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In the lower tropical troposphere, the quality of GPS radio occultation (RO) bending angle and refractivity may vary substantially from one profile to another, due to the variations of the horizontal and vertical structure of water vapor. For the assimilation of observations into a NWP system, appropriate observational errors for a given type of observation must be specified. Such observation errors are often statistically determined, not taken into account the quality of the individual observations. Given the significant variations of water vapor in the lower tropical troposphere, the observational errors calculated from statistical approach are usually fairly large. This poses the challenge that some good quality RO observations may be under-weighted in data assimilation. A better approach for RO data observational errors specification can be developed, if there is additional information on the quality of individual RO sounding profiles.

In this study, we develop a new approach for RO observational errors specification based on the local spectral width (LSW) of RO, which is a measure of the uncertainty in RO retrieval due to the non-spherically symmetrical irregularity. It is found that the LSW/2 shows approximately linear relationship with respect to the statistical RO errors diagnosed by the Hollingthworth and Lonnberg (1986). Based on this relationship, we use LSW/2 to derive dynamic observational errors of RO bending angle and refractivity for data assimilation. In this way, the RO observations with low LSW (high quality) are assigned smaller errors and weighted more in data assimilation.

Assimilation and forecast experiments of COSMIC RO refractivity data with the Weather Research and Forecasting (WRF) model demonstrate that the LSW-derived dynamic error can improve the quality of analysis and forecast, and improve track forecast of tropical cyclones.

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