EMAG2: Earth Magnetic Anomaly Grid

Presented by Spock and Minnie Mouse

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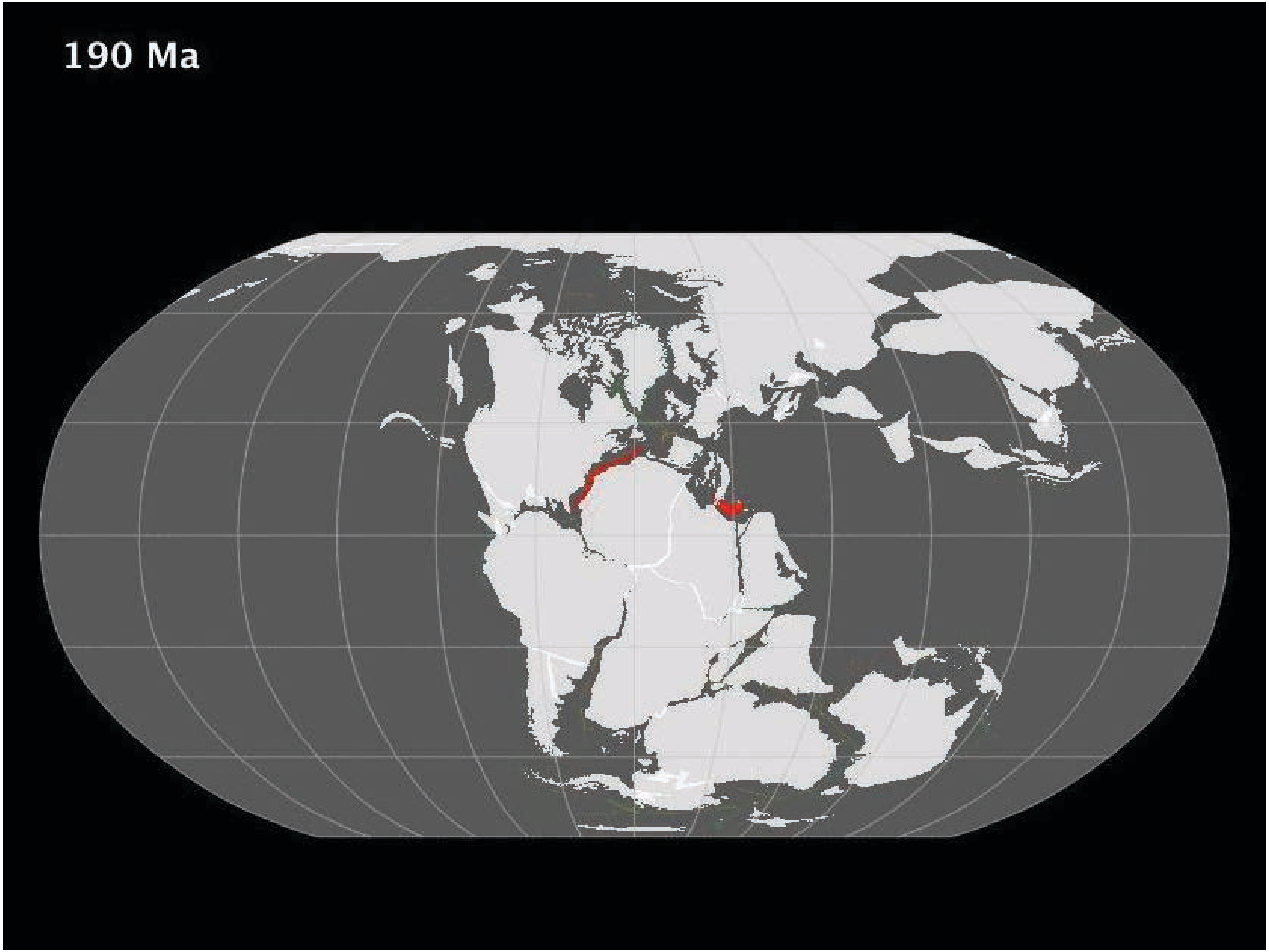
the paleomag odd couple)

Outline

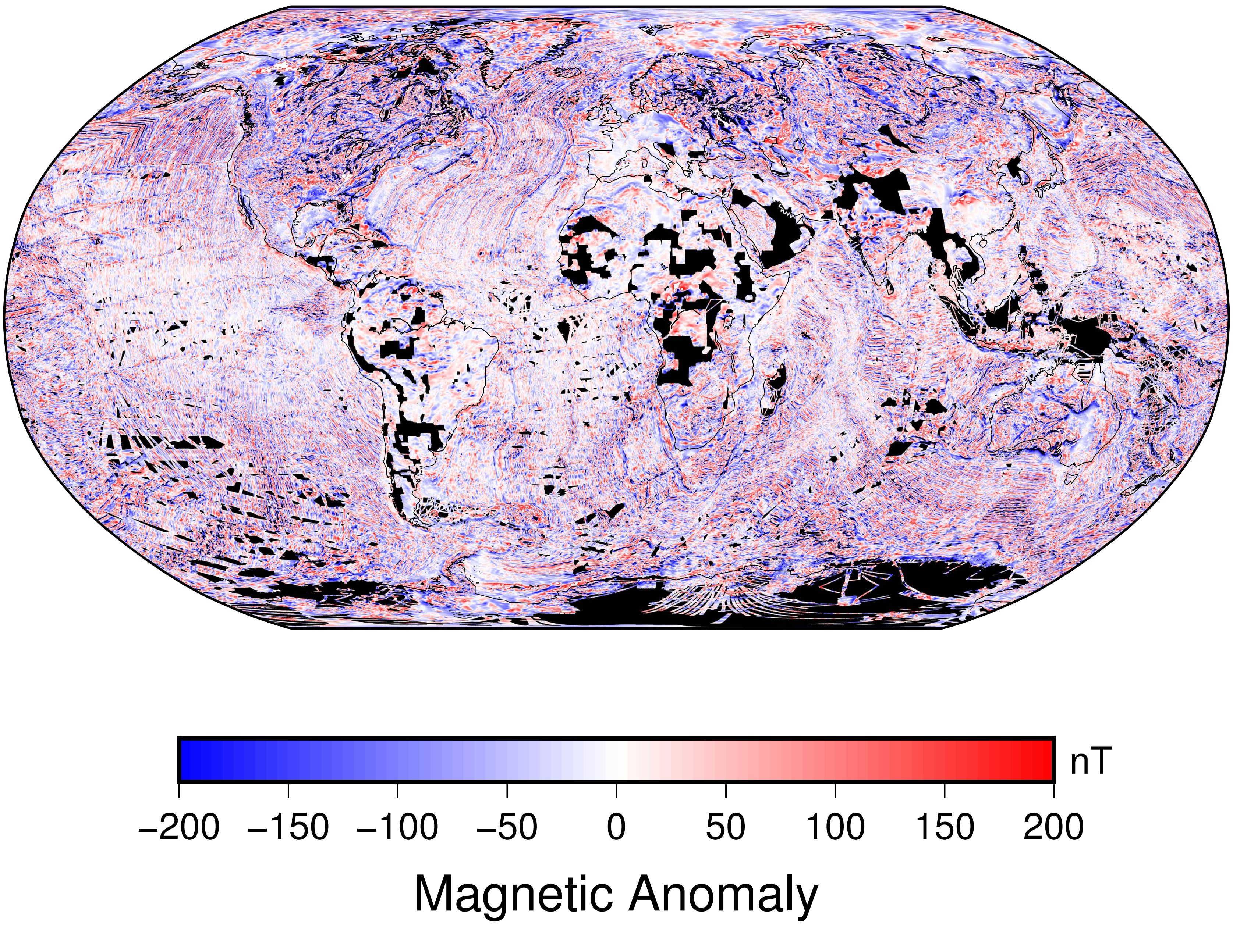
- Intro to Magnetic Anomalies & EMAG2
- Limitations
- Upward Continuation
  - Examples
- Edge Effects
- Applications of EMAG2


