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Operational simulations of transient atmosphere-ocean dynamics: Benefits for the interpretation of Earth rotation variability

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By means of precisely observed variations of Earth rotation, in principle, mass redistributions within and mass exchanges between the Earth's subsystems are monitored. However, since Earth rotation parameters represent an integrated signal of the Earth's response to internal and external forces, the interpretation of these observables with respect to individual underlying physical processes requires independent methods, e.g., from theory and modelling.

Here, a numerical model approach is presented allowing for consistent mass, momentum, and heat fluxes within and exchanges between the subsystems atmosphere, oceans, and continental hydrology. Operational atmospheric analyses from ECMWF available within 3 days of delay only are used to force a hydrological discharge model as well as a global model for the ocean's baroclinic circulation and ephemeral tides. The unconstrained hydrological discharge and ocean models are coupled via continental freshwater fluxes in order to close the hydrological cycle.

Based on a de-composition of the simulated regional contributions to the effective angular momentum functions by means of empirical orthogonal functions (EOF), characteristical signals of Earth rotation anomalies are attributed to causative physical processes. Primarily focussing on polar motion excitation, it will be discussed to what extent Earth rotation observations can be utilized to monitor climate relevant dynamics in the atmosphere-hydrosphere system.