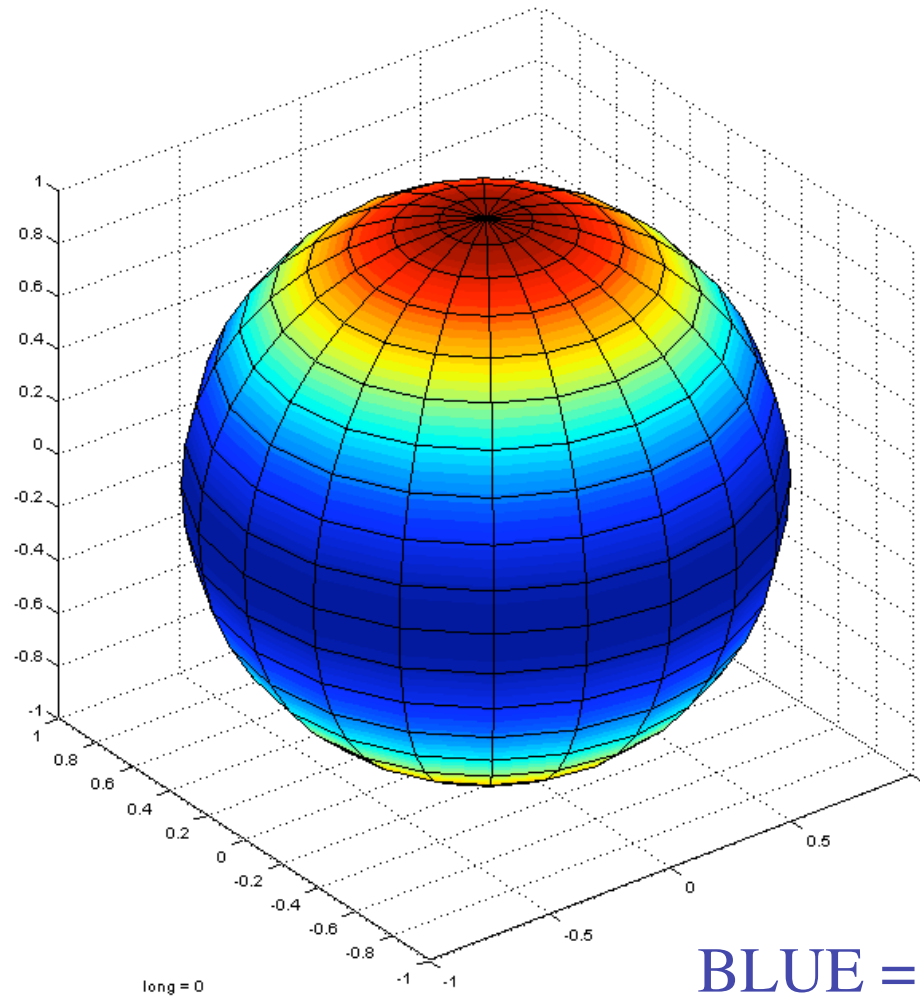


Gravity Field of the Earth

