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Applications of a weekly updated TRF from satellite laser ranging: observing geophysical events

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Since over two decades now, Satellite Laser Ranging (SLR) tracking data contribute to the definition of the Terrestrial Reference System (TRS). The origin of the Terrestrial Reference System (TRS) is realized through the estimated coordinates of its defining set of positions and velocities at epoch, constituting the conventional Terrestrial Reference Frame (TRF). Driven by numerous geophysical processes, continuous mass redistribution within the Earth system causes concomitant changes in the Stokes coefficients describing the terrestrial gravity field. Seasonal changes in these coefficients have been closely correlated with mass transfer in the atmosphere, hydrosphere and oceans and they are now routinely monitored from dedicated space missions (e.g. GRACE). The stability, integrity and applicability of the TRF are directly related to the accuracy and fidelity with which such motions can be observed or modeled during the position determination of the defining sites (e.g. from analysis of SLR data to LAGEOS 1 and 2). Variations in the very low degree and order terms, produce geometric effects that are manifested as changes in the origin and orientation relationship between the instantaneous and the mean reference frame (multi-year average), as well as the axes of figure orientation. SLR contributed the most accurate observations of these effects yet, demonstrating millimeter level accuracy for weekly averages. Over the last few years we have updated the multi-year TRF definition incrementally, adding every week, the new weekly data set, thereby extending the validity of the TRF and at the same time, incorporating all the available observations. This weekly update of the underlying mean TRF enabled the accurate observation of several significant geophysical events, recent and in the past, involving mass motion in the hydrosphere and the solid Earth. We have now implemented improvements in the analysis methodology and the underlying models, used in a new series of weekly results, consistent with

the recently adopted IERS Conventions 2003, and using the latest improvements in modeling SLR observations. We will present our results from several years of LAGEOS 1 and 2 and ETALON 1 and 2 SLR data, assess their accuracy, compare them to geophysical signals, and to the monthly series from the GRACE project.