L1-L2 BENDING ANGLE FITTING AND L2 EXTRAPOLATION IN THE TROPOSPHERE

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

(1) EUMETSAT, Darmstadt, Germany

In Radio Occultation (RO) processing, the modeling of the ionospheric effects on the GNSS frequencies L1, L2 and L5 is crucial to avoid undesired biases in the retrieved neutral bending angle profiles. At EUMETSAT we adopt a linear fitting of the L1-L2 difference, which is based on a Chapman layer bending angle profile. The extrapolation of the L2 profile in troposphere, where the L2 signal drops out, is the current approach adopted in the operational RO processors for the RO experiments onboard Metop B and C, Sentinel-6A (S6A), and the SPIRE constellation.

After the activation of TriG GNSS-RO receiver onboard the S6A satellite on November 28th 2020, the early bending angle retrievals showed non-physical neutral bending angles close to the altitude where the L2 bending angle tracking was lost. This, through the ionospheric correction, had a negative impact on the neutral bending angle profiles. This effect was observed in both GPS and GLONASS occultations. To compensate for this, before performing the ionospheric correction, the EUMETSAT S6A RO Non Time Critical (NTC) processor currently uses a simple algorithm removing all L2 data below the altitude at which the absolute L1-L2 difference is larger than a threshold. However, with the increasing solar activity of solar cycle 25, a large bias in the L1-L2 difference led the algorithm to often cut the L2 signal too high, where the signal was still meaningful. This bias effect looks to be affecting the processing of occultations from S6A, Metop and COSMIC-2, more than the ones from Spire satellites.

With the goal of using as much physical data as possible and more accurately remove the non-physical part, we performed an investigation of the possible approaches to improve the fitting of L1-L2 differences and the resulting L2 bending angles cutoff and extrapolation that would work with all RO receivers operated by EUMETSAT. We present the results of this investigation and a way forward, by comparing the resulting L1B products against forward-modeled ECMWF products