190 Ma

EMAG2: Earth Magnetic Anomaly Grid

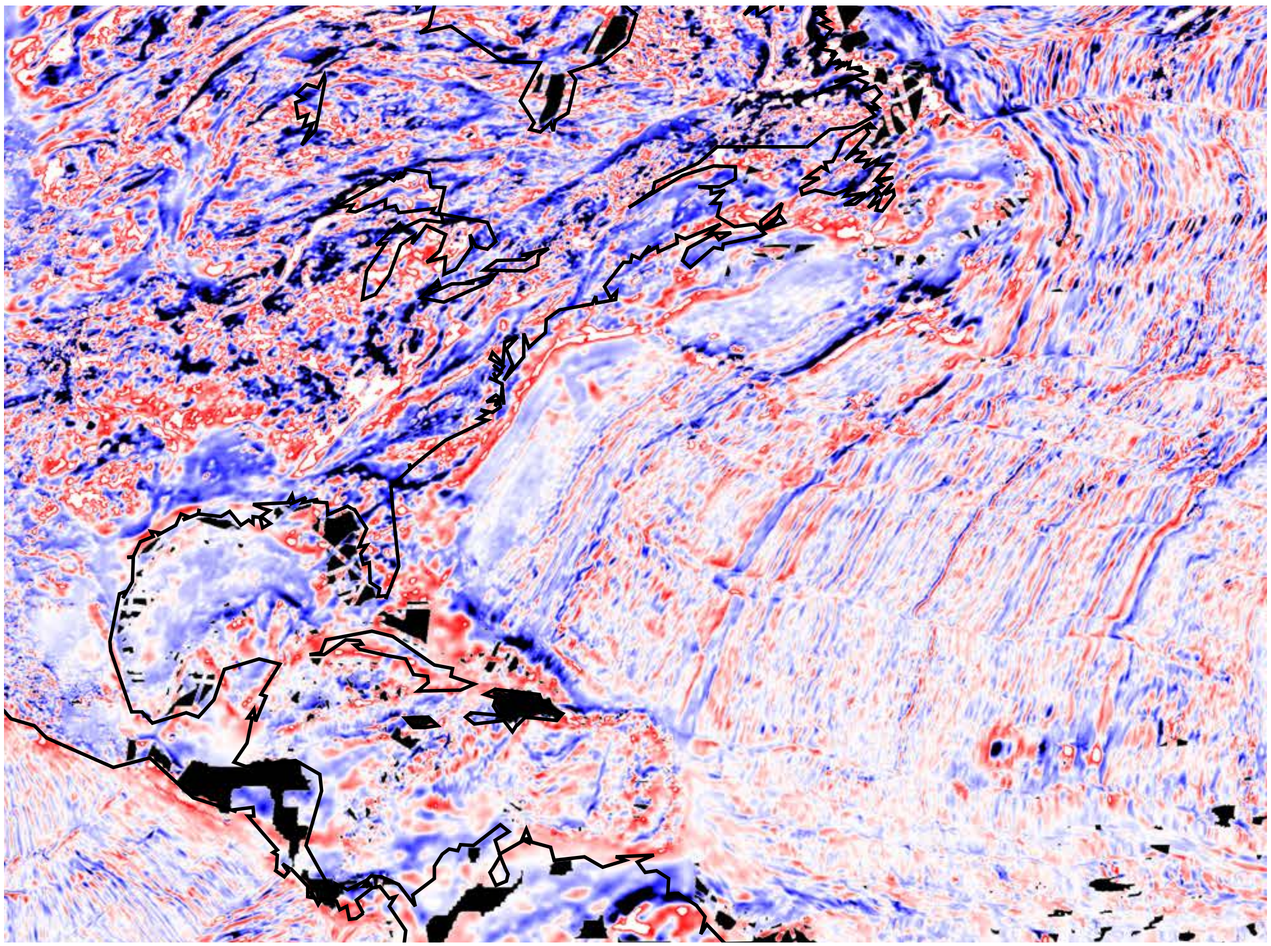
- 2 arcmin resolution
- 4km above geoid
- Shipborne and airborne data
- An oceanic crustal age model was used for extrapolation
- The longest wavelengths (>330 km) were replaced with the latest CHAMP satellite magnetic field model MF6

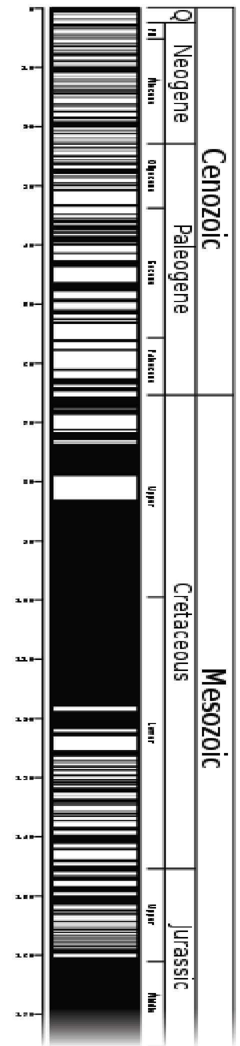
EMAG 2



Limits on Mapping Ocean Anomalies

- Smoothed data makes most magnetic chrons unrecognizable





Upward Continuation

What is the observed magnetic field for a given height z above the surface?

$$A\left(\vec{k},z\right)=A\left(\vec{k},0\right)e^{-2\pi\left|\vec{k}\right|z}$$

- A= Magnetic field reading
- wavenumber $\vec{k}=\left(k_x,k_y\right)$ or $\left(\frac{1}{\lambda_x},\frac{1}{\lambda_y}\right)$
- $\left|\vec{k}\right|=\sqrt{k_x^2+k_y^2}$

Example:

