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Interaction between subdaily Earth rotation parameters and GPS orbits

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In processing GPS observations the geodetic parameters like station coordinates and ERPs (Earth rotation parameters) are estimated w.r.t. the celestial reference system realized by the satellite orbits. The interactions/correlations between estimated GPS orbis and other parameters may lead to numerical problems with the solution and introduce systematic errors in the computed values: the well known correlations comprise 1) the correlation between the orbital parameters determining the orientation of the orbital plane in inertial space and the nutation and 2) in the case of estimating ERPs with subdaily resolution the correlation between retrograde diurnal polar motion and nutation (and so the respective orbital elements).
In this contribution we study the interaction between the GPS orbits and subdaily model for the ERPs. Existing subdaily ERP model recommended by the IERS comprises ∼100 terms in polar motion and ∼70 terms in Universal Time at diurnal and semidiurnal tidal periods. We use a long time series of daily normal equation systems (NEQ) obtaine from GPS observations from 1994 till 2007 where the ERPs with 1-hour resolution are transformed into tidal terms and the influence of the tidal terms with different frequencies on the estimated orbital parameters is considered. We found that although there is no algebraic correlation in the NEQ between the individual orbital parameters and the tidal terms, the changes in the amplitudes of tidal terms with periods close to 24 hours can be better accmodated by systematic changes in the orbital parameters than for tidal terms with other periods. Since the variation in Earth rotation with the period of siderial day (23.93h, tide K1) in terrestrial frame has in inertial space the same period as the period of revolution of GPS satellites, the K1 tidal term in polar motion is seen by the satellites as a permanent shift. The tidal terms with close periods (from ∼24.13h to ∼23.80h) are seen as a slow rotation of the celestial pole with periods of about a year and less. We make an estimate of the systematic changes introduced in the orbital parameters in the case if erroneous tidal model is kept fixed in the processing.