Galileo precise orbit determination based on GNSS and SLR observations

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The European Global Navigation Satellite System (GNSS) Galileo is on the final stretch to achieve the full operational capability. The Galileo system will contribute to the great extent to the users who demand a precise navigation system. Moreover Galileo will provide a substantial contribution to the Earth's sciences. Due to that fact, Galileo satellites demand that operational precise orbit products be delivered. In order to provide precise orbits, all potential perturbing forces and accelerations acting on satellites have to be evaluated and considered in a proper way.

Thanks to the fact that the European GNSS Agency released the optical and geometrical metadata for the Galileo satellites, coping with the direct solar radiation pressure (SRP), albedo, and infrared Earths' radiation can be brought to the application of the satellite macro-model, such as the box-wing model.

Galileo satellites are equipped with laser retroreflector arrays for range measurements and are continuously tracked by laser stations of the International Laser Ranging Service. Range measurements provide a valuable feedback for precise GNSS orbits in the form of an independent validation tool. However, range measurements can contribute also to the combination with GNSS data for precise orbit determination.

In this work, we provide results of the precise Galileo orbit determination with the evaluation of the impact of direct SRP, albedo, infrared radiation and antenna thrust based on GNSS observations and the SLR validation. We also evaluate the impact of SLR observations on the quality of the combined GNSS and SLR orbit solutions.