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Impact of loading effects on the Terrestrial Reference Frame determination

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The International Terrestrial Reference Frame (ITRF) is defined as a secular frame represented by a set of station positions and linear velocities. The ITRF2005 integrates time series of station positions to form long-term solutions for the four space geodetic techniques. Currently, a pure linear model is used to parameterize station displacements in the estimation process, plus occasional discontinuities. As station motion caused by surface loading is available from models but not included in the input data analysis, we suggest here to correct time series of station positions with a loading model as part of the ITRF combination procedure. This has the large advantage of permitting flexible testing of variations in the load treatment without complicating the raw data analyses and without introducing unnecessary high-frequency noise into the station position estimates. The chosen loading model has been built on a weekly basis using surface fluid data and the Green's function approach. It accounts for atmosphere, continental water, non-tidal ocean, and ice sheet effects. We propose to compare the displacement model with the stacked post-fit station residuals using a rigorous approach. Equivalent origin translation and scale time series are built using the model exclusively, in order to interpret SLR translations and SLR and VLBI scale factors from the frame stacking. Based on preliminary analysis we observe good agreement that supports using the loading model to correct time series of positions at the combination level. It remains to be determined what is the optimal filtering that should be applied to the load displacements to minimize noise effects. The position time series will be corrected by the model and stacked to yield secular reference frames that are relatively free of loading effects. The result of this procedure

will be compared with the non-corrected stacking results. On the one hand, study of the estimated Helmert and Earth orientation parameters estimated during the stacking will be useful to validate the correction procedure. On the other hand, the differences between the estimated positions and velocities will be investigated as well as residual position time series.