Geophysical Research Abstracts
Vol. 21, EGU2019-5628-1, 2019
EGU General Assembly 2019

Potential improvement of the GNSS satellite box-wing model based on the on-board accelerometer measurements

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Acceleration due to solar radiation and Earth's albedo constitutes a dominant non-gravitational perturbation (NGP) acting on the GNSS satellites. In the process of precise orbit determination this effect is nominally handled by empirical models (ECOM) and semi-analytical box-wing models that use a priori information on satellite surface parameters. However, complex physical properties of the satellite body as well as radiation, especially in terms of radiation emitted and reflected from the Earth, are known with limited accuracy. Therefore, one of the ideas already discussed in the context of the next generation Galileo satellites is to make use of the on-board accelerometer measurements that can potentially overcome weaknesses of NGP models. The purpose of this study is to explore the potential benefits of on-board NGP measurement taking into account realistic parameters of the existing accelerometers as well as two different orbit estimation scenarios. The first scenario assumes that the simulated accelerometer measurements are directly included into equation of motion during orbit estimation process. The second approach expands the standard observation vector by adding NGP measurements which leads to a possibility of refinement of satellite box-wing models and can finally improve orbit predictions.
In the summary we will discuss advantages and disadvantages of using accelerometer measurements in orbit determination process, and propose a set of recommendations for the accelerometers that could potentially be embarked on-board GNSS satellite.