COMPARISON OF GNSS ORBITS DETERMINED USING MICROWAVE AND OPTICAL OBSERVATIONS

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Abstract

Satellite Laser Ranging (SLR) provides a remarkable accuracy of measurements to geodetic satellites. SLR provides the origin of the International Terrestrial Reference Frame (ITRF) and the global scale due to the fact of using precise devices, i.e., high energy laser and precise timers, but also due to characteristics of geodetic satellites. All satellites of new Global Navigation Satellite Systems (GNSS), i.e., GLONASS, Galileo, BeiDou, QZSS and IRNSS, are equipped with laser retroreflector arrays (LRA). As a result range measurement to GNSS satellites can be provided by laser stations of the International Laser Ranging Service (ILRS). Those data not only serve as a validation tool for microwave orbits, but also can be used to determine an SLR-only orbit solution. In this paper the preliminary results of the comparison of GNSS orbits determined using microwave and optical observation are discussed. For all Galileo satellites, the mean RMS of differences is equal to 4.2 cm, 13.7 cm and 25.0 cm in the radial, along-track and cross-track direction, respectively. The orbit of the MEO BeiDou satellite is characterized by a slightly larger values of RMS than Galileo satellites: 7 cm, 17 cm, 29 cm in the radial, along-track and cross-track direction, respectively. Due to deficiencies in the QZS-1 normal mode modelling in Bernese GNSS Software a large number of SLR observations was removed during the data screening. Due to that fact RMS at the level of 55 cm, 506 cm and 354 cm in the radial, along-track and cross-track direction, respectively are an unreliable results.