$A\left(\vec{k},0\right)=50nT$

$\lambda=8km$

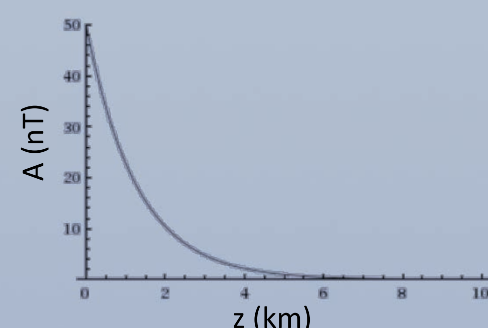
$k=.125km^{-1}$

$z=100m$

$A\left(.125,0.1\right)=50e^{2\pi(.125)0.1}=46.22nT$

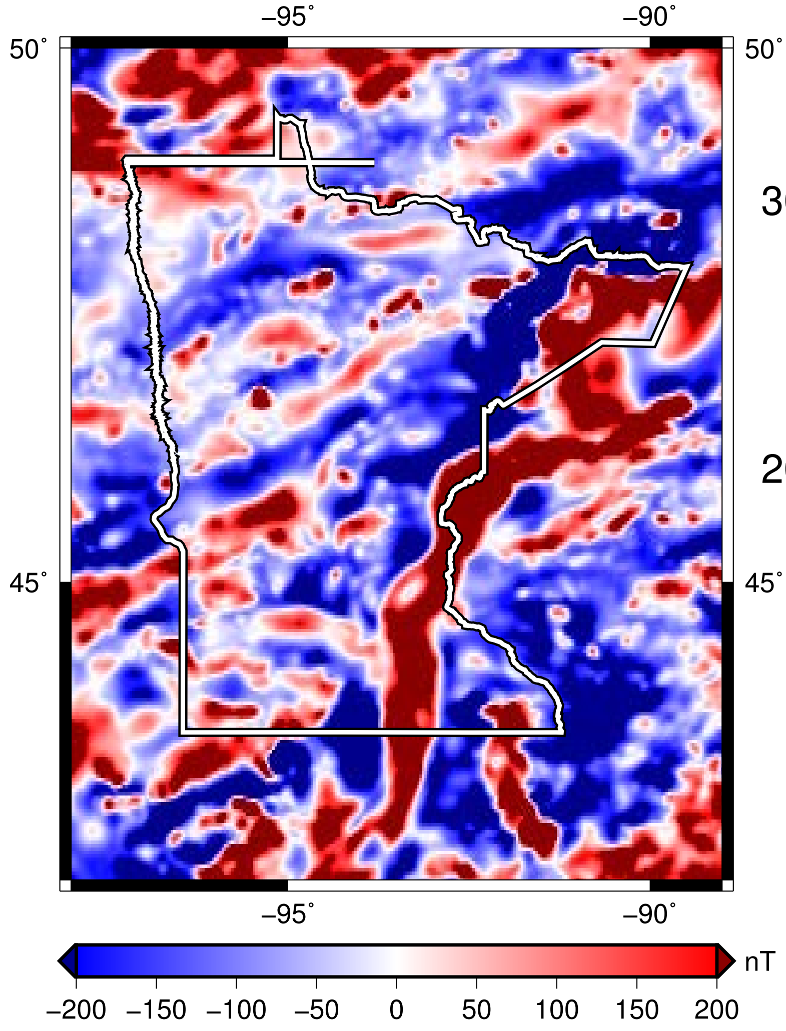
$z=1km$

$A\left(.125,1\right)=50e^{2\pi(.125)1}=22.79nT$

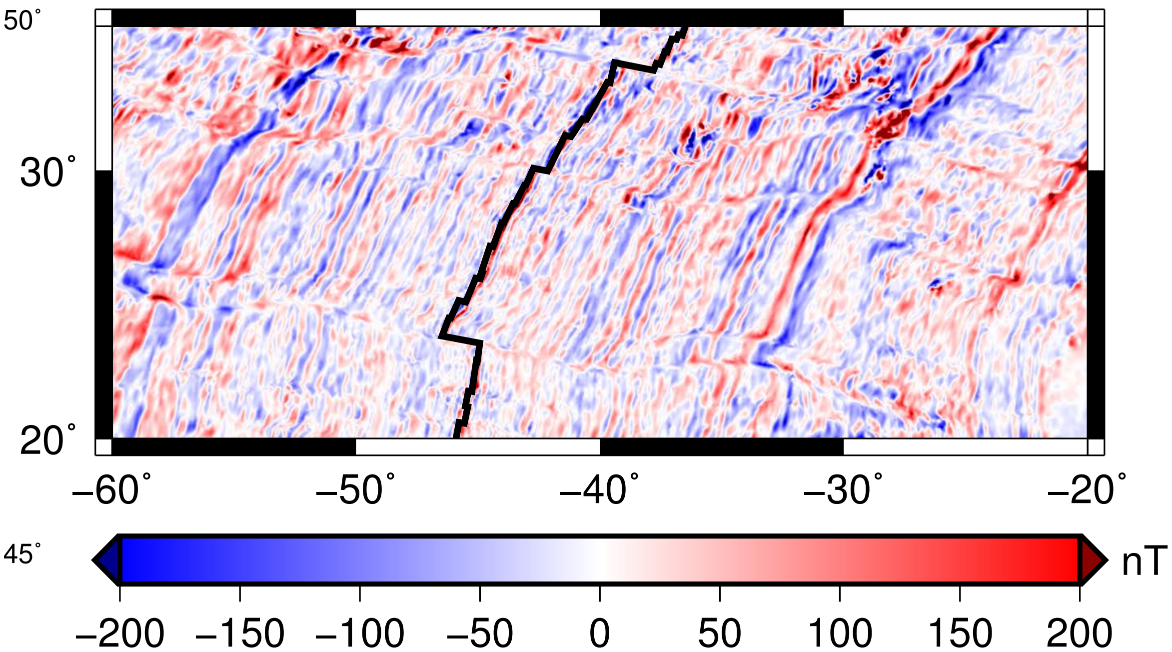


Example

Minnesota



