GPS MEASUREMENTS OF TIDALLY INDUCED SOLID EARTH DISPLACEMENTS

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We study load and solid earth tides using globally distributed continuous GPS data and models of ocean and solid earth tides. A two-step strategy is used to maintain reference frame consistency and to allow economical tidal determination on a large number of global sites. First, a fixed network of 45 sites with good geographic coverage and available data is used in daily global analyses to estimate site coordinates, tidal displacements, orbits, and other parameters simultaneously. The daily estimates of tidal displacements are subsequently merged with the least squares method and decomposed into network displacements and deformation with respect to the network. Once tides are determined for the network, the data will be processed again with tides fixed to optimally smooth the orbits and clocks. Tides on any other sites can then be determined using the point-positioning method.

About 500 days of data with a time span of 30 months have been processed for the global network to estimate the amplitudes and phases of 3-dimensional displacements due to M2, S2, N2, K2, K1, O1, P1, and Q1 tides. Displacements with respect to the reference frame attached to the network for M2, N2, O1, and Q1 are determined very well, with RMS repeatabilities between two subsets at the level of 1-2 mm for the amplitudes. The RMS amplitude differences between the GPS estimates and predictions from the GOT00/OLFG/OLMPP load tide model are at the 1 mm level for these 4 tides. GPS results for the other 4 frequencies are a factor of 2-3 noisier. The two pairs of frequencies are very close to each other with a beat period of 183 days. Improved results with more data and reduced contamination will be presented. We will also discuss load-induced network transition with respect to the geocenter and earth orientation changes.