Gravitational coupling between the inner core and the mantle and variations of the Earth rotation

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A travel time residual of the seismic waves in the eastern hemisphere (40 deg E to180 deg E) of the inner core shows a periodic variation of the period of about 20 years (Report,2008).

In the process of the inner core growth in the eastern hemisphere, the latent heat on the surface is transferred into the core-mantle boundary (CMB) and causes the phase transition. The phase transition induces the double layer of mass near the CMB .We consider that the gravitational torque between the inner core and that the mantle can excite the decadal oscillation of the Earth's rotation.

The phase transition consists of the ultralow-velocity zone (ULVZ) and the perovskite to post-provskits phase transition.The major axes of the equatorial ellipses of both the inner core and the mantle are pointing at 15 deg W longitude in the equilibrium state.The gravitational torque exerts on the inner core and the mantle due to a small shift of the direction of the major axes of the equatorial ellipes on the equator.Additional coupling mass is simply discussed as a cylindrical tube of which axis is taken to be perpendicular to the boundary.

In the case of the heat production in the eastern hemisphere of the inner core to be periodic variations, the rotational motion of the mantle shows a libration consequently. But the libration is associated with the damping motion of which half-life is 7 times as long as the period of the libration.The period of the libration depends on the magnitude of the gravitaional torque.The decadal oscillation will be resulted from a large amount of contribution of the mantle on the gravitaional torque .In the case of endothermic state on the surface of the inner core in the eastern hemisphere, the densisty distribution of the outer core is in stable configurations. The thermal convective heat transport to the mantle is interrupted. The heating of the mantle is intermittent.