Excitation of Earth's Inner Core Rotational Oscillation During 2001–2003 Captured by Earthquake Doublets

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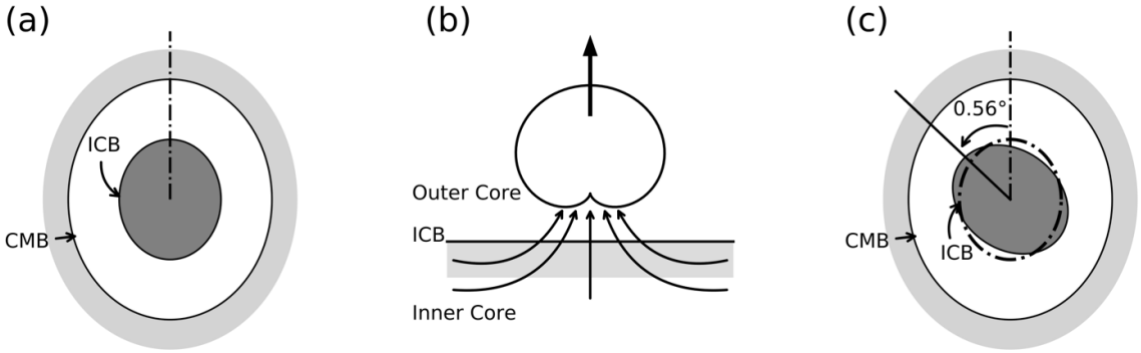
Abstract. The nature of any differential rotation between Earth's inner core and mantle is important for understanding Earth's magnetic field and intradecadal variations in the length-of-day; however, a consensus on the existence and rate of differential rotation is still lacking after 25 years. The reported model for inner core differential rotation from seismic body waves is controversial and might be explained by non–rotational processes. Here, we explore inner core differential rotation using the decorrelation of inner-core sensitive coda waves from 123 earthquake doublets recorded during 1991–2017. We find that the inner core was nearly locked to the mantle before 2001 and after 2003 with relatively small motion about an equilibrium position. During 2001–2003 the inner core experienced a burst of differential rotation, possibly in response to a magnetic torque induced by the expulsion of light elements from the inner core. We suggest that this fleeting bit of differential rotational helped excite an inner core rotational oscillation, consequently exciting the six-year-oscillation in the length-of-day.



Schematic model of the inner core oscillation excitation. ***(a)*** *The inner core is initially in the equilibrium position and gravitationally locked to the mantle.* ***(b)*** *A buoyant parcel or blob enriched in light elements is expelled from the inner core.* ***(c)*** *Inner core rotational oscillation under the disturbance resulting from the blob release. The dashed ellipse shows the original inner core equilibrium position at the time in (a).*

Reference

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