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Analysis of causal oceanic processes with respect to a triannual period arising in the polar motion from 1988 to 1998

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Observations of the variable Earth's rotation represent the impact of a combination of various physical processes in the Earth's system, requiring independent models of certain processes in order to properly interpret and separate individual contributions.

Here, transient hydrospheric effects on the Earth's rotation are presented by means of a numerical model approach allowing mass and momentum fluxes among the subsystems atmosphere, ocean and continental hydrology. Operational and reanalysis data from ECMWF are used to force a hydrological discharge model and a global model for the ocean's baroclinic circulation and ephemeral tides (OMCT). The unconstrained hydrology and ocean models are coupled via continental discharge in order to close the hydrological cycle.

Wavelet analyses of observed and simulated ERP time series reveal a significant periodic signal in the y component of polar motion with a period length of about three years arising from 1988 to 1998. Decomposition of the simulated ERP time series into the contributions of the several model components atmosphere, ocean and continental hydrology indicates that this signal is caused by the ocean. A further decomposition of the simulated oceanic contributions to polar motion into regional patterns reveals whether this period is a local or a global phenomenon. Then the physical causes of the considered anomaly are investigated by means of statistical analyses of its correlation to hydrographical output data of the ocean model OMCT.