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Global terrestrial reference frames

Abstract

Global terrestrial reference systems (TRSs) are realized by global terrestrial reference frames (TRFs) providing coordinates and velocities of globally distributed stations. The four space geodetic techniques GNSS (Global Navigation Satellite System), SLR (Satellite Laser Ranging), VLBI (Very Long Baseline Interferometry) and DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) are combined to get a reference frame with highest accuracy and stability. Local measurements on the ground at co-located sites, so-called local ties, are currently used to tie the single-technique solutions together. The latest official realization of the International Terrestrial Reference System (ITRS) is the ITRF2014 released by the Institut National de l'Information Géographique et Forestière (IGN). In addition, the two other ITRS combination centers the Deutsches Geodätisches Forschungsinstitut (DGFI-TUM) and the Jet Propulsion Laboratory (JPL) released the DTRF2014 and the JTRF2014, respectively. TRFs are the basis for almost all geodetic measurements such as classical as well as satellite observations, since a reference connects the measurements with the surface of the Earth. Therefore, the provision of accurate reference frames is one of the main tasks of geodesy. The Global Geodetic Observing System (GGOS) requires specifically that the TRF should have an accuracy of 1mm and a long-term stability of 0.1mm/yr in order to reliably interpret parameters which refer to the TRF such as the global sea level rise. Since all currently available TRFs do not meet the GGOS requirements, simulation studies can be useful to better understand the errorlimiting factors. In the framework of the project GGOS-SIM (Simulation of a global TRF for GGOS) observations of all four space geodetic techniques (GPS, SLR, VLBI, DORIS) were simulated within the time span 2008-2014. Different combination strategies as well as the impact of planned stations on the TRF were studied. Furthermore, it is planned to investigate by simulations the effect of future GNSS generations on the TRF.