# On the Assessment of Global Terrestrial Reference Frame Temporal Variations

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Global Terrestrial Reference Frames (GTRFs) as the International Terrestrial Reference Frame (ITRF) provide reliable 4-D position information (3-D coordinates and their evolution through time). The given 3-D velocities play a significant role in precise position acquisition and are estimated from long term coordinate time series from the space-geodetic techniques DORIS, GNSS, SLR, and VLBI. GTRFs temporal evolution is directly connected with their internal stability: The more intense and inhomogeneous velocity field, the less stable TRF is derived. The assessment of the quality of the GTRF is mainly realized by comparing it to each individual technique's reference frame. E.g the comparison of GTRFs to SLR-only based TRF gives the sense of the ITRF stability with respect to the Geocenter and scale and their associated rates respectively. In addition, the comparison of ITRF to the VLBI-only based TRF can be used for the scale validation. However, till now there is not any specified methodology for the total assessment (in terms of origin, orientation and scale respectively) of the temporal evolution and GTRFs associated accuracy. We present a new alternative diagnostic tool for the assessment of GTRFs temporal evolution based on the well-known time-dependent Helmert type transformation formula (three shifts, three rotations and scale rates respectively). The advantage of the new methodology relies on the fact that it uses the full velocity field of the TRF and therefore all points not just the ones common to different techniques. It also examines simultaneously rates of origin, orientation and scale. The methodology is presented and implemented to the two existing GTRFs on the market (ITRF and DTRF which is computed from DGFI) , the results are discussed. The results also allow to compare directly each GTRF dynamic behavior. Furthermore, the correlations of the estimated parameters can also provide useful information to the proposed GTRFs assessment scheme.