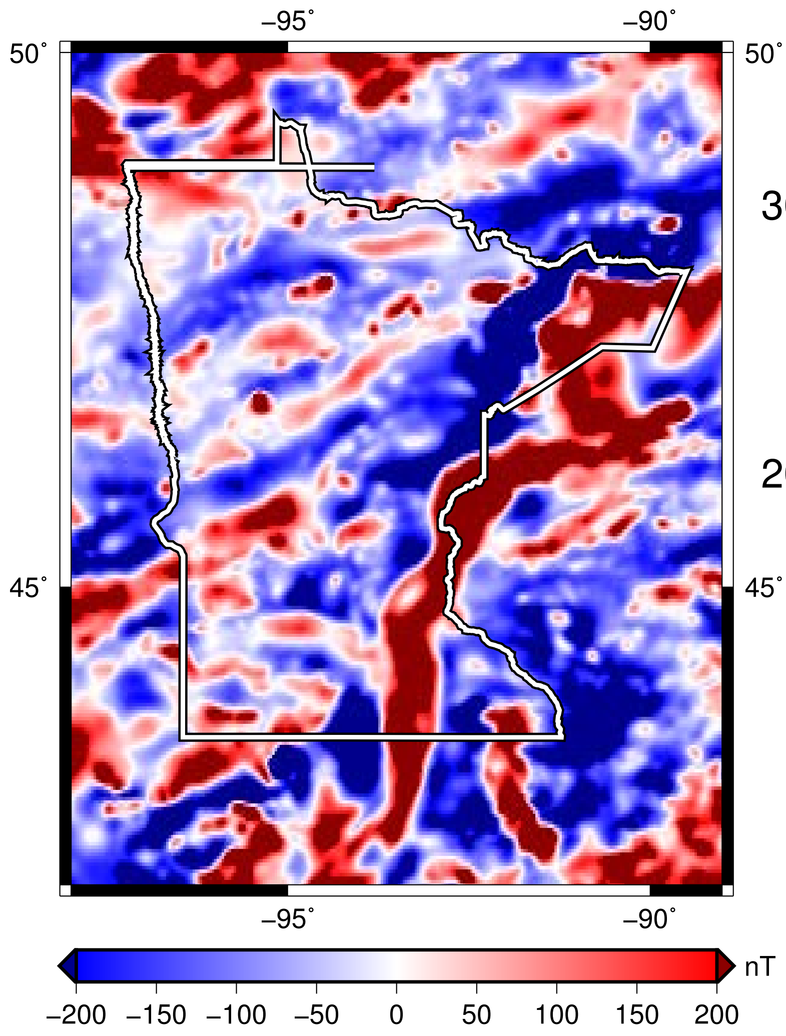
Mid Atlantic Ridge



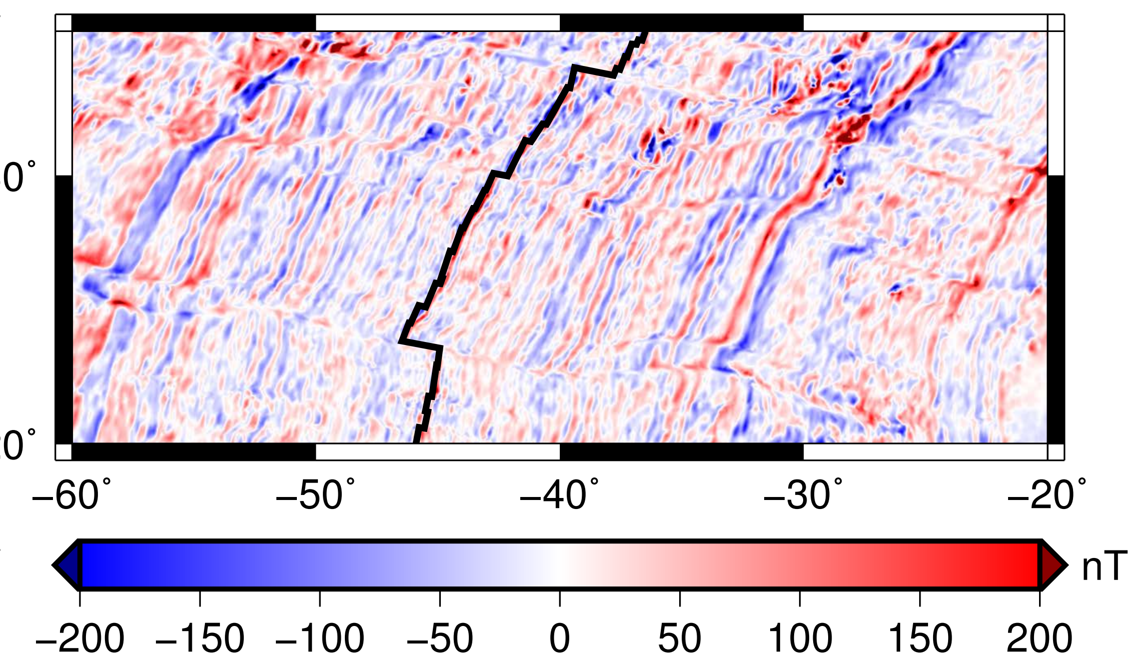
z = 0 km

Example

Minnesota



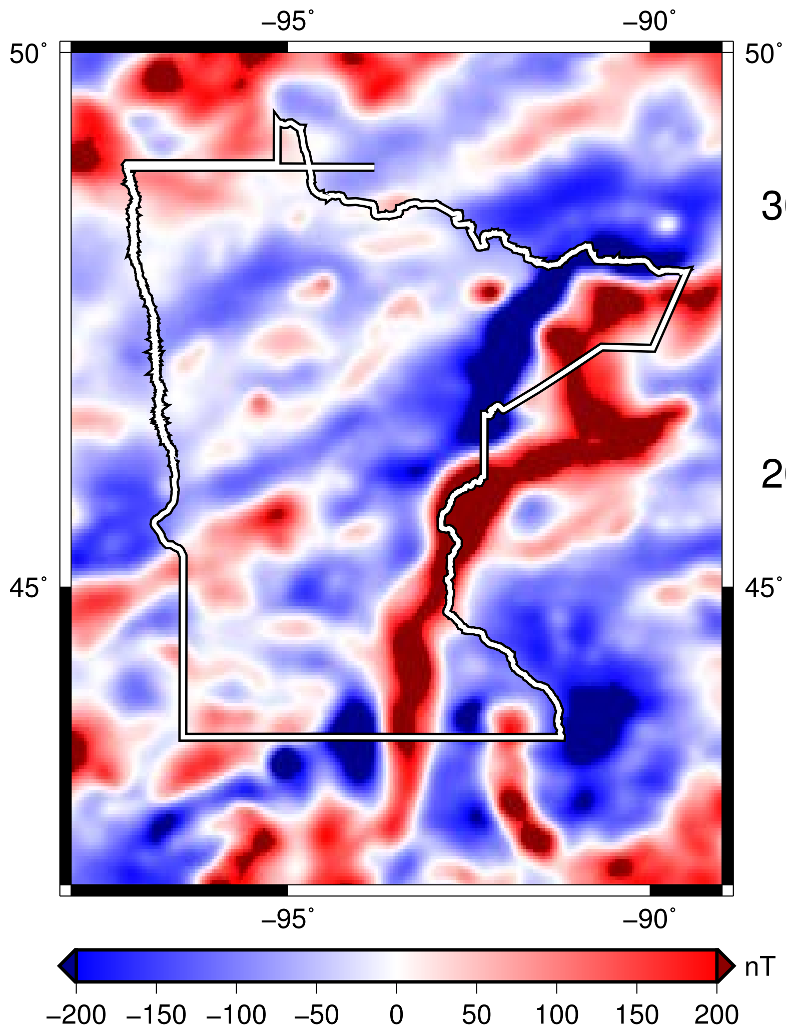
Mid Atlantic Ridge



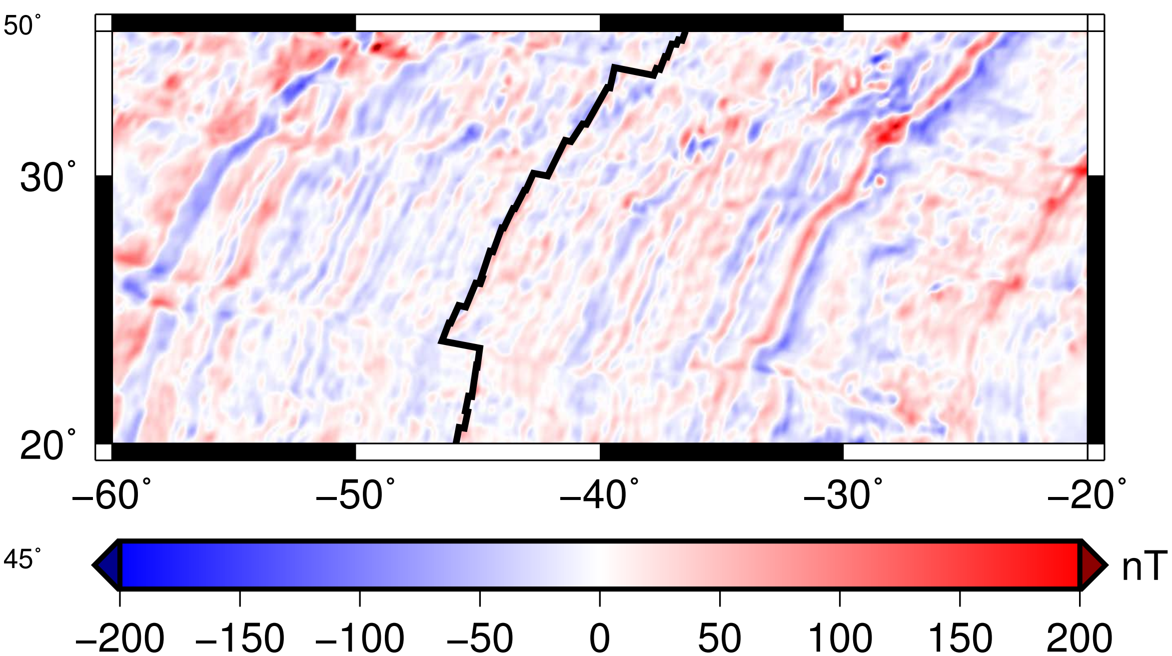
z = 1 km

Example

Minnesota



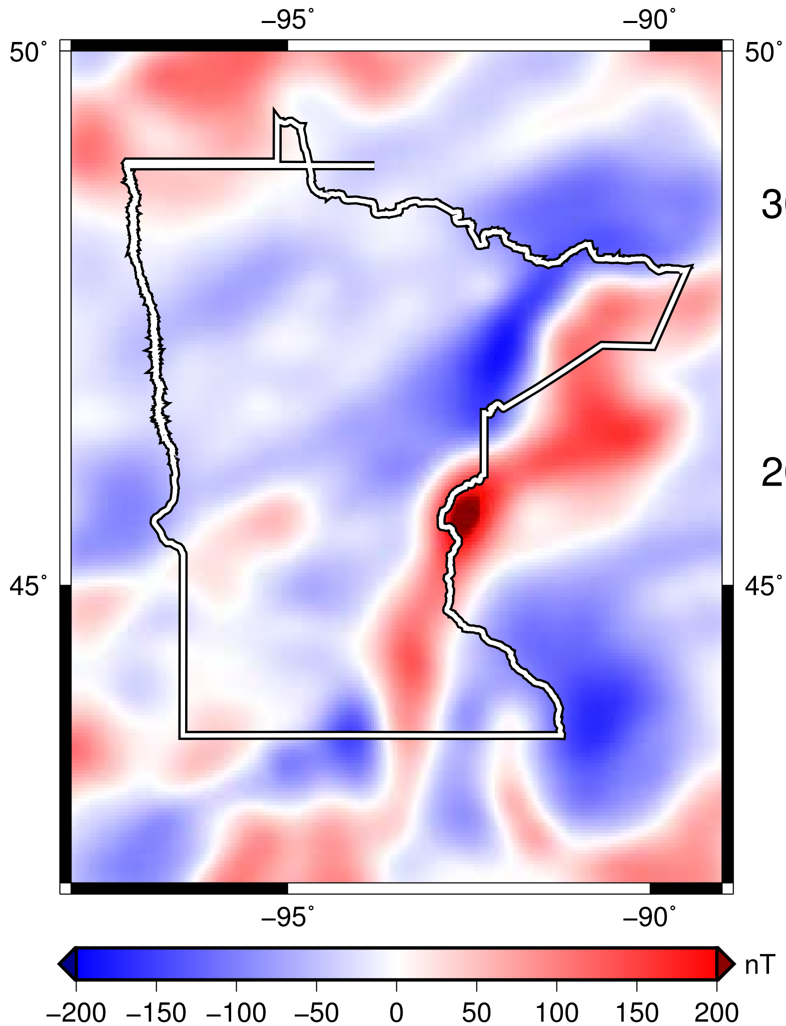
Mid Atlantic Ridge



