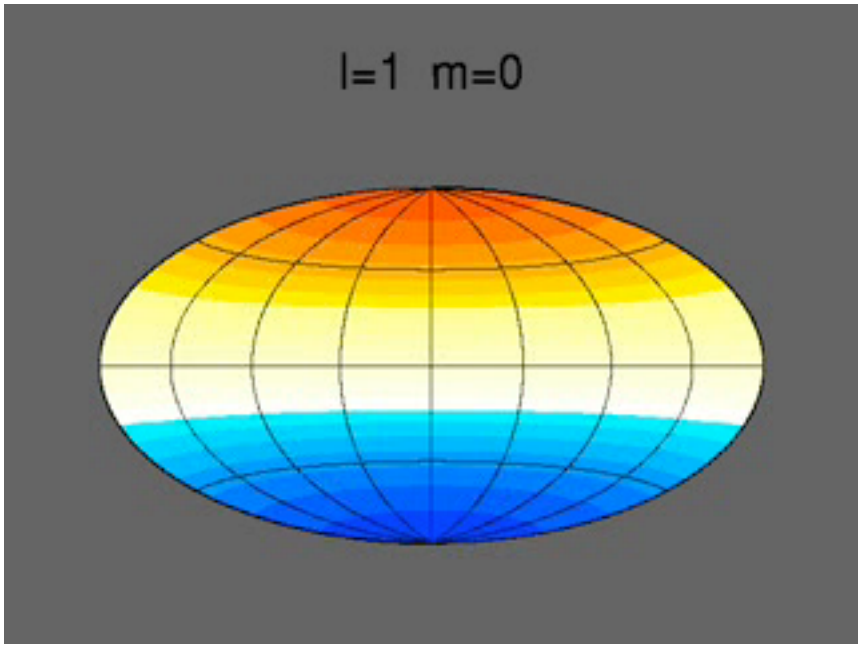
Animation of Spherical Harmonics



From: http://geodynamics.usc.edu/~becker/teaching-sh.html

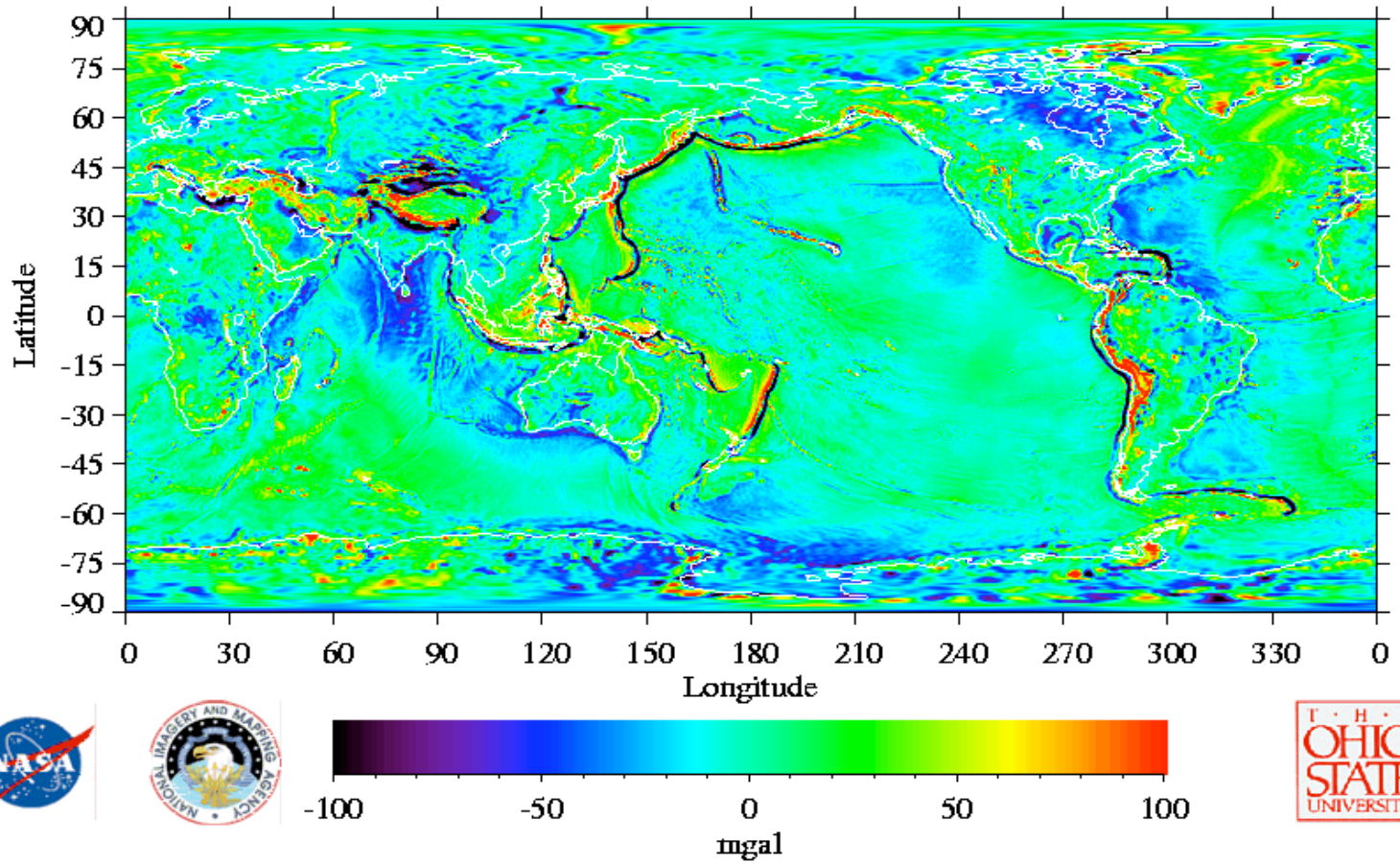
How Do we Estimate Gravity Field?

