Using Regional-scale OSSEs to Explore the Impact of Water Vapor Sensitive Infrared Brightness Temperatures on Analysis and Forecast Accuracy

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Regional-scale Observing System Simulation Experiments (OSSEs) of a high impact weather event across the central U.S. are used to examine the impact of water vapor sensitive infrared brightness temperatures on the analysis and forecast accuracy. Compared to a control case without satellite assimilation, wind and temperature analyses were more accurate at the end of the assimilation period when observations sensitive to water vapor in the upper troposphere were assimilated; however, cloud and moisture analyses were most improved when observations sensitive to water vapor in the lower and middle troposphere were assimilated. The more accurate analyses at the end of the assimilation experiments led to improved short-range precipitation forecasts compared to the control case. Equitable threat scores were consistently higher for all precipitation thresholds. These results demonstrate that the ability of water vapor sensitive infrared brightness temperatures to improve not only the 3D moisture distribution, but also the temperature, cloud, and wind fields, enhances their utility within data assimilation systems.