Geophysical Research Abstracts
Vol. 14, EGU2012-2178, 2012
EGU General Assembly 2012

Degree-1 mass transport, deformation and geocenter motion – An overview of theoretical developments and inverse approaches

X. Wu (1), J. Ray (2), and T. van Dam (3)

(1) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, United States (Xiaoping.Wu@jpl.nasa.gov), (2) NOAA National Geodetic Survey, Silver Spring, Maryland, United States (jim.ray@noaa.gov), (3) University of Luxembourg, Luxembourg, Luxembourg (tonie.vandam@uni.lu)

The three degree-1 spherical harmonic components of horizontal mass transport processes in the Earth system describe the longest wavelength hemispherical mass exchanges. The mass loads deform the solid Earth and its surface, and cause geocenter motion between the center-of-mass of the total Earth system (CM) and the center-of-figure of the solid Earth surface (CF). The degree-1 mass transport or the equivalent geocenter motion should complement global gravity measurements to form a complete spatial spectrum for global mass variation monitoring. Although elastic deformation of the solid Earth contributes very little to the translational geocenter motion, rapid advances in global geodesy have allowed the seemingly small degree-1 deformation components to be measured precisely and converted to the equivalent degree-1 mass variations. The separation of the degree-1 mass variations gets even better when other types of data are further combined. The solid Earth also responds viscoelastically to the massive late Pleistocene and Holocene deglaciation events. The Glacial Isostatic Adjustment (GIA) or rebound deformation drives a significant geocenter velocity at present, which depends on both ice and water history and mechanical properties of the solid Earth. If measured and separated out from that due to secular trends in present-day surface mass variations, the GIA induced geocenter velocity can be used with other data to further constrain deglaciation history and probe deep into the Earth's interior. Significant progress has been made in understanding and measuring geocenter motion in the past 15 years and since the launch of the GRACE gravity mission.