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A comparison of ITRF2014, DTRF2014 and JTRF2014 polar motion series with geophysical excitation data

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Three solutions were generated in response to the 2014 update by the IERS of the International Terrestrial Reference Frame: ITRF2014, the official solution from IGN; DTRF2014, from DGFI; JTRF2014, from JPL. Each incorporates essentially the same time series information of geocentric station positions + Earth rotation parameters + their associated variance-covariances from the four contributing space geodetic techniques (SLR, VLBI, DORIS, GNSS) plus local 3D vector ties (measured by conventional surveying methods) that relate a subset of co-located stations.

Given the fact that measurements by all the techniques, as well as the local ties, suffer significant unmodeled systematic errors that are poorly understood, the covariance matrices are not reliable except for their geometrical aspect. So the three combination strategies differ not just in their mathematical procedures, but more importantly in how the systematic errors are handled (or not). Factors include the relative weighting of inputs, modeling of non-linear station motions, detection of time series discontinuities, etc. The final combination results therefore also differ, mostly in rather subtle ways.

There are very few ways to make external evaluations of the quality of the various combinations as independent observations are generally not accurate enough. However, one approach has been shown to give useful insight by comparing the daily polar motions with geophysical excitations computed from global circulation models for atmosphere, ocean, and hydrology. J. Kouba (2010) did this for ITRF2008 and DTRF2008 and found an excess of high-frequency rotational scatter in the DGFI solution. After the development of the IGS in the 1990s, the ITRF daily polar motion accuracy has been about 30 uas or 1 mm of surface rotation. The corresponding geophysical models are not nearly so accurate but their independence does provide a valuable reference against which the geodetic results can be compared.

Direct inter-comparisons of the three combined polar motion series and the IGS-only series (which predominates since $\sim$2000) already reveal interesting features: seasonal amplitudes vary markedly, up to $\sim$20 uas for the annual term in one case; differences for periods longer than monthly are greater than found in 2008; and 7-d harmonics are found in one series but not the others. We also apply the refined polar motion excitation theory of W. Chen et al. (2013), which incorporates frequency-dependent effects and updated Earth parameters, to further study the 2014 frame solutions. Results will be presented in the poster.