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After the introduction of a new operational processing suite for GRAS radio occultation data in November 2016, EUMETSAT also completed the reprocessing of the full GRAS data set. The reprocessed data covers the period from shortly after the launch of Metop-A in October 2006 to the end of 2016, and includes data from the Metop-B satellite since after its launch in September 2012. From late 2016 onwards, the reprocessed data set is continued by current operational products which are based on the same retrieval algorithms as the reprocessed data.

The newly introduced processing scheme is based on a Full Spectrum Inversion, exploiting the combined open and closed loop measurements provided by the GRAS instruments. In the mid and lower troposphere, biases of the wave optics processing against ECMWF data are, as expected, improved compared to the previous geometrical optics version. Nevertheless, some small S-shaped vertical bias structure remains at impact altitudes below 8 km, and is accompanied by an asymmetry between rising and setting biases. Interestingly, both the bias structure and its rising vs. setting asymmetry changed in May 2013.

This change in rising vs. setting bias characteristics coincided with an onboard software update carried out in May and June 2013 on Metop-B and -A, respectively. The update modified open loop tracking parameters, significantly extending the continuous tracking into lower (“deeper”) straight-line tangent altitudes (SLTAs). Thus, extending open loop measurements further down had a systematic impact on lower tropospheric biases in EUMETSAT’s processing.

Sokolovskiy et al. (2009) pointed out that processing deep radio occultation signals may introduce positive biases due to noise at low SLTAs. On the other hand, Marquardt et al. (2016) demonstrated that many deep GRAS occultation suffer from occurrences of impact multipath, which – if occurring more frequently – would also increase positive biases. For both mechanisms, signal cut-off algorithms play a crucial role in the processing.

We will present details of the lower tropospheric bias structure in the present EUMETSAT processing of GRAS data, and in particular address the asymmetry between rising and setting occultations. We’ll further discuss the sensitivity of the lower tropospheric bias to the height of the signal cut-off for GRAS data. Introducing Renyi entropy as a new diagnostic tool, we’ll also look at the relevance of impact multipath in the problem.

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