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The COSMIC 1D-Va--which produces GNSS-RO-based soundings of temperature, moisture, and pressure--recently underwent a major update to replace the earlier version that was used in CDAAC production for the last two decades. This new 1D-Var is currently being employed to process COSMIC-2 data and will be expanded to COSMIC and other missions for their retrospective data processing. As the COSMIC 1D-Var retrievals are being utilized for many applications in diverse areas, we would like to report a number of new and unique features and aspects that distinguish this new 1D-Var from the previous version and data assimilation practices, with the intent to assist the scientific community and data users in making informed decisions about the use of the 1D-Var data products. Also to be presented are the results of our multifaceted and extensive retrieval validation and verification. The validation, which makes use of synthetic data sets with known error statistics, confirms that the 1D-Var behaves as intended by design and yields a retrieval far smaller than the observation and a priori in both systematic and random errors. The verification, carried out with real-world data sets, shows that the 1D-Var retrieval agrees remarkably well with collocated RS92 radiosondes and model analyses, and that the retrieved moisture in the lower troposphere is largely independent of a priori and as a result attains long-term stability. Notably, the retrieval is stable enough to clearly detect the changes made in the past to the NCEP operational forecasting system.
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