EGU2020-18550
https://doi.org/10.5194/egusphere-egu2020-18550
EGU General Assembly 2020

Taking advantage of satellite clock stability for Galileo orbit model performance assessment.

Dmitry Sidorov, Rolf Dach, and Adrian Jäggi
Astronomical Institute, University of Bern, Bern, Switzerland (dmitry.sidorov@aiub.unibe.ch)

Over the course of 2016 and 2017 the European GNSS Agency (GSA) made the Galileo satellite meta information publicly available. This long-awaited metadata package included details on satellite mass, dimensions, surface optical properties, attitude law as well as the antenna phase center corrections. As a result of this undertaking, the GNSS community initiated numerous studies to advance orbit models for these spacecrafts. In particular, the Center for Orbit Determination in Europe (CODE) refined the Empirical CODE Orbit Model (ECOM2) to adopt it to these lightweight satellites. This extended ECOM2 is currently used for computation of the CODE precise products involving Galileo (the Ultra-Rapid, Rapid and Multi-GNSS Extension (MGEX) products) in the frame of the International GNSS Service (IGS) activities.

The Galileo satellites carry state-of-the-art passive hydrogen maser (PHM) clocks that have been marked by high stability by many research groups. The commonly adopted procedure for the satellite clock corrections computation includes introduction of orbits estimated beforehand. This is served to fix the geometry between satellites and ground stations with a disadvantage that the estimated satellite clock corrections to a large degree depend on the quality of the introduced orbits. As a consequence, the estimated satellite clock corrections may suffer from potential radial orbital errors.

In this study we make an attempt to assess empirical orbit models used for Galileo satellites by introducing clock modelling in our precise orbit determination (POD) procedure. Thus, we take advantage of the stability of the PHM clocks operated by the Galileo satellites to introduce additional constraints to the radial orbital component already during the dynamic POD step. The obtained results suggest that introducing a satellite clock model to POD leads to improvements in solutions if the employed dynamic orbit model is correct. Also, in view of increasing number of GNSS satellites using well-performing clocks, the POD employing clock modelling appears to have high potential in further refining of orbit models.