Potential TRF improvements through better understanding of laser ranging target signature effects

Toshimichi Otsubo[1]; Graham M. Appleby[2]; Tadahiro Gotoh[1]; Toshihiro Kubo-oka[1]

[1] NICT; [2] NERC Space Geodesy

http://www.nict.go.jp/ka/control

The origin of the International Terrestrial Reference Frame is fully defined and the scale partly defined by laser ranging to LAGEOS satellites. State-of-the-artlaser ranging systems potentially have a 1-mm ranging precision, but this precision has not been fully utilised in the realisation of the terrestrial reference frames, especially in their scales.

Otsubo and Appleby (2003) found that the tracking-system dependent centres-of-mass corrections for the LAGEOS and ETALON satellites can vary across the ILRS network by up to 1 cm and 5 cm respectively. Any error in the satellite centre-of-mass correction that is applied during orbital determination is highly correlated with the simultaneous determination of Earth's gravitational constant (GM). In routine analyses, the community has not hitherto taken the system-dependent satellite signature effect into consideration, i.e. we simply apply the widely-used standard 251-mm correction for LAGEOS and 576-mm correction for ETALON for all data from all tracking stations. Any deviation of the true value from the standard value directly affects the height component of station coordinates, and thus the origin and the scale of the derived terrestrial reference frame by the corresponding amount.

With the on-going development in laser ranging systems and continuing improvement in the modelling of CoM corrections, plus proposed new satellite systems to be placed in a variety of altitudes, satellite laser ranging is expected to produce improvements in the accuracy of the determination of GM and scale of terrestrial reference frames in the future.