Rotation factor: dynamics and interaction of the Earth's core and mantle

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The crystalline solid inner core is the most distant and enigmatic part of our planet, and along with the Earth's crust is the smallest one. The inner core was discovered in 1936 and to date there have been established a number of its anomalous and puzzling features - low rigidity and viscosity (comparing to other solids), high seismic attenuation, strong anisotropy and differential rotation. The inner core is isolated from the upper solid Earth shells by the liquid outer core with low viscosity, and hence it can rotate, oscillate, precess, vibrate and move out along the spin axis. About 25 years ago studies of generation, evolution and sustainment of the Earth's magnetic field launched active investigations of the crystalline core. The estimate of differential rotation velocity with respect to mantle is also important for explaining a number of geodynamical processes, for instance, such as the observed global distribution of seismicity spatially coordinated with critical latitudes. One of the hypotheses associates the latter with variation in the Earth's rotation velocity. In this report we analyse all information published thus far for differential rotation of the Earth's inner core and acknowledge multiple controversies. The differential rotation velocity estimated by body waves is between 0 and 3 degrees per year; the Earth's normal mode data yield the velocities between -2.5 and -0.8 degrees per year, whereas the most probable estimates are from -0.2 to 0.2 degrees per year. The eastward inner core stationary rotation envisaged by Glatzmaier and Roberts in their modelling is unlikely. The rotation is rather non-stationary - with accelerations/decelerations related to mantle processes. The study is accomplished under auspices of IDG RAS Research plan - project #0146-2019-004.