- Terrestrial data
  - Measurements of surface gravity
  - Fit spherical harmonic coefficients
- Satellite data
  - Integrate equations of motion subject to force model
  - Estimate initial conditions (position+velocity)
  - Estimate coefficients of (spherical harmonic expansion of) gravity field

EGM96

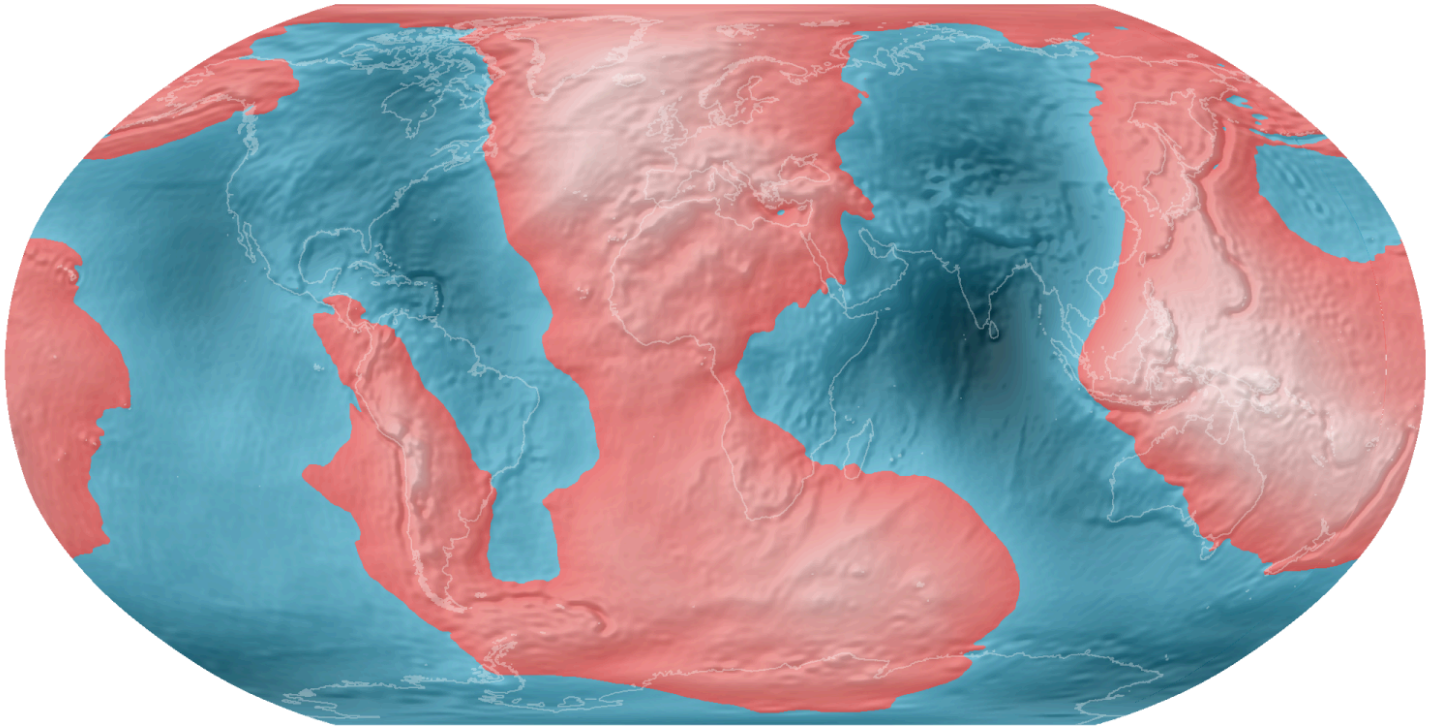
- Based on a combination of satellite and terrestrial data
- 70x70 combination solution
  - Direct satellite altimetry (TOPEX/POSEIDON, ERS-1, GEOSAT)
  - Direct tracking of >30 satellites
  - Surface gravity normals
- N>70 from terrestrial data
  - Global gravity anomalies

