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Regional contributions to seasonal and inter-annual polar motion variations from atmosphere, ocean and continental hydrosphere

Henryk Dobslaw (1), Robert Dill (1), Aleksander Brzezinski (2), and Maik Thomas (1)

(1) GFZ Potsdam, Geodesy and Remote Sensing, Potsdam, Germany (dobslaw@gfz-potsdam.de), (2) Space Research Centre, Polish Academy of Sciences, Warszawa, Poland

Daily effective angular momentum functions from atmosphere, oceans, and continental hydrosphere that are consistent in terms of global mass conservation among the sub-systems are obtained from atmospheric data the most recent ECMWF re-analysis ERA Interim and corresponding simulations with the hydrological model LSDM and the ocean model OMCT covering 1989 - 2008. Correlations between simulations and geodetic excitation functions based on the EOP C04 polar motion series are generally improving when considering oceanic and even continental effects in addition to the atmosphere, with correlation coefficients that exceed values of 0.8 during the most recent years. While contributions to the annual wobble are found to be of similar amplitude and phase as in previous studies, both seasonal averaged and inter-annual variations are able to capture the main characteristics of individual peaks in the corresponding geodetic excitation functions. By decomposing the simulated global angular momentum functions into their regional contributions, atmospheric and oceanic pressure and current distributions in accordance with continental water storage variations are shown to be of similar importance for polar motion excitation on seasonal time-scales, whereas continental water flow contributions to the relative angular momentum of the Earth have been found to be three orders of magnitude lower than the corresponding effect of water storage changes. The data-sets discussed here are publicly available via the restructured Geophysical Fluids Center of the IERS.