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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quality Aspects of the Wegener Center Multi-Satellite GPS Radio Occultation Record OPSv5.6" *by* Barbara Angerer et al.

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We thank the reviewer for the affirmative feedback and the valuable comments. Please find our response below:

(comment 1) "Much of the quality control and quality monitoring is based on the bias and standard deviation (noise) of the bending angle profile in the height interval 65-80 km. What vertical resolution does the raw ionospheric-corrected bending angle profiles have? Is it just corresponding to the excess-phase sampling frequency? Note that the noise may be affected by this resolution, and also by filtering of the excess-phase time

series. Any comments on this issue?"

(response 1) In our processing, the excess phase profiles are smoothed using a regularization filter. The vertical resolution of the raw ionosphere-corrected bending angle profile is primarily determined by the filter width used there (to a minor degree also by the additional L2 signal filtering during the ionospheric correction). This yields a vertical resolution of about 2 km for the ionosphere-corrected bending angle in the mesosphere where we extract these standard deviation (noise) diagnostics, leading to a certain noise level for bending angle profiles that is comparatively smaller than for the excess phases. The key point for making the bending angle noise a useful diagnostic is, however, that we use the filter settings in a fixed way for all multi-satellite processings and over the full time period. Therefore it is always the same excess phase-to-bending angle processing that is applied, independent of the specific RO mission (CHAMP, COSMIC, MetOp, etc.). The magnitude of the bending angle noise for the different RO missions is hence a good diagnostic to help judge the mission performance and the degree of influence of the upper boundary initialization.

We added the following sentence in the manuscript:

page 5 line 4: "Before entering the bending angle retrieval, the excess phase is filtered using a regularization filtering method, with identical filter settings for all RO missions."

(comment 2) "One way to minimize time dependencies when generating long-term climate data records is to take a priori information from reanalyses rather than from operational NWP models. What are the considerations here?"

(response 2) Thank you for pointing this out. We are aware that using a priori information from reanalyses for our bending angle initialization would possibly be preferable for climate applications. However, most of the reanalyses assimilate RO

and are therefore not independent of RO. Furthermore, even reanalyses records are not free of influences due to observing system changes, or other biases. This is why we use ECMWF forecasts (24 h and 30 h), which are largely independent of RO. We added the following sentence to clarify this:

page 5 line 32: "Using ECMWF forecasts (24 h and 30 h), instead of, e.g., ECMWF analyses, prevents the direct impact of assimilated RO data on the high altitude initialization. The forecast range of at least a day is sufficient to make the a priori information decorrelated from the analyses information."

(comment 3) "The sampling errors are estimated as the difference between the sub-sampled and the full ECMWF field. It seems lika a good practice to subtract these errors from the observed climatology, and the results clearly show that it is efficient in removing a large fraction of sampling-related artefacts. But is there any risk that one accidentally add something to the climatology that should not be added? Suppose you have a bin, in which you do your averaging, and in your model there is an overall gradient across the bin whereas in the real atmosphere there is no gradient. With a non-uniform sampling, your estimated sampling error would include a component that should not be there. The same type of reasoning could be made for, e.g., a diurnal cycle that is not perfectly described by the model. Any comments on these risks, and the suitability of the chosen approach?"

(response 3) We agree that there is a risk of introducing a bias from the chosen reference field to the sampling error corrected climatology. However, as mentioned in the manuscript (**page 12 line 28**), this residual sampling error is estimated to be small. Scherllin-Pirscher et al. (2011a) conducted an error analysis on climatologies and concluded for the residual sampling error to be of the same order of magnitude as the statistical error. Nevertheless, we intend to investigate a possible bias due to the SE

correction in the future, e.g., by using different reference fields.

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