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It is well-known that in the presence of super-refractive layers in the lower troposphere, inversion of GNSS radio occultation (RO) measurements using the Abel transform yields biased refractivity profiles. Additionally, the inversion assumes a spherically symmetrical atmosphere, which makes it difficult to find information about horizontal refractivity gradients. Thus, it is difficult to reconstruct the true refractivity from a RO signal. To retrieve the bending angle, the phase matching (PM) operator can be used. This operator outputs a complex function of the impact parameter, from the phase of which we can calculate the bending angle. However, additional information about the atmosphere might be embedded in its amplitude. We present the PM amplitudes generated from MetOp-A GRAS data and compare them to PM amplitudes from simulated (using wave optics propagation) signals based on co-located refractivity profiles from ECMWF. From this comparison we can find surface reflections in some of the measurements, and processing a segment of the signal proves useful to more clearly distinguish them. In the simulated data we also see dramatic negative spikes at heights corresponding to super-refractive layers, although these cannot be properly distinguished in the real data due to high levels of noise. Furthermore, we see significant oscillations that simulations with instrument noise do not account for. In an attempt to better understand what causes the high levels of noise as well as the oscillations, we present the PM amplitudes of simulated signals where we add turbulence as well as horizontal gradients to the refractivity profiles.
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