LEO POD Requirements: Now and the Future

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Typical POD (Precision Orbit Determination) requirements for geodetic quality LEO satellites are currently at the few centimeter level (1-***fã***) in the radial component and the few decimeter level in the horizontal components, which is usually met using post-processing methodologies.

These requirements have been demonstrated to have been met with, for example, ICESat (600 km) and GRACE (400 km). Other LEO satellites have positioning requirements that are meter level to tens of meters. Even on ICESat, for example, the real time requirements are several meters, but this also includes the ability to predict the ICESat position to tens of meters accuracy over 48 hours. Different methodologies are used on ICESat to achieve the respective real time and post-processing requirements. In the case of ICESat with a laser altimeter to measure changes in the polar ice sheets, factors such as errors in the z-component of the LEO orbit are important considerations, as well as motion of the respective ITRF origin with respect to the actual Earth center of mass. This paper will address these issues and the role of the current IGS products in meeting the requirements.

In the near term (e.g., ~5 years), satellites already in orbit will not be influenced by expansion of the navigation satellites with, for example, GALILEO, because of the receiver design of these in-orbit satellites. However, as new receivers with multi-constellation capability become available, the fundamental question that LEO planners will need to address is the gain in LEO orbit accuracy with such multi-constellations and the concomitant impact on processing strategies and the potential introduction of new error sources. This paper will delineate considerations for the future in high accuracy POD applications for geodetic quality applications, such as advanced ICESat or GRACE missions. If, for example, GALILEO were available today with the high accuracy geodetic LEOs, what would be gained? And what is the accuracy requirement expected for LEOs on the next generation of advanced geodetic quality satellites?

Finally, looking to the time horizon, navigation satellite constellations have been proposed for future applications at the Moon and Mars. While the user base of such constellations would be far smaller than Earth applications, the extension of the methodologies used at Earth warrant consideration for the lunar and planetary applications should similar navigation constellations be implemented. What new challenges are posed by such applications and can IGS contribute?