Assimilation of microwave radiances over the rainbands of tropical cyclones

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Abstract

Microwave satellite observations are one of the largest datasets assimilated into Numerical Weather Prediction (NWP) models. However, the potential of microwave observations in improving the weather forecasts is limited by the accuracy of all-sky radiative transfer calculations. We introduce a novel Bayesian Monte Carlo technique to improve the assimilation of microwave observations over the rainbands of tropical cyclones. The BMCI technique eliminates the need for a forward model in the data assimilation system. The technique includes three steps, (i) generating a comprehensive dataset using in-situ cloud measurements and atmospheric profiles, (ii) generating synthetic ATMS observations from the training dataset, and (iii) using real observations to estimate the geophysical variables over the rainbands of tropical cyclones. The retrieved profiles of temperature, relative humidity, and cloud water content as well as surface information such as SST were then assimilated into the model. The results show that assimilating the BMCI retrievals can influence the dynamical features of the cyclone, including a stronger warm core, a symmetric eye, and vertically aligned wind columns.

Keywords: microwave observations, forward model

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