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Effect of AMSU-A observation and adjusted AMSU-A observation error covariance on numerical weather predictions

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In this study, the effect of individual observations on numerical weather predictions was evaluated using the adjoint-based forecast sensitivity to observation (FSO) method. The effect of individual observations on 24 hour forecasts in the Korea Meteorological Ministration (KMA) Unified Model (UM) showed that the observation impact of Advanced Television and Infrared Observational Satellite Operational Vertical Sounder (ATOVS) AMSU-A on the forecasts was largest, followed by the SONDE, AIRCRAFT, and IASI. Especially, ATOVS AMSU-A radiance data were most helpful to improve temperature forecasts over the Northern Pacific. The effect of AMSU-A radiance data was varied with channels: the effect of channel number 5-8 which retrieve tropospheric temperatures was largest. Horizontally, the observation impact of AMSU-A on the forecasts was aggregated near mid-latitude troughs in the Northern and Southern Hemisphere for winter and summer months, respectively. In East Asia, the observation impact of AMSU-A installed in METOP-A was largest at 00 and 12 UTC, whereas that of AMSU-A installed in NOAA 18 and 19 was largest at 06 and 18 UTC, which is associated with the scanning track passing through the East Asia.

Using the FSO, the forecast sensitivity to error covariance (FSR) was calculated for July 2012. The FSR indicates that reducing observation error covariance and increasing background error covariance help to reduce the forecast error. The observation error covariances were adjusted using the multiple linear regression method of the FSO data of July 2012, and then applied to the forecasts for August 2012. Consistent with the previous results, the multiple linear regression method based on FSR suggested that the background error covariance needs to be inflated by 30%, whereas most of the observation error covariances need to be deflated. Because both FSO and FSR for AMSU-A data were largest, the observation error covariance of AMSU-A was reduced and the forecasts using the reduced AMSU-A observation error covariance show better results compared to the operational forecasts in KMA UM.