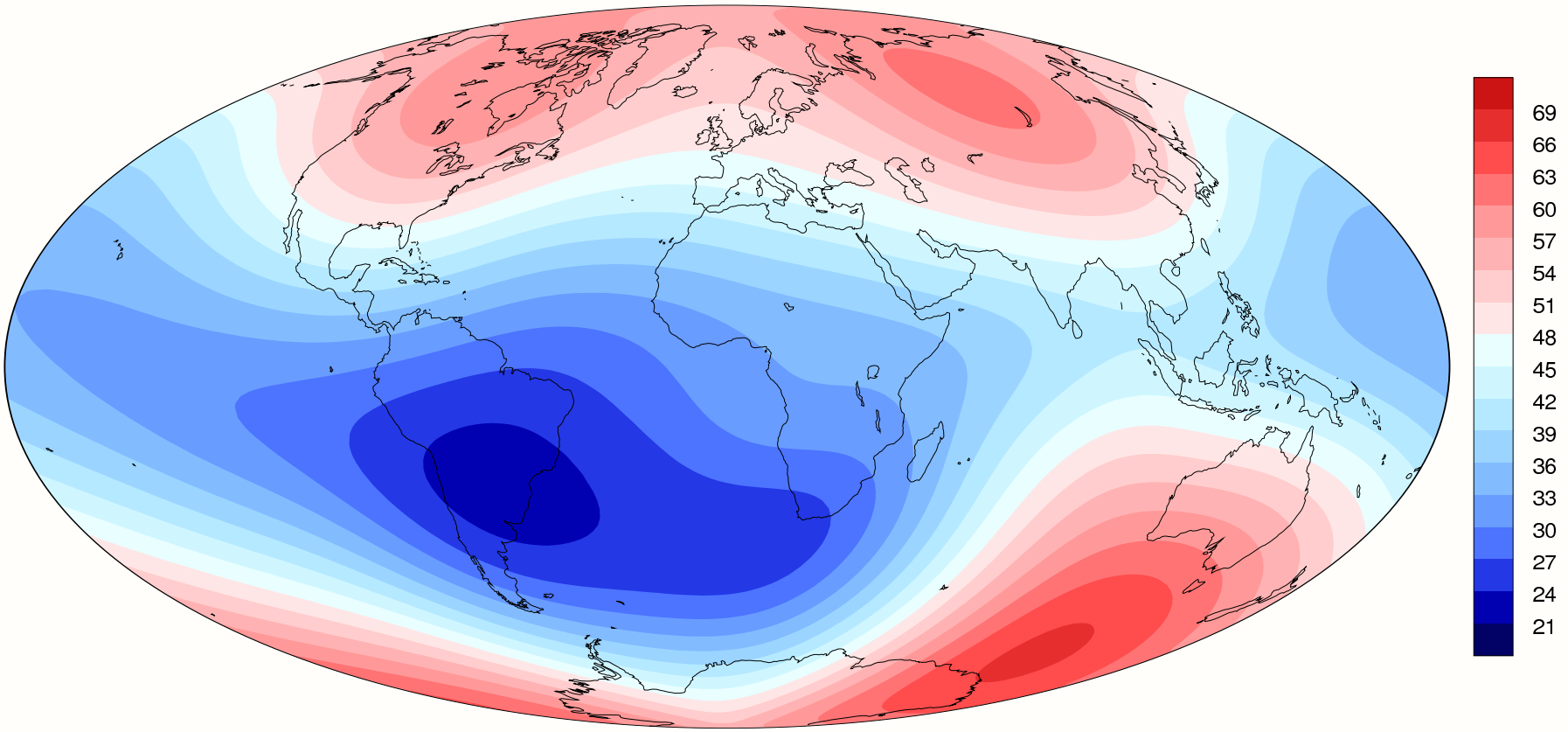

Fig 4: Field intensity (F)at Earth's surface in 2010 : units micro Tesla.