30’ Mean Gravity Anomalies: EGM96 (Nmax=360)



Deviation of the Geoid from the idealized figure of the Earth

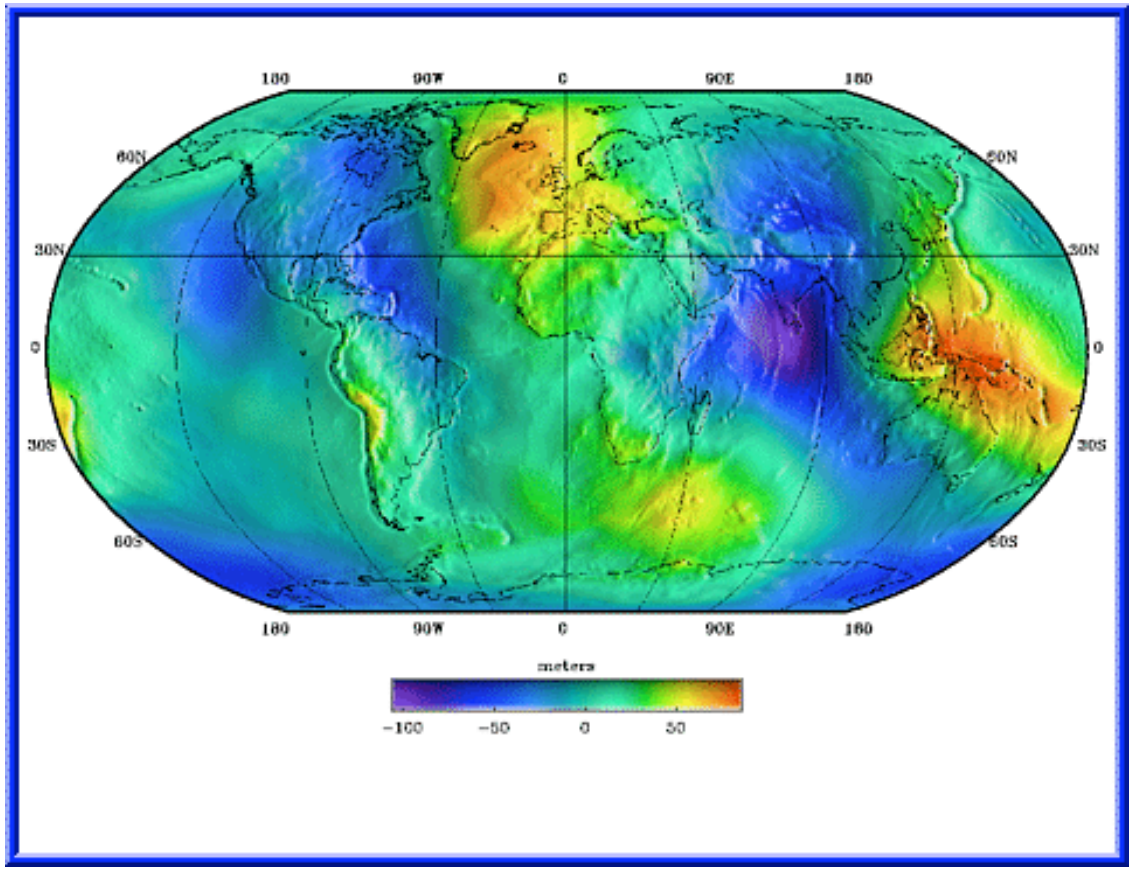
(difference between the EGM96 geoid and the WGS84 reference ellipsoid)



