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The core-mantle coupling contribution to the excitation of the Earth's rotation variation on decadal time scale

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Based on the newly developed geomagnetic field model C^3FM2 and a set of additional input models, like the electric conductivity of the Earth's mantle and the topography of the core-mantle boundary (CMB), we compute the electromagnetic (EM) and topographic (TOP) core-mantle coupling torques. Those coupling torques cause variations in the Earth rotation and can be expressed by equivalent excitation functions. As in our previous work, for the determination of the EM coupling torque, the geomagnetic field is determined at the CMB by the non-harmonic downward continuation. Herein, we consider a set of different radial stratifications of the electrical conductivity of the Earth's mantle. A requirement for the determination of the toroidal geomagnetic field at the CMB is the knowledge of the time variable surface fluid-flow velocity at the CMB in the outer core. Based on these velocities and the poloidal geomagnetic field at the CMB, we solve the initial boundary value problem for the time variable part of the toroidal geomagnetic field. The time-dependent fluid-flow velocities are also used to compute the TOP coupling torque consistently for different CMB topography models

This investigation is restricted to this time interval 1962–2000, because the considered atmospheric (AAM) and oceanic angular momentum (OAM) functions are based on the ERA-40 reanalysis provided by the ECMWF, which are given for this time interval. We use a combination of the equivalent excitation functions, AAM and OAM time series, for the forward calculation of the variation of polar motion and length-of-day on decadal time scale. The contributions of the different excitation functions for different frequencies to the modelled variation of polar motion and length-of-day are analysed. They are focused on the decadal time scale, which is the characteristic one for coupling processes at the CMB.