IGRF for Epoch 2010

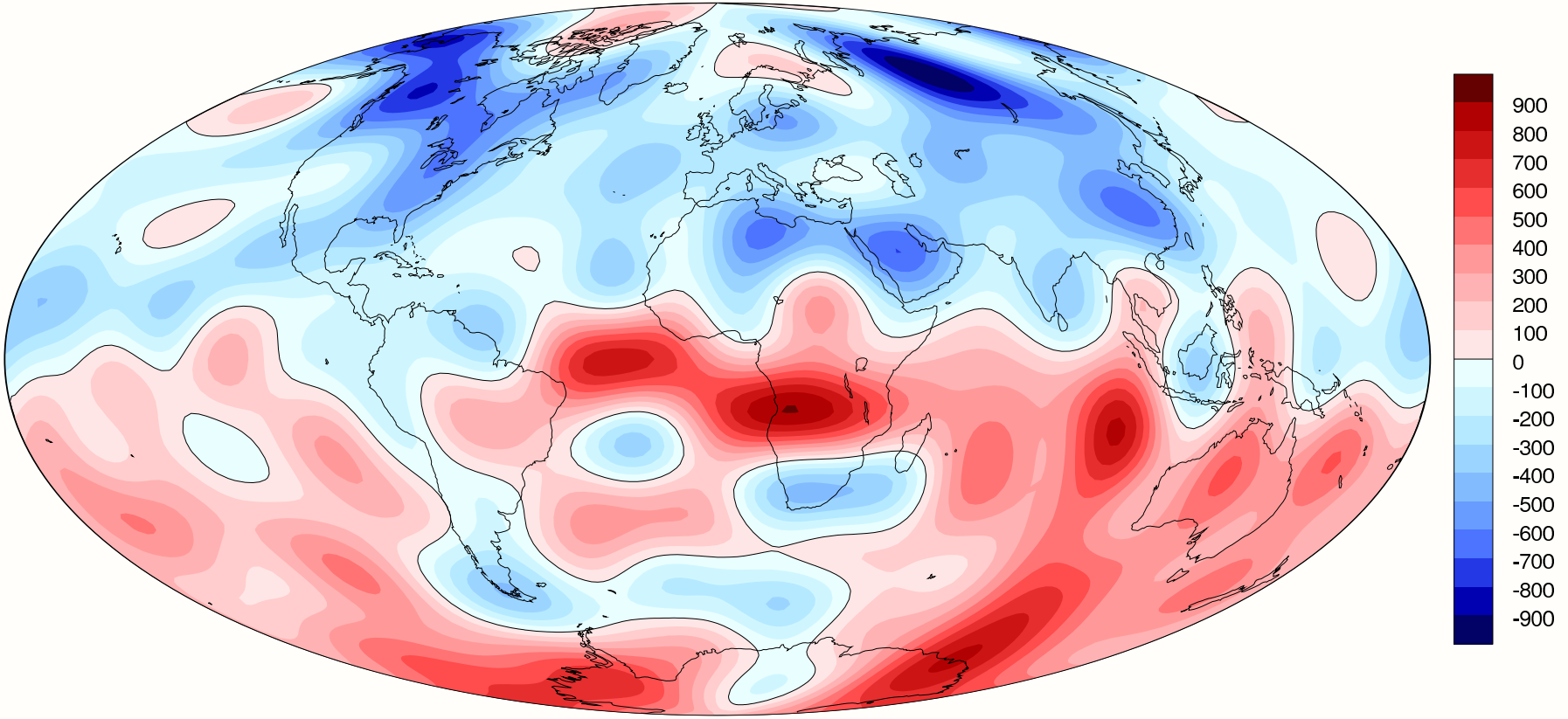

Fig 5: Radial field (B_r) at CMB in 2010 : units micro Tesla.