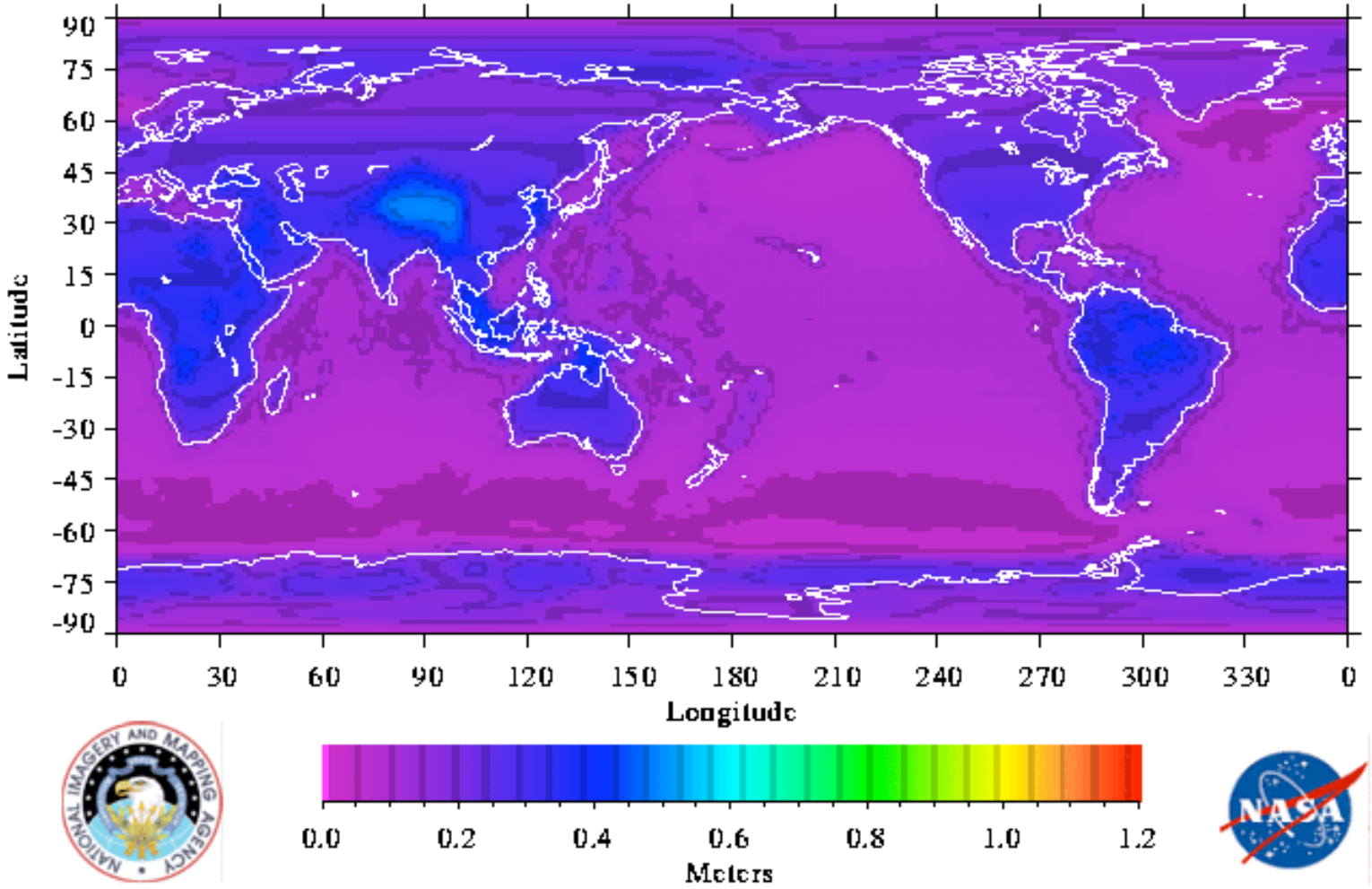
Red areas are above the idealized ellipsoid; blue areas are below.