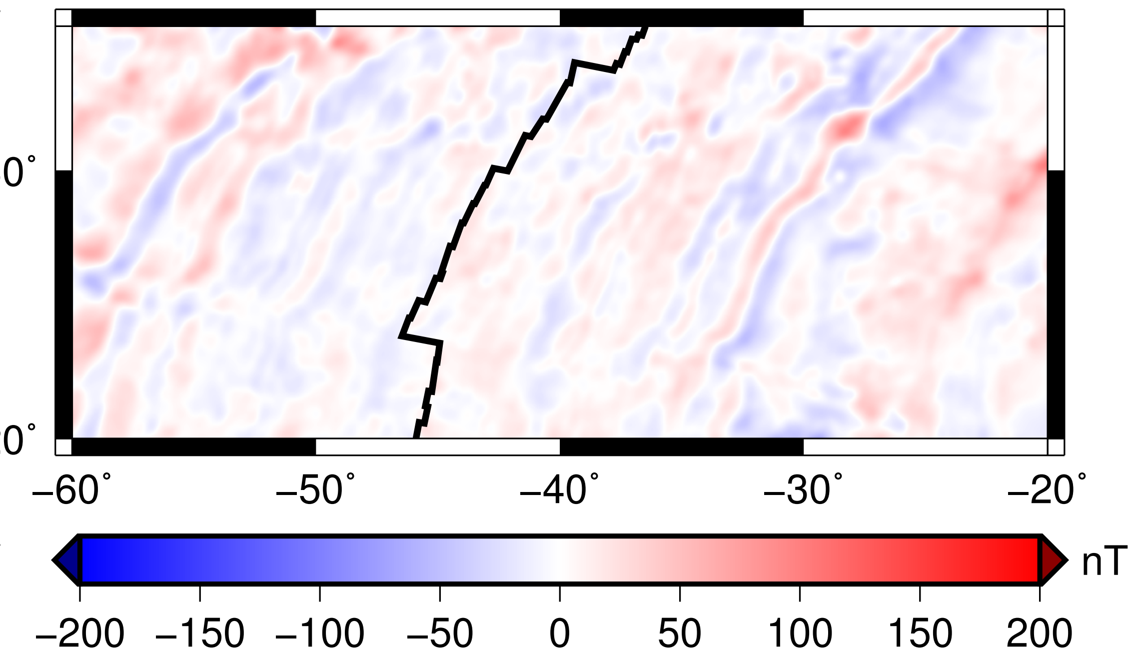
z = 10 km

Example

Minnesota



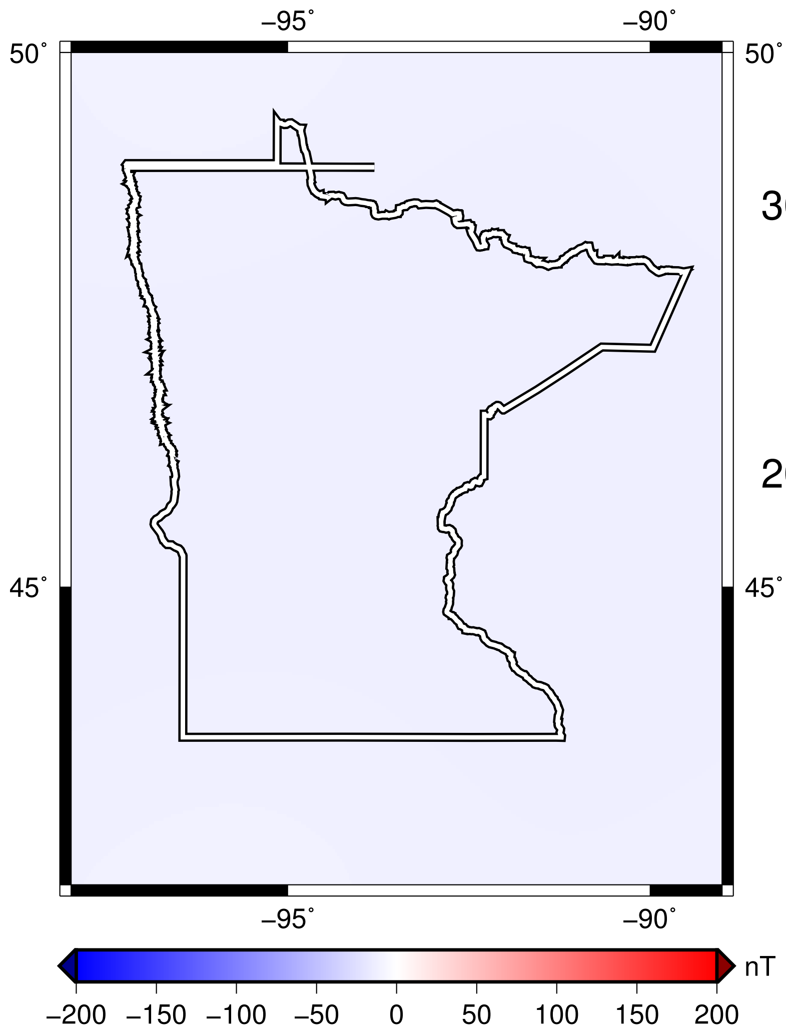
Mid Atlantic Ridge



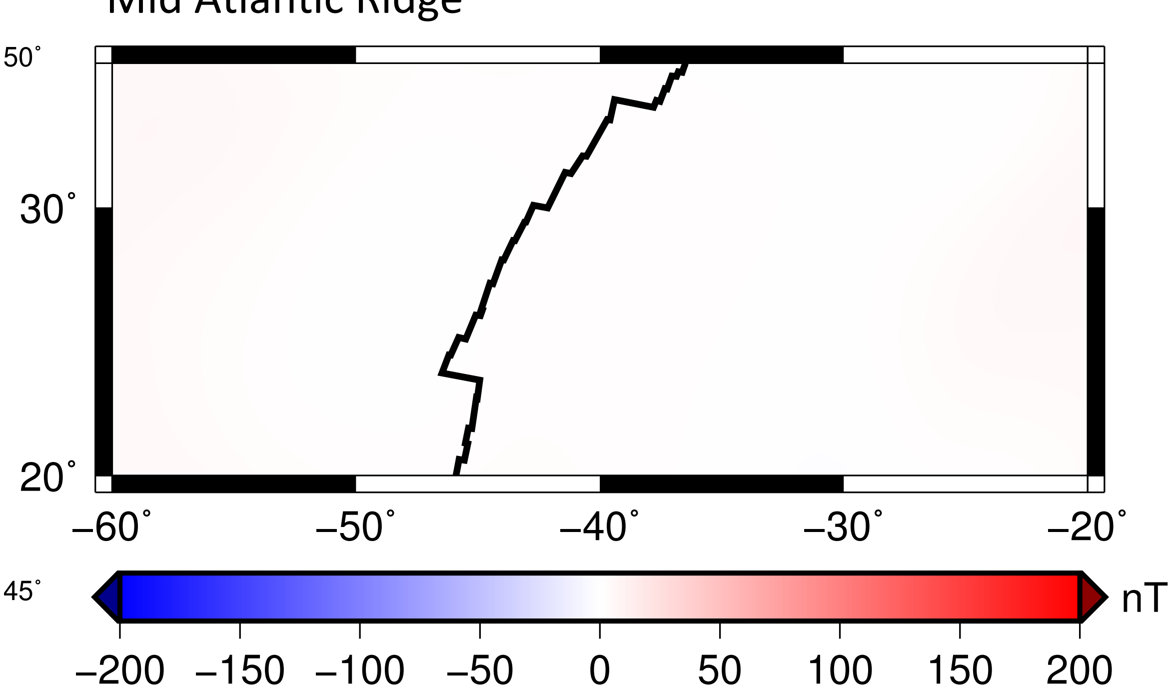
z = 30 km

Example

Minnesota



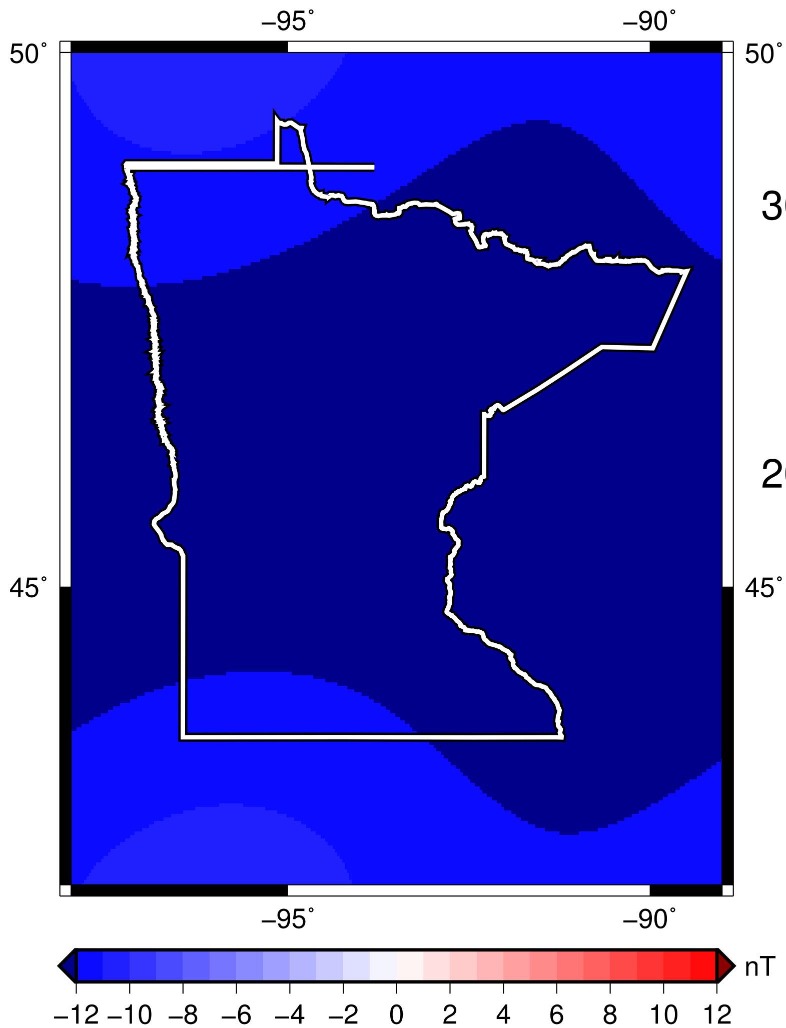
Mid Atlantic Ridge



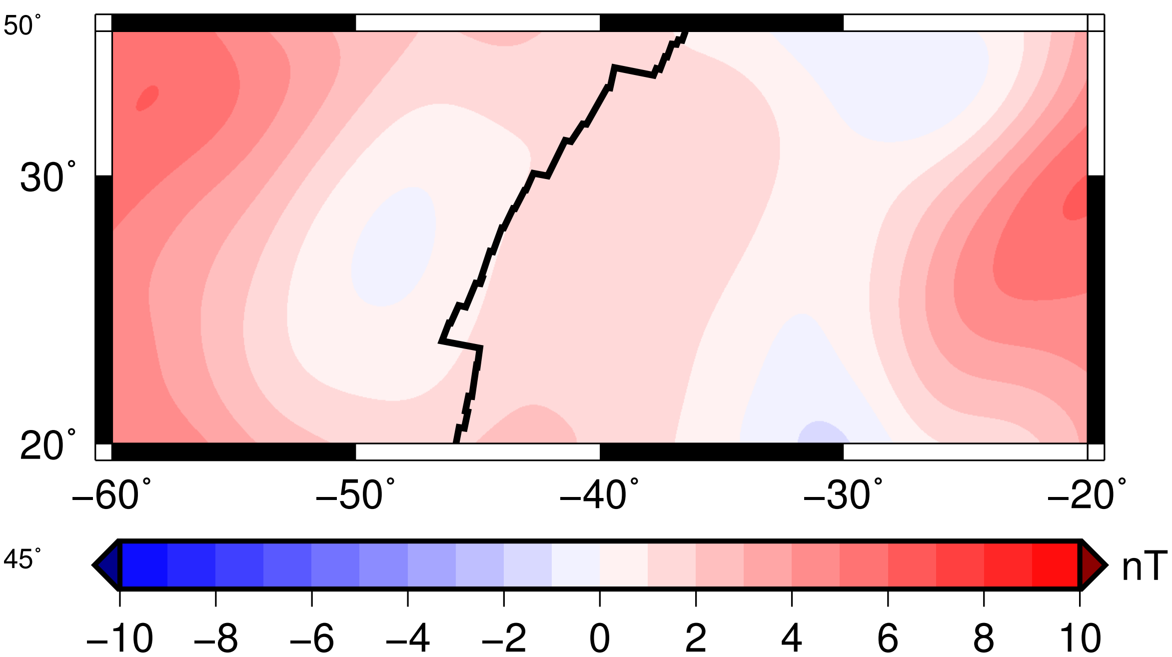
z = 450 km

Example

Minnesota

