

How Does Assimilating a Large Commercial GNSS RO Dataset Impact HAFS Hurricane1 Forecasts? An Evaluation in Support of the ROMEX Experiment?

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This study presented in this manuscript uses the well-publicized ROMEX multi-RO source dataset to carry out RO data denial experiments, for purposes of evaluating the impact of any one or more RO data sources upon TC intensity and track forecast. The operational NOAA HAFS operational forecast model is used to assimilate the RO bending angles using the GSI and a 1-D bending angle operator.

General Comments

General. The study is somewhat compromised by model configuration, since the RO denial experiments don't apply to the HAFS outer domain, only to the inner 12x12-deg nest (initial and lateral boundary conditions are downscaled from the operational GFS model), given the way that HAFS is designed. To the extent that the impact would be different when assimilating the same RO into both nests is unknown and a subject for a future evaluation. This limitation is clearly stated and does not take away from the results presented. However, could you provide some better insight on how this impacts these results? Most of the bending angle information arises from the lower ~200-km path centered near the Earth tangent point, and your nest is about 6x that (~1200 km) in both dimensions.

Line 283. These satellites orbit in known patterns and the locations of RO predictable and are not "random". Like other satellite observations that arise from low Earth orbit and associated repeat/revisit locations, there could be very fortuitous alignment of multiple satellite observations at a critical time in the TC evolution. Or not. I think a better word here is "variability".

Line 701: COSMIC-2 receivers orbit asynchronously in the tropical and mid-latitudes, whereby Spire receivers' orbit in synchronous orbits (less data in tropical latitudes). Given this, the line "...the incremental benefits of assimilating additional RO data may be proportionally greater outside the tropics". Given the focus on TC regions, it is suggested to mention the need to sustain future RO data that cover tropical latitudes with COSMIC-2-like sampling density.

Side note: The authors may be interested in a RO-related TC impact study, that uses recent advanced polarimetric radio occultations. These data may prove useful for evaluating the selection of HAFS (or other) model microphysics (which admittedly was not part of this evaluation, but a suggestion for future HAFS evaluation). A good example is here:

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