ESA/ESOC Analysis Center Progress and Improvements

Abstract

ESa/ESOC is one of the most active Analysis Centers within the IGS and it is providing some of the best products available. This poster highlights some of the changes, developments and improvements that were made in recent years.

Multi-GNSS: The modernization of the existing and the deployment of new Global Navigation Satellite Systems introduces new satellites, new orbits, new signals and additional frequencies. Improvements in the IGS products will strongly depend on our understanding of these new systems. We are focusing on: satellite force models, handling of different attitude modes, satellite PCO/PCV values, and the handling of the different signals and biases.

Orbit Modeling: The new GNSS satellites, Galileo, GPS IIF, GLONASS, Beidou, QZSS, are posing some interesting new challenges. The key issue here is the increasing area to mass ratio and the physical characteristics of the satellite bodies which makes them more sensitive to the radiation pressure. Furthermore, the different attitude modes that are being used to handle the satellite eclipse phases are posing some new and interesting challenges.

Multi-GNSS Activities

We periodically analyze the data from the IGS Multi-GNSS Experiment (MGEX) as at the current stage we prefer a detailed analysis of the MGEX data over routine analysis. In the scope of these activities we have derived a consistent set of Galileo, Beidou and QZSS PCO/PCVs based on processing the data of 2014 and 2015.

Box-Wing Modelling

We have extended our activities in this area now also to the satellites of the "new" constellations, i.e., Galileo, Beidou and QZSS. We believe that for Beidou and QZSS an accurate model of the satellites will be of great benefit, if not even mandatory. This is due to the fact that for small beta angles these satellites switch their attitude mode from yaw-steering (the nominal attitude mode used by GPS, GLONASS and Galileo) to orbit normal mode. In the orbit normal mode the satellite's orbit is no longer oriented towards the Sun and thus the solar radiation pressure becomes very hard to model. In the orbit normal mode phase the widely used ECOM model, and also the enhanced ECOM2 model, fail to properly model the radiations forces.

Conclusions

- The ESA/ESOC Analysis Center remains fully dedicated to the IGS.
- Despite 20 years of service still significant progress can be made.
- GPS and GLONASS can be combined without any issues. Combined solutions are outperforming GPS-only solutions.
- Satellite activities are taking place at ESA/ESOC with respect to multi-GNSS processing and modeling:
  - A lot of different signals and biases
  - PCO/PCV estimation from multiple ACs needed, for all frequencies
  - Very challenging satellite modeling issues, in particular the orbit normal mode regimes of Beidou and QZSS but also GPS IIF issues
  - For multi-GNSS more effort needed from more ACs and AACs!