IMPACT OF THE GNSS CLOCK RATE ON RADIO OCCULTATION BENDING ANGLES

S. Padovan (1), Y. Andres (1), S. Paolella (2), A. Von Engeln (2), R. Notarpietro (2), L. Butenko (2), F. M. Alemany (2), F. Sancho (1), and C. Marquardt (2)

(1) EUMETSAT, Flight Dynamics Division, Darmstadt, Germany
(2) EUMETSAT, Remote Sensing Division, Darmstadt, Germany

Measuring the bending angle of a signal travelling through the Earth's atmosphere, between a GNSS satellite and a LEO spacecraft, requires an accurate knowledge of the position and velocity of the two space vehicles during the radio occultation (RO) event. The GNSS positions and clocks are provided as auxiliary files, while the Precise Orbit Determination (POD) of the LEO is a necessary step of the bending angles retrieval process. At EUMETSAT, the POD software embedded in the RO operational processors for the EPS missions (Metop-B and -C) and Sentinel-6A use a zero-differencing approach to estimate the LEO orbits and clocks.

The GNSS space vehicles have revolution periods in excess of 10 hours and their orbits, which are relatively smooth, are typically provided at a 15-minute rate. The GNSS clocks are needed to synchronize the receiver clock when performing the LEO POD. Being GNSS clocks more affected by random variations, a smaller sampling interval is required to obtain accurate interpolations, as needed by the bending angles retrieval process.

For this study we process a month-long batch (September 2021) of RO data from the RO receiver onboard Sentinel-6A. As auxiliary GNSS products, we use JPL-generated orbits and high-rate clocks (1 Hz) for both the GPS and GLONASS constellations. We test the impact of different down-sampling of the GNSS clock data on the LEO POD solutions and on the RO bending angles retrieval processing. The resulting L1B products from the different data sets, resulting from different down-sampling values, will be assessed by estimating the number of degraded and failed occultations and by comparing them with forward-modelled ECMWF bending angle profiles.