

SGD001-01

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Geocenter motion of the mantle and the inner core

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Recent observations of satellite laser ranging, GPS and GRACE have revealed motions of the mantle with respect to the center of the Earth. Here we study gravitational coupling between the mantle and the inner core, especially rotation of the Earth and libration (Buffett, 1996; Zu et al., 2000; Aurnou and Olson, 2000). The centers of gravity of the mantle and the inner core are on the equator and the polar axis of the Earth. Distributions of the surface density of the mantle and the inner core with respect to the center of gravity of the mantle and the inner core are expressed with modes of Y_{111} and Y_{101} in the form of the spherical function. The centers of gravity of two bodies deviate from the center of gravity of the Earth, and offer the same effect as the eccentric rotation. Consequently additional modes of Y_{221} and Y_{201} are induced to the potential field of the local frames, the mantle and the inner core. If we take the value of displacement along the equatorial plane and the polar axis to be the same value, large contributions to the Earth's maximum moment of inertia are induced from variations along the equatorial axis. We assume that the figures of the mantle and the inner core consist of biaxial ellipsoids of which equatorial flattenings are different. We derive the rotational torques with the potential of the mantle and the inner core and the mutual libration between the mantle and the inner core. We take deviation of the center of gravity of the mantle to the center of gravity to be 2mm, the variations of the Earth rotation relative to the observed value (Gross et al., 2004) are found to be about 1/5 and the oscillation frequency of the libration to be about 1/4 of that of the 24 year-decadal oscillation.

Keywords: geo-center, mantle, inner core, gravitational coupling, libration, Earth rotation