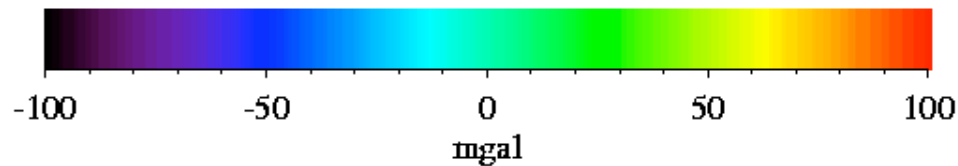
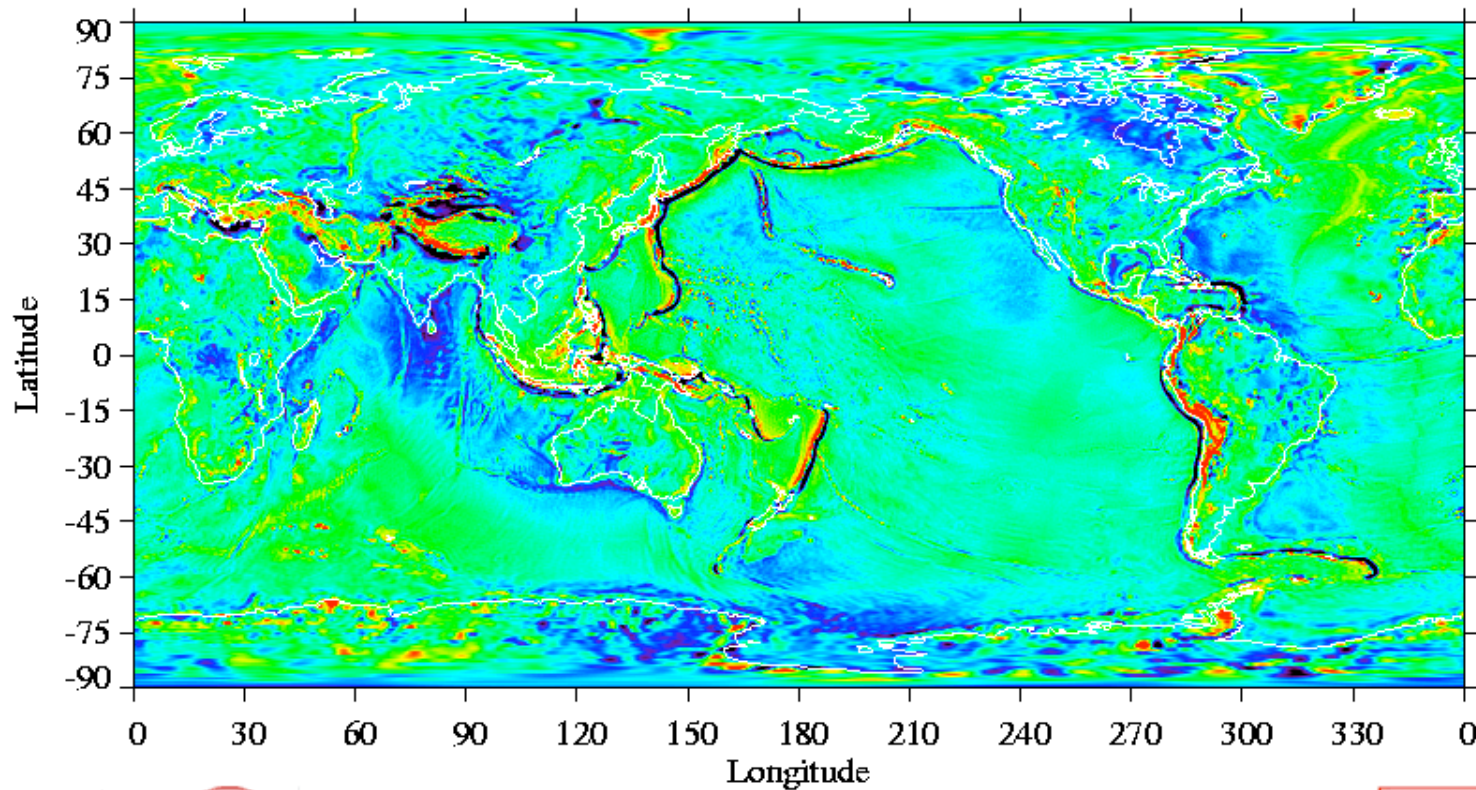


