Geophysical Research Abstracts
Vol. 12, EGU2010-11446, 2010
EGU General Assembly 2010

Contribution of SLR Tracking of GNSS Constellations to Future ITRF

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The development of future realizations of the International Terrestrial Reference Frame (ITRF) in the age of the Global Geodetic Observing System—GGOS, places very stringent requirements in its accuracy and stability attributes. As of this time, the generally accepted and quoted goal is an origin definition at 1 mm or better at epoch and a temporal stability on the order of 0.1 mm/y, with similar numbers for the scale (0.1 ppb) and orientation components. These goals are based on extensive deliberations within the Earth science community. None of the IAG positioning techniques can achieve this goal alone. In part this is due to the non-observability of certain attributes from the particular technique. Another major problem though is the limitations of the tracking network and the available targets. SLR for instance has a very poor distribution of tracking stations and a rather small number of satellite targets in orbits that are useful for ITRF development. With the real prospect of outfitting the future GNSS constellations with CCR arrays, there is an opportunity to dramatically increase the number of targets, improve the sky-coverage, and increase at the same time the chances that a SLR station has a target to track at any time. With careful planning and calibration of the CCR array location with respect to the radiometric phase center and the center of gravity of the s/c, these targets can deliver a very significant contribution in the development of the future ITRF realizations. With the number of such targets of opportunity reaching well over a hundred over the next decade, we need to define minimum requirements in order to avoid undue burdening of the SLR network and waste of resources. Using simulations of SLR data to GPS, Galileo, etc., we examine the utility of bringing the two techniques together in orbit and the tangible benefits that we expect to collect on the ground in realizing the ITRF. We present here the results of extensive simulation studies aimed at designing optimal combinations of the number of required sites versus the number of targets and the temporal schedule required to achieve the typical GGOS accuracy standards.