SV for Epoch 2010-2015

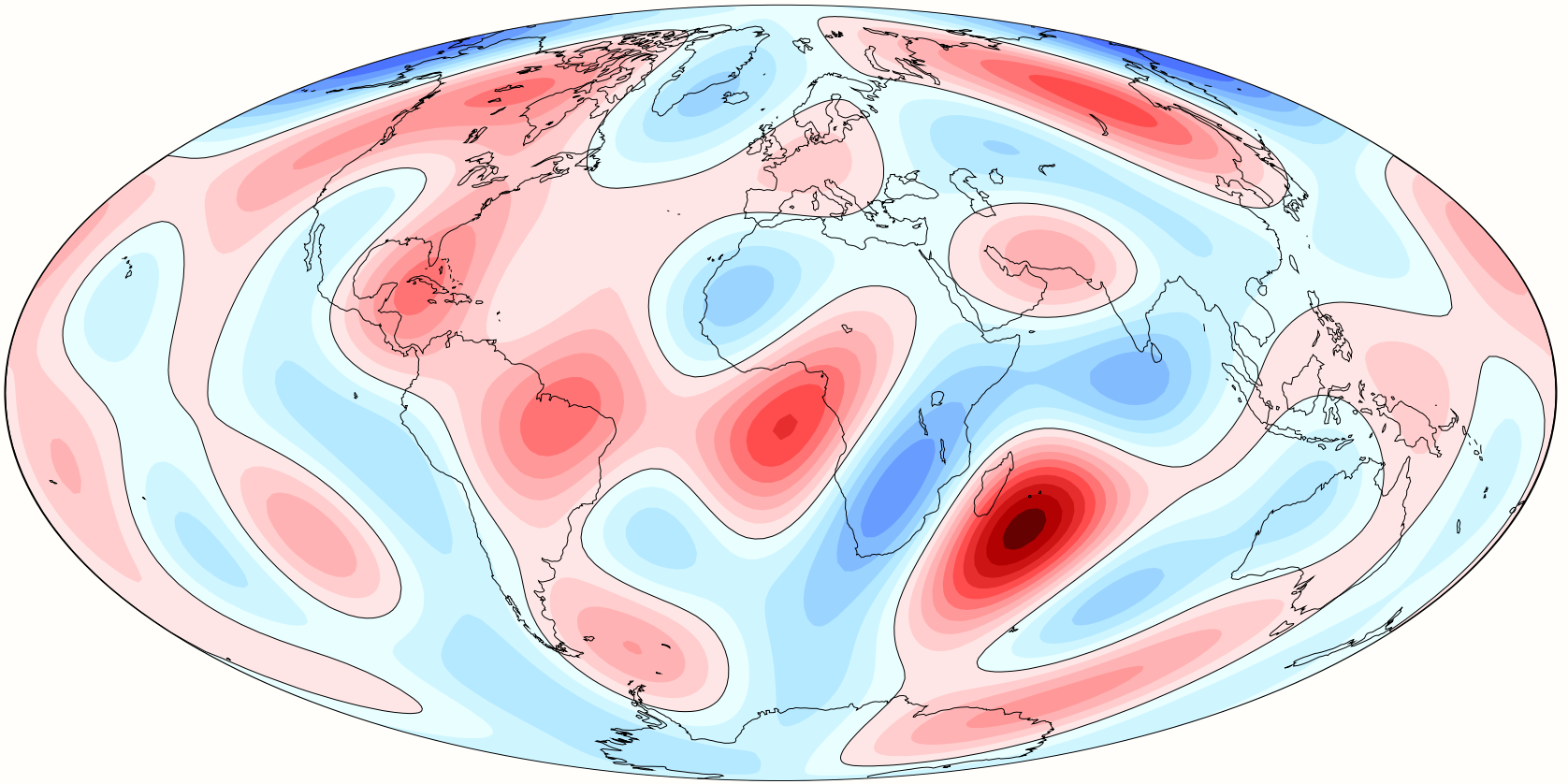

Fig 6: Radial Field Change($\partial B_r/\partial t$) at CMB 2010-2016 : units micro Tesla / yr.

Summary

- IGRF-11 has been finalized on schedule and will be available online before the end of 2009.
- The new spherical harmonic coefficients will be accessible from the webpage http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html.
- Updated software will follow in January 2010.
- Candidate models and evaluations will also be made available online.
- A special issue of Earth, Planets and Space devoted to IGRF-11 is now in preparation.