[EJ] Evening Poster | S (Solid Earth Sciences) | S-GD Geodesy

[S-GD02]Geodesy General Contributions &Global Geodetic Observing System

convener:Koji Matsuo(Geospatial Information Authority of Japan), Yusuke Yokota(Japan Coast Guard, Hydrographic and oceanographic department), Takahiro Wakasugi(国土交通省国土地理院)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

In this session, general contributions from all areas of geodesy are welcomed. Topics of interest will include but not limited to recent advances in measurement techniques, reference frame realization, earth rotation or earth tide. In addition, this session also provides a forum for discussing GGOS (Global Geodetic Observing System) related observation programs, advancements of geodetic techniques, collaboration among various organizations in the world. Topics will include improvements of observing system and data analysis, participations in global programs, global reference frames and geodesy's contributions to society.

[SGD02-P03]The study of satellite laser ranging observations application: LEO orbit validation and geocenter motion derivation

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Keywords:SLR, orbit validation, geocenter motion

Space geodesy techniques can provide the monitoring data of global variations with high precision and large coverage through the satellites. Satellite Laser Ranging (SLR) is one of the modern space geodesy techniques and has the high surveying precision. SLR is based on a two-way principle and provides unbiased distance observations irrespective of the satellite clock. As such, SLR tracking provides an important complement to purely radiometric observations of the satellites. The subject of this research is the Low Earth Orbit satellite (LEO), GRACE-A. LEO will suffer complex perturbations and large gravity, however, it can more directly reflect the changes in the Earth's gravity because of the low altitude. LEO can be a good tool to observe Earth from the space. This paper evaluated the quality of LEO orbits and derived the geocenter motion (GM) by using SLR data of GRACE-A, which is a LEO equipped with the laser retro-reflector arrays (LRAs) that enable SLR measurements.

There are two major applications about SLR measurements, orbit validation and GM derivation. SLR observations to LEO satellites can provide an independent validation of the orbits determined from GNSS microwave observations. SLR allows an independent way of external orbit validation except for the internal validation. The distance between an SLR station and an observed satellite, given by the SLR measurement, is compared with the distance derived from station coordinates and a standard orbit. According to the results in this research, the cm-level LEO orbit validation can be achieved.

GM describes the difference of CF (Center of Figure) respect to CM (Center of Mass of the Earth System) due to the re-distribution and deformation of the earth system. Because satellite tracking data between ground stations and satellites orbit around the CM, GM is related to the realization of the ITRF

(International Terrestrial Reference Frame) origin. In this study, GPS (Global Positioning System) observation data of IGS (International GNSS Service) and SLR (Satellite Laser Ranging) tracking data are applied to estimate the coordinates of observing sites on Earth’s surface. The GPS observing sites are distributed deliberately and globally by 15° ×15° grids. Meanwhile, two different global ocean tide models are applied here. The model used in ITRF comparison and combination is parameter transformation, which is a mathematical formula allowing to transform the different frames between ITRF and CM system. Following the parameter transformation, the results of GM can be determined.