BLUE = lower than sphere

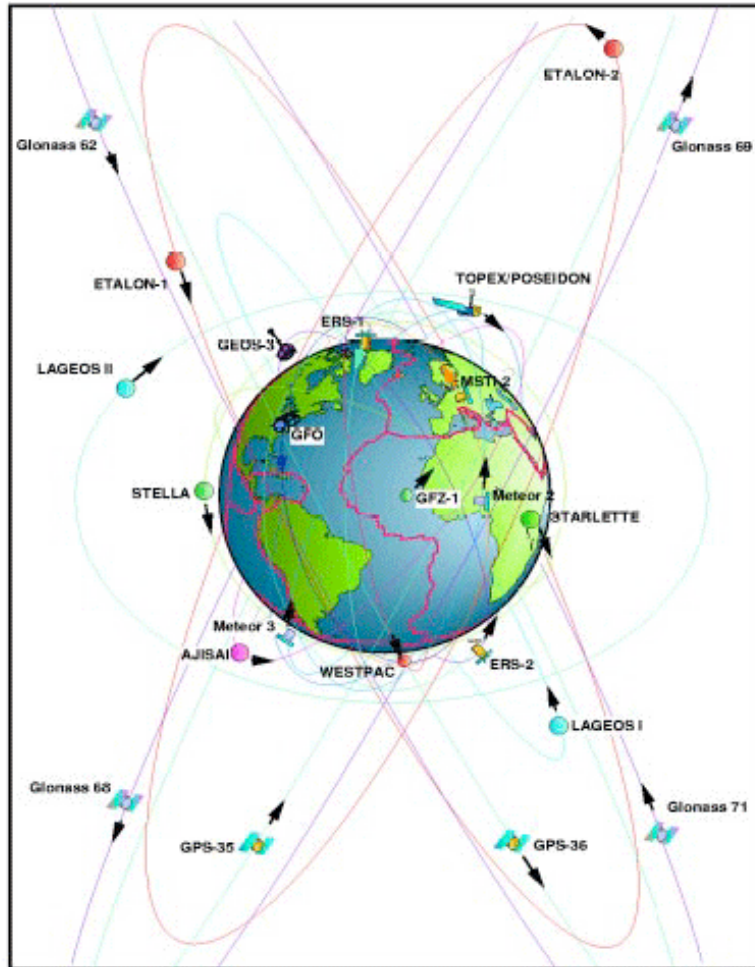
RED = higher than sphere

Gravity Anomalies

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

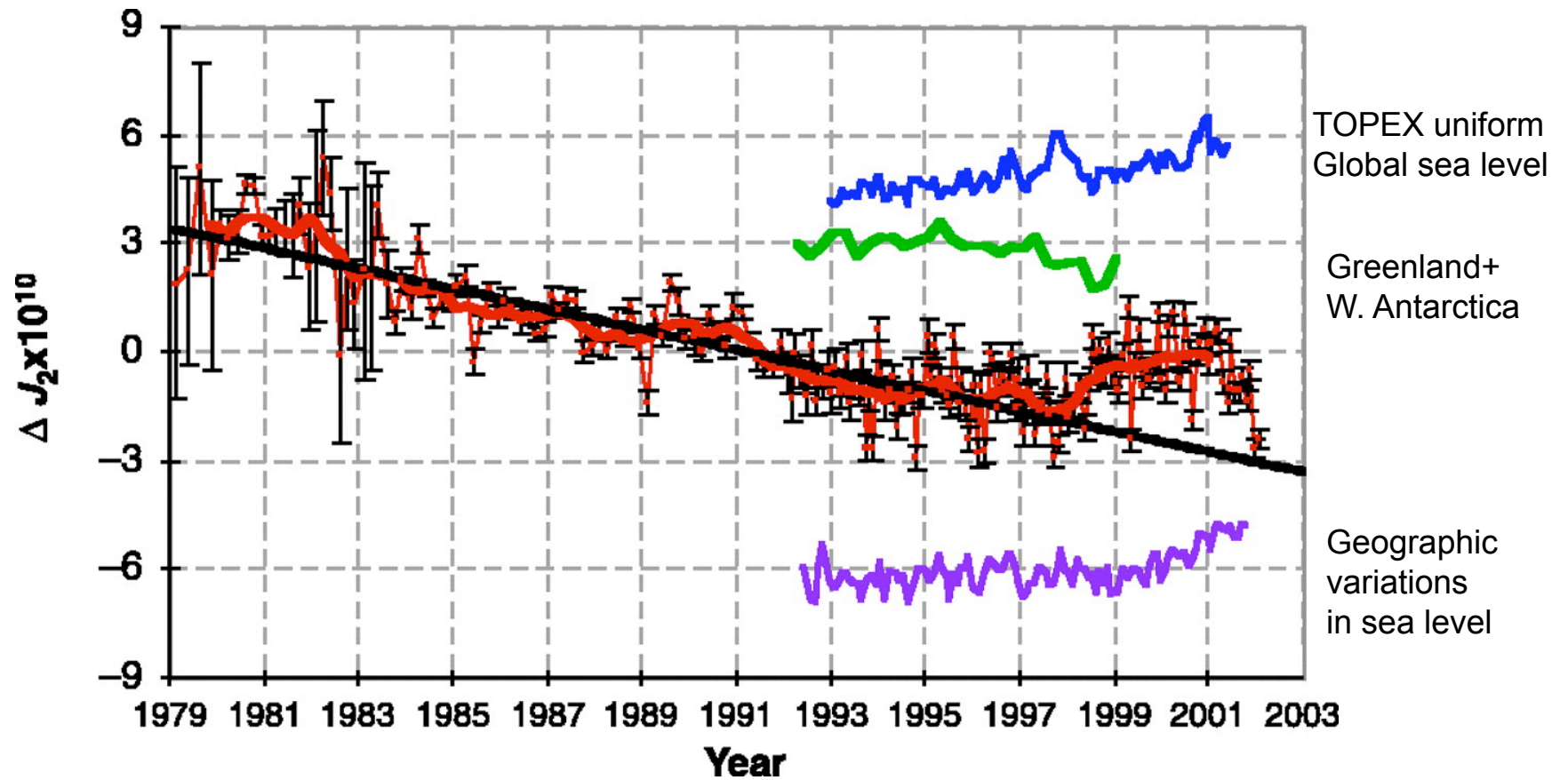


SLR Measures J2



- Best measurement of J_2 comes from *Satellite Laser Ranging*
 - Bounce laser off reflector on satellite
 - Estimate orbit and laser position
- Very sensitive to geocenter and low order gravity field
 - Satellite orbit determination involves integration of equations of motion given initial conditions and force model (gravity)

Changes in J_2



Cox and Chao (2002)

An Explanation?

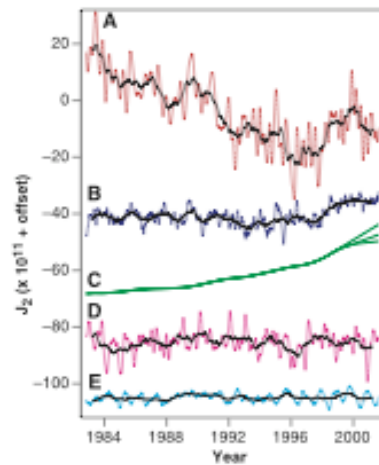


Fig. 1. J_2 observations and source terms, considered for October 1982 to September 2001. (A) Geodetic observations (5). Earlier data were omitted due to their larger formal uncertainties. (B) Integrated oceanic effects from ECCO OGCM analyses (8) with T/P and XBT data assimilated beginning in 1993. (C) Subpolar glacial effects (13–15) with three post-1998 melting scenarios (see SOM Text and table S1). (D) Integrated atmospheric effects from NCEP reanalysis data (16) with the IB assumption applied (17) and data from Antarctica excluded (18). (E) Integrated groundwater effects from NCEP reanalysis data. Color lines show monthly interpolation or moving averages, and black lines show annual averages; all series have had composite seasonal cycles and arbitrary vertical offsets removed. Units are 10^{-11} .

From Dickey et al., 2002
Science

- Explains change in 1998 as due to melting of mountain glaciers, which had not been considered by Cox and Chao