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Inferencing Core-Mantle Geodynamics with Angular-Momentum Excitation of Length-of-Day Variations

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Under the conservation of angular momentum (AM), any variation in the AM (delta-AM) of the geophysical fluids should be accompanied by an equal and opposite variation in the solid Earth's delta-AM, which in turn will manifest as variation in the Earth's rotation. However, the conversion factor involves the physical inertia for the delta-AM to excite Earth rotational variation, that is, the moments of inertia of the solid Earth. The question is: to what extent, does the core participate in the delta-AM excitation process of the Earth rotational variations from intra-seasonal to inter-annual time scales? Using length of day change and general circulation model delta-AMs including ECMWF atmospheric AM, ECCO oceanic AM and GLDAS hydrological AM, we show that core-mantle is decoupled in intra-seasonal time scales and slightly coupled in inter-annual time scales, at a least squares fit criterion. In the frequency domain, the geodynamics of core-mantle varies with frequency slightly. The geodynamics of core-mantle tends from decoupling in intra-seasonal time scales to slightly coupling in inter-annual time scales. To avoid the inverted barometer (IB) effects between atmospheric delta-AM and oceanic delta-AM, we also substitute the mass term of delta-AM by delta-C20 gravity coefficients observed from SLR. However, we acquire the similar results.