Geophysical Research Abstracts
Vol. 18, EGU2016-16812, 2016
EGU General Assembly 2016

Box-wing model approach for solar radiation pressure modelling in a multi-GNSS scenario

Guillermo Tobias and Adrián Jesús García
GMV, Spain

The solar radiation pressure force is the largest orbital perturbation after the gravitational effects and the major error source affecting GNSS satellites. A wide range of approaches have been developed over the years for the modelling of this non gravitational effect as part of the orbit determination process. These approaches are commonly divided into empirical, semi-analytical and analytical, where their main difference relies on the amount of knowledge of a-priori physical information about the properties of the satellites (materials and geometry) and their attitude. It has been shown in the past that the pre-launch analytical models fail to achieve the desired accuracy mainly due to difficulties in the extrapolation of the in-orbit optical and thermic properties, the perturbations in the nominal attitude law and the aging of the satellite's surfaces, whereas empirical models' accuracies strongly depend on the amount of tracking data used for deriving the models, and whose performances are reduced as the area to mass ratio of the GNSS satellites increases, as it happens for the upcoming constellations such as BeiDou and Galileo.
This paper proposes to use basic box-wing model for Galileo complemented with empirical parameters, based on the limited available information about the Galileo satellite's geometry. The satellite is modelled as a box, representing the satellite bus, and a wing representing the solar panel. The performance of the model will be assessed for GPS, GLONASS and Galileo constellations.
The results of the proposed approach have been analyzed over a one year period. In order to assess the results two different SRP models have been used. Firstly, the proposed box-wing model and secondly, the new CODE empirical model, ECOM2. The orbit performances of both models are assessed using Satellite Laser Ranging (SLR) measurements, together with the evaluation of the orbit prediction accuracy. This comparison shows the advantages and disadvantages of taking the physical interactions between satellite and solar radiation into account in an empirical model with respect to a pure empirical model.