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Comparison of hydrological signal in polar motion excitation with those based on the FGOALS-g2 climate model

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Our investigations are focused on the influence of different land hydrosphere surface parameters (precipitation, evaporation, total runoff, soil moisture, accumulated snow) on polar motion excitation functions at seasonal and nonseasonal timescales.

Here these different variables are obtained from the Flexible Global Ocean-Atmosphere-Land System Model, Grid point Version 2 (FGOALS-g2), which is a climate model from the fifth phase of the Coupled Model Intercomparison Project (CMIP5); with CMIP5 being composed of separate component models of the atmosphere, ocean, sea ice, and land surface.

In this study Terrestrial Water Storage TWS changes were determined as: differences between the precipitation, evaporation and total surface runoff content, and as the total soil moisture content being a sum of soil moisture and snowfall flux changes.

We compare the model-based data with those from estimates of the Equivalent Water Thickness determined by GRACE satellite observations from the Center for Space Research (CSR).

The transfer of angular momentum from global geophysical fluids to the solid Earth is described by the equatorial components χ_1 and χ_2 of the polar motion excitation functions. Observationally, these so-called geodetic excitation functions of polar motion can be determined on the basis of the equations of motion by using observed x, y components of the pole.

The second-degree, first-order coefficients of the Earth gravity field are proportional to variations of the equatorial component χ_1, χ_2 of the series of the gravimetric excitation function of polar motion. This gravimetric function can be compared with the mass term of geodetic excitation of polar motion.

Our analysis comprises (1) determinations and comparisons of regional patterns of hydrological excitation functions of polar motion, and (2) comparison of the global hydrological function determined from the FGOALS-g2 and GRACE data with a hydrological signal in the geodetic excitation function of polar motion, determined as a residual geodetic and atmospheric plus oceanic excitations.