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Patterns of regional over-land geophysical excitation functions of polar motion in seasonal spectral bands

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For comparison of regional atmospheric excitations from meteorological analyses and hydrological excitations obtained from both GRACE results and from hydrological models, variances of these data and residuals of these variances are computed. We determine regional values of equatorial components of the atmospheric excitation function of polar motion, which are proportional to the equatorial components of angular momentum (AAM), based on a high spatial resolution network of 3312 equal-area sectors from the surface pressure fields of the NCEP-NCAR reanalyses. We focus on the results over land because we are interested as well in the regional variability of land-based hydrological excitations; we compare results from the various regions from the atmosphere and hydrosphere.

We focus on correlations and covariances between these regional excitations values and either the global geodetic excitation function, determined from the geodetic observational data, or the atmospheric/hydrospheric excitation functions, equivalent to the sum of such excitations in all regions. These may be studied alternately as global modes, though not necessarily limited to the over-land areas. We computed the geophysical fluid data within different temporal spectral bands, from sub-seasonal to interannual period ones. Important variations of atmospheric excitations occur over North America and Asian regions, as has been previously noted, but here we relate excitations to the structure of the topography within the various spectral bands. Particularly strong hydrological variability occurs in areas like Southeast and South Asia, and the South American Amazon. We examine this variability at different time scales to obtain a comparison with the atmosphere, using both hydrological data and GRACE data and we note any discrepancies. These analyses determine regional sources of polar motion excitation in different spectral bands from both the atmosphere and hydrosphere. The extent to which the atmosphere and hydrosphere excitations significantly correlate with the global excitations may be judged by statistical tests of correlation, a number of which we explore as evidence to support judgments of significance.