

3.5.6.5 Special Bureau for the Mantle

As with any geophysical processes that involve mass transports, large-scale motions in the mantle produce variations in Earth's rotation, gravity field, and geocentre. Among them, however, currently only two topics have been extensively investigated:

(1) The co-seismic effects on various geodynamic parameters, including low-degree gravitational Stokes coefficients, Earth rotation parameters (length-of-day and polar motion excitation), and Earth's moments of inertia changes. They are shown as cumulative effects for 19,050 earthquakes spanning Jan 1977 through May 2002. The computation is based on Chao & Gross, 1987 (Chao, B. F. and Gross, R. S., Changes in the Earth's rotation and low-degree gravitational field induced by earthquakes, *Geophys. J. Roy. Astron. Soc.*, **91**, 569-596, 1987) using the centroid-moment tensor solutions of all major earthquakes larger than magnitude 5 as published in the Harvard CMT catalogue.

(2) Post-glacial rebound, or glacial isostatic adjustment (GIA) modelling output from Erik Ivins (JPL). This set of data consists of graphics and spherical harmonic geopotential rates complete through degree 12 for each of three different cases. The geopotential rates are provided as a function of the lower mantle viscosity ranging from 10^{21} to 10^{23} Pa-sec. The first case uses ICE3G and a standard (Tushingham and Peltier, 1991) Earth model. The second case has an upper mantle viscosity of 3.2×10^{20} Pa-sec (Johnston and Lambeck, 1999) and lithosphere thickness = 80 km. The third case has a fixed deepest mantle (CMB to 650 km above) viscosity at $\eta = 7 \times 10^{22}$ Pa-sec, variable mantle viscosity from 650 km above the CMB to the 670 km seismic discontinuity, an upper mantle viscosity of 5×10^{20} Pa-sec and a lithospheric thickness of 100 km. Also posted are a set of GIA modelling data from Prof. Richard Peltier (University of Toronto). This set consists primarily of the graphics from chapter 4 in the recent book "Sea Level rise: History and Consequences" (ed. B. Douglas, M. Kearney, and S. Leatherman, Academic Press, San Diego, 2001).

Further improvements of the GIA models and other parallel model output from other authors are to be surveyed and incorporated. Also under preparation is a model scenario of the mantle tectonic movements and resultant geodynamic effects over geological timescales by M. Greff-Lefftz (IPGP).

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