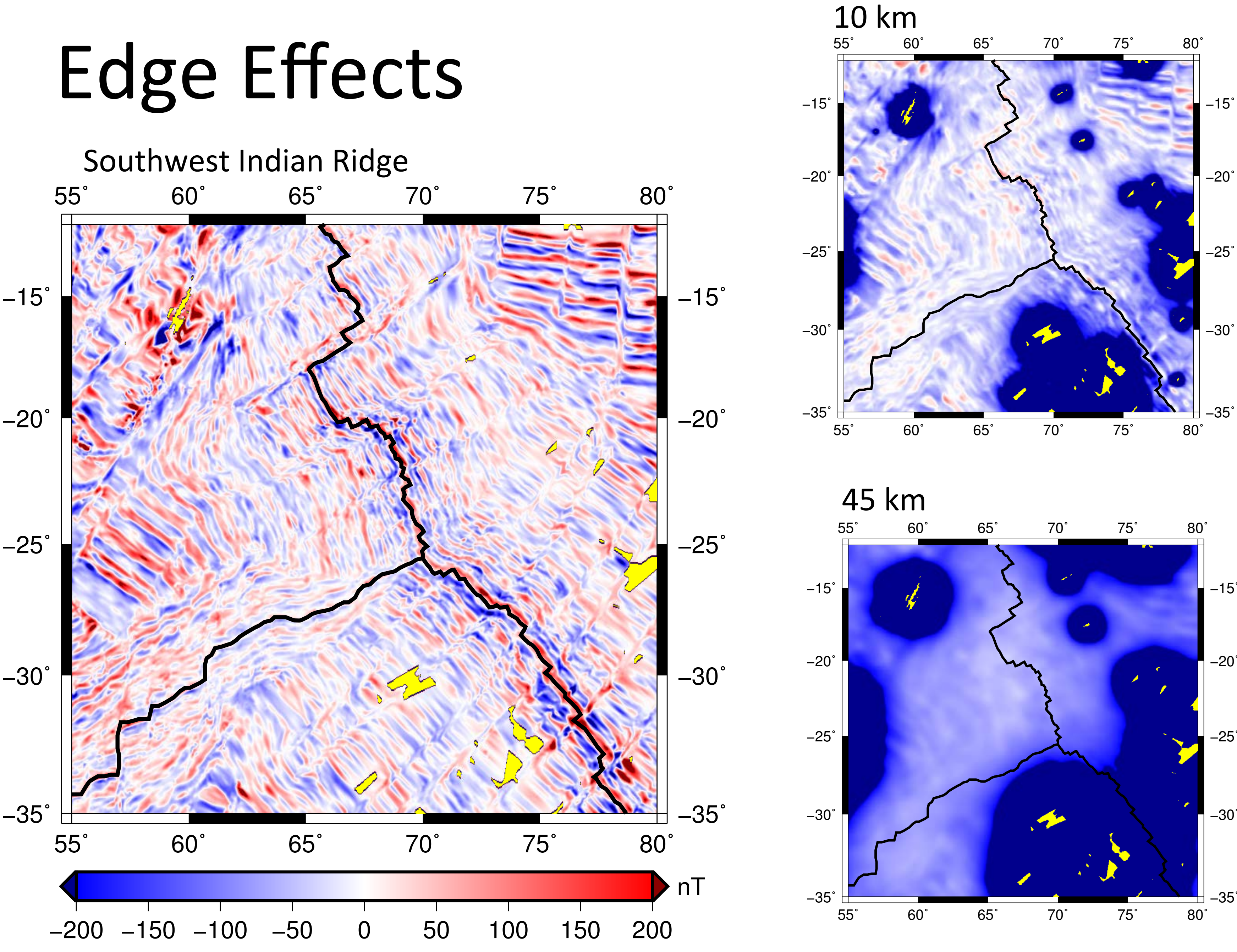


Mid Atlantic Ridge

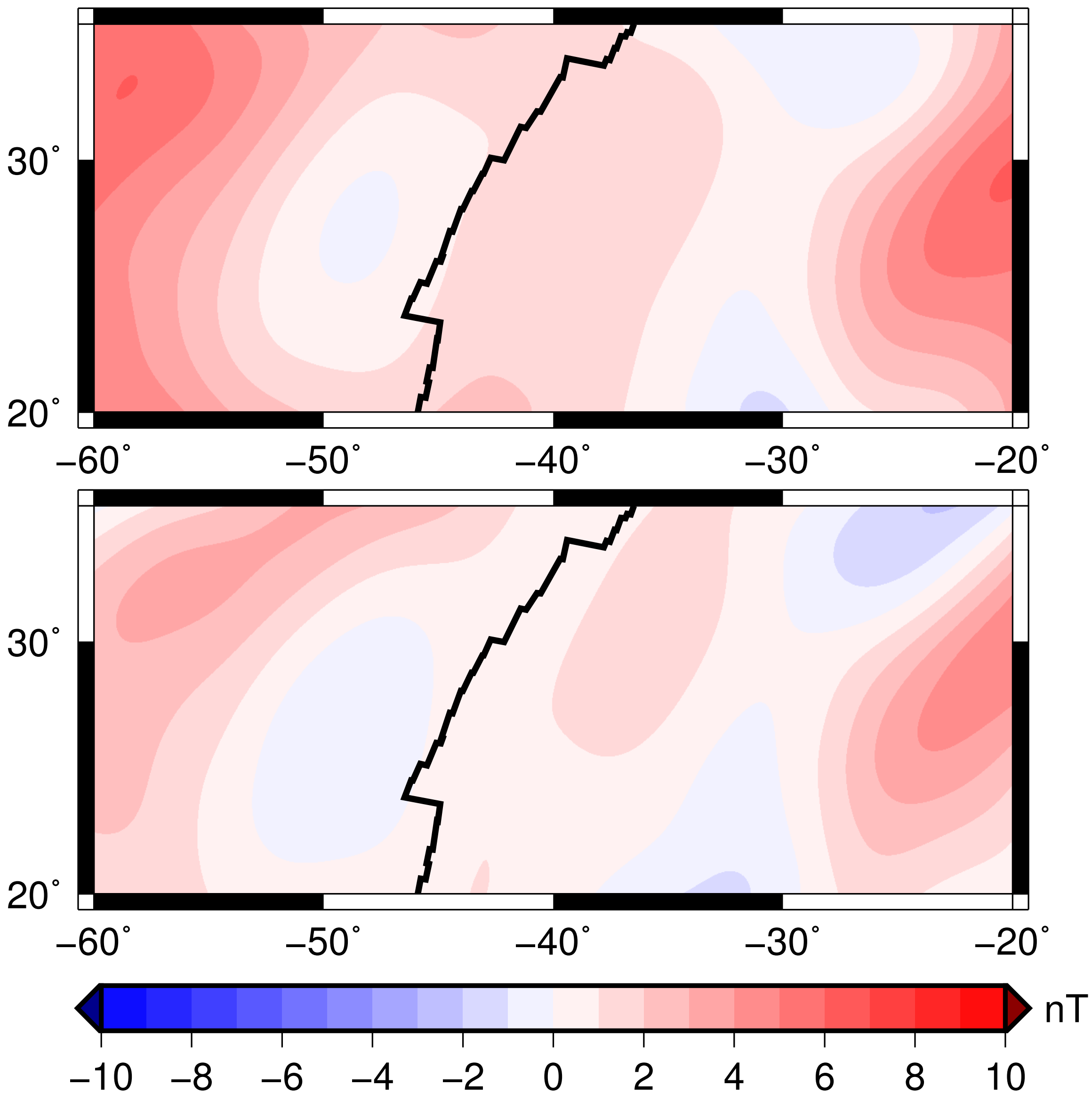


z = 450 km

Edge Effects



Edge Effect Correction

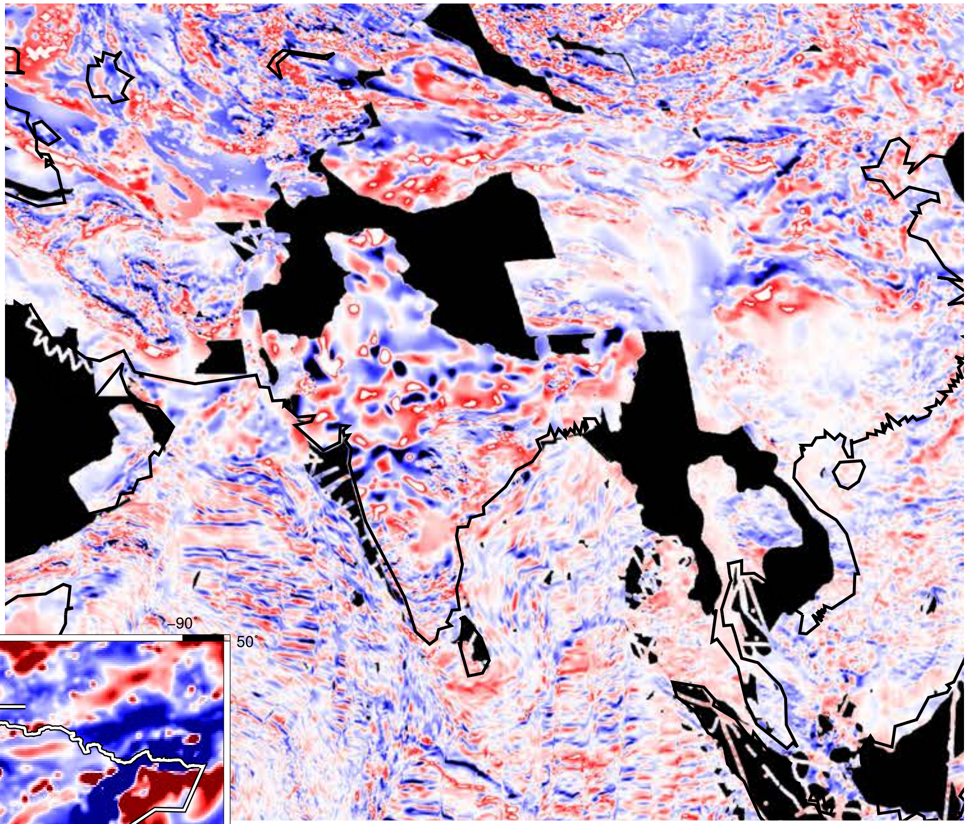


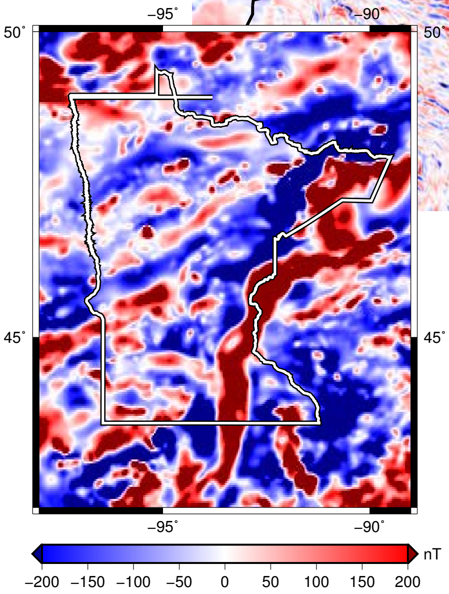
Possible Applications of EMAG2

- Model subsurface structure
- Global Depth to Curie Isotherm

Geologic Applications of EMAG2

- Identify large zones of volcanic provinces
- Analyze regional, long wavelength features such as suture zones that show the location of collisions, cratonic areas
- Identify Mineral Prospects





Conclusion

- Magnetic anomalies are awesome and EMAG2 is the most detailed and comprehensive grid available for analyzing large-scale and global features.

References:

- Maus, S., et al. (2009), EMAG2: A 2–arc min resolution Earth Magnetic Anomaly Grid compiled from satellite, airborne, and marine magnetic measurements, Geochem. Geophys. Geosyst., 10, Q08005, doi:10.1029/2009GC002471.
- Movie created using GPlates version 1.4
- Figures generated in GMT5