From Wikipedia

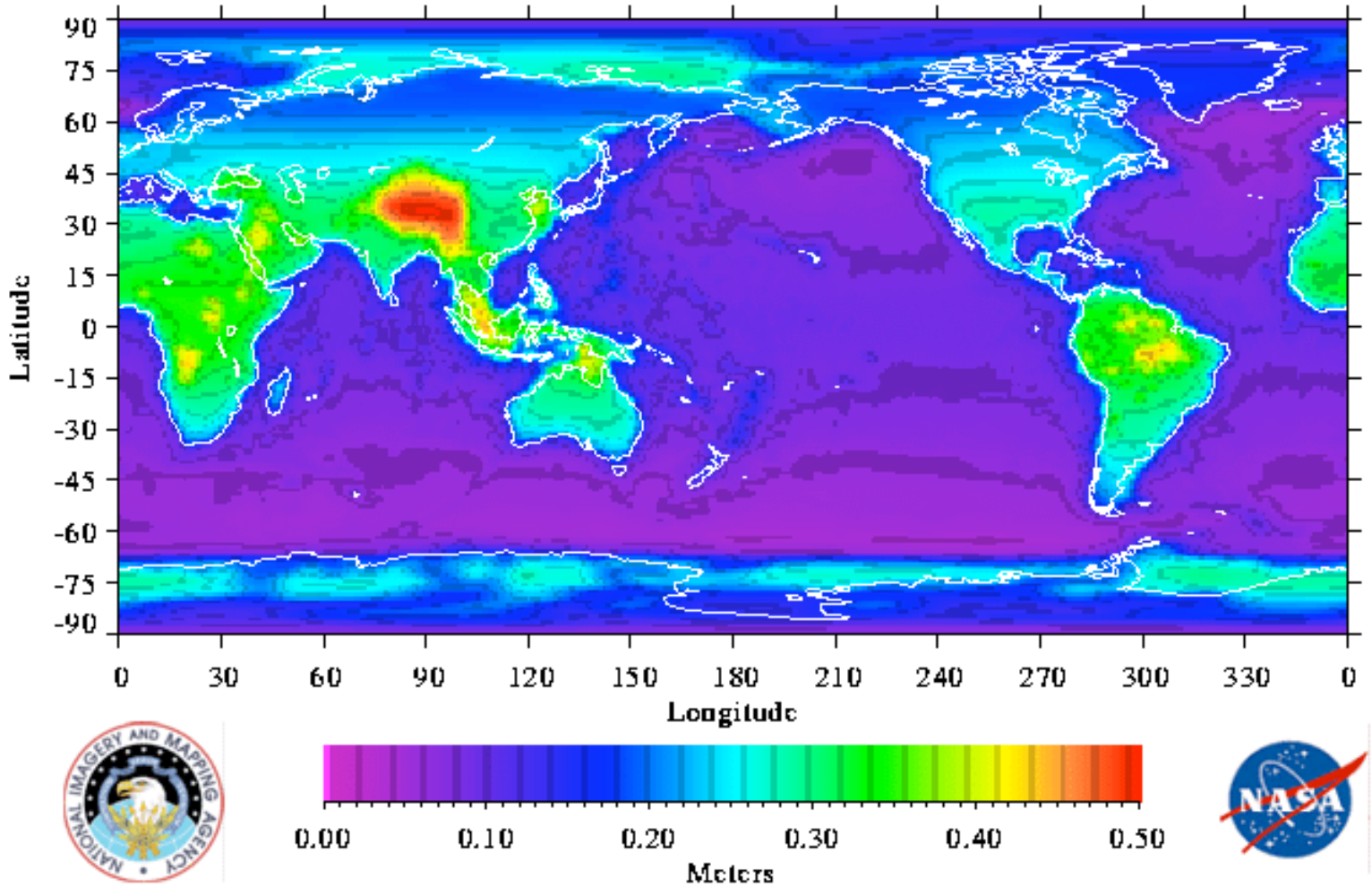
EGM96 Geoid



EGM96 Geoid Error, 70x70

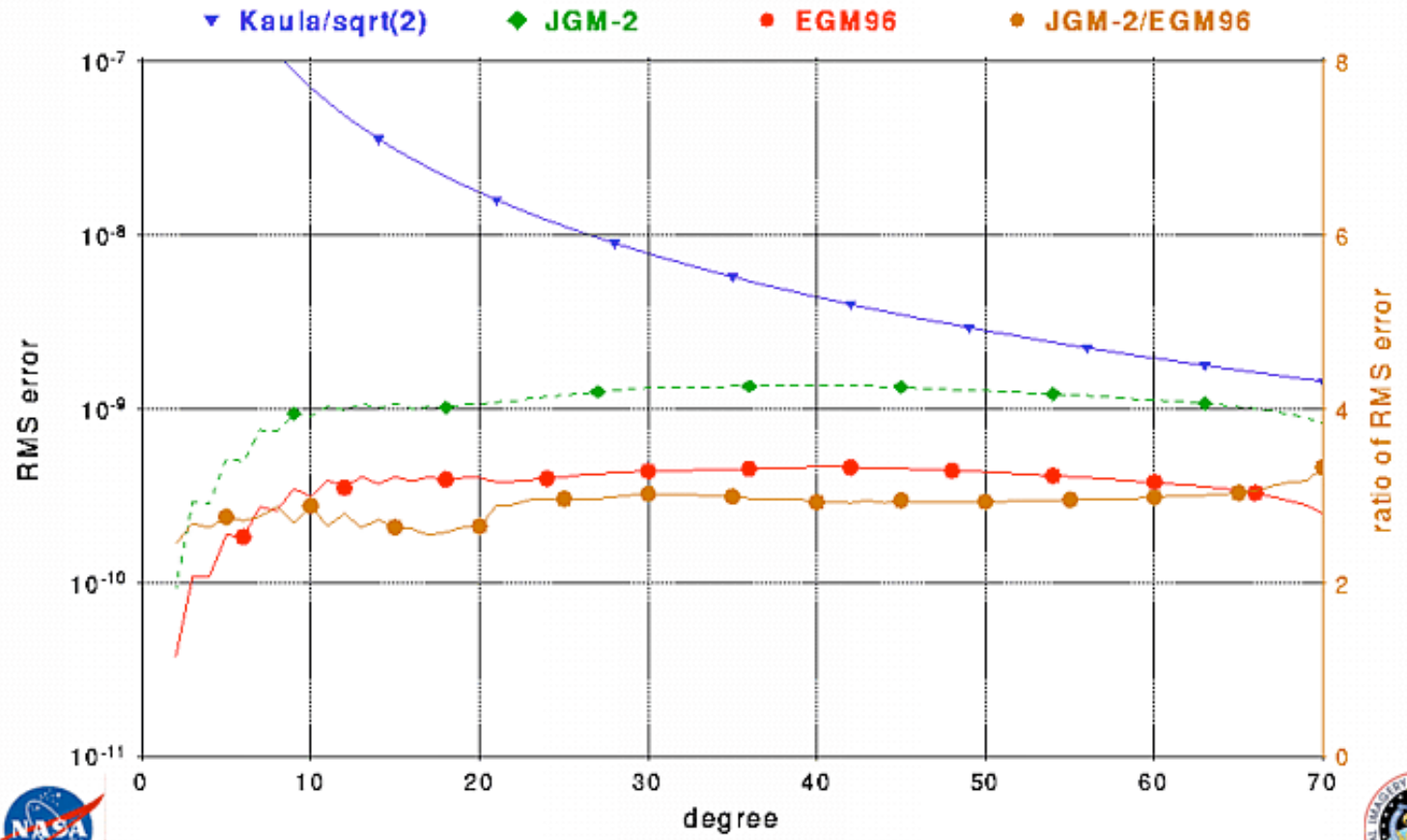


EGM96 Geoid Error, 70x70



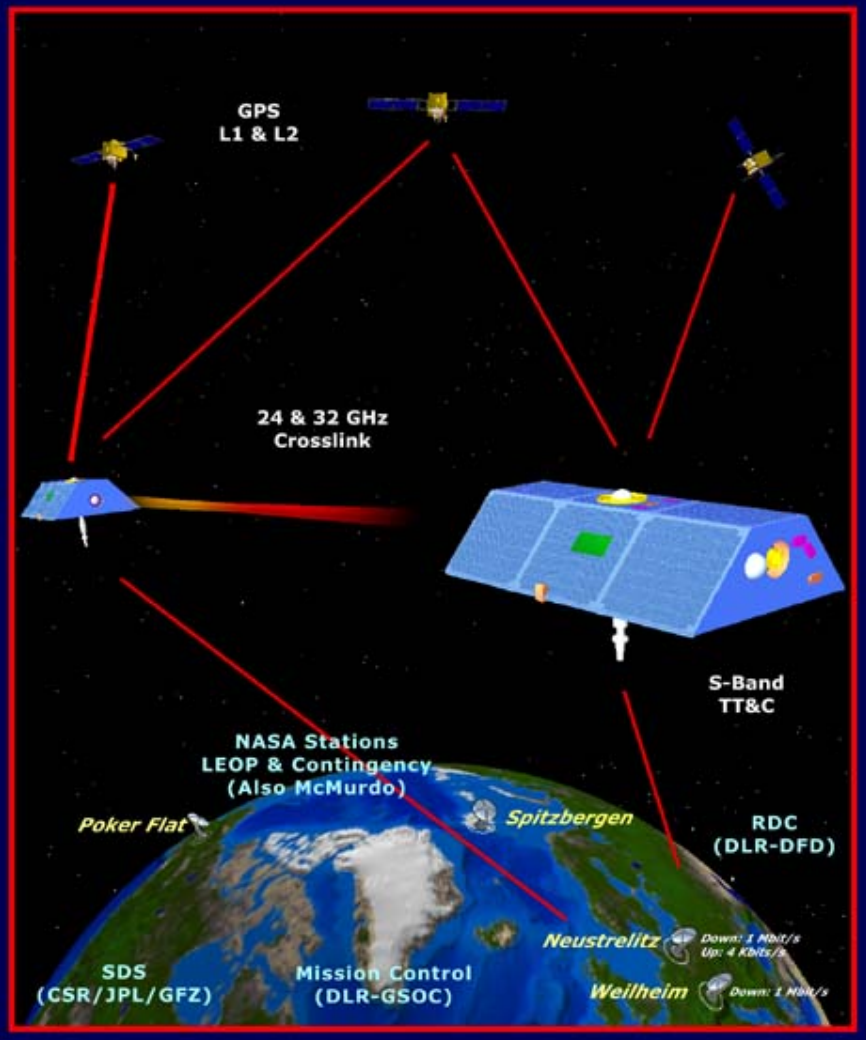
RMS Error per Degree per Coefficient

for combination model EGM96



GRACE

- ***G***ravity ***R***ecovery ***A***nd ***C***limate ***E***xplorer
- A specific gravity change mission
- A pair of satellites orbiting closely, as a gravity gradiometer
  - Postglacial rebound
  - Global water cycle
  - Hydrology/climate change



GRACE Mission

Science Goals

High resolution, mean & time variable gravity field mapping for Earth System Science applications.

Mission Systems

Instruments

- KBR (JPL/SSL)
- ACC (ONERA)
- SCA (DTU)
- GPS (JPL)

Satellite (JPL/DSS)
Launcher (DLR/Eurockot)
Operations (DLR/GSOC)
Science (CSR/JPL/GFZ)

Orbit

Launch: June 2001
Altitude: 485 km
Inclination : 87 deg
Eccentricity: ~0.001
Lifetime: 5 years
Non-Repeat Ground Track
Earth Pointed, 3-Axis Stable