

대기물리 분과 [P-049]

Improving lower-tropospheric temperature and humidity profiles over land by incorporating ASOS data into GK2A AMI retrievals

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The accuracy of atmospheric profiles retrieved from satellites often suffers in the lower troposphere, particularly over land, due to the limited sensitivity of infrared channels and errors in the near-surface background profiles. To enhance the temperature (T) and humidity (Q) profiles retrieved from the GK2A AMI over land, this study incorporated 2-meter and surface measurements from the Automated Surface Observing System (ASOS) into a 1DVar-based retrieval system. In each retrieval, the ASOS data were compared with the first guess and used to adjust the lower part of the first-guess profiles by vertical interpolation. Forecast fields from the high-resolution local prediction model LDAPS (1.5 km horizontal resolution) were used as the first-guess. In addition, surface skin temperature and surface emissivity for the AMI infrared channels were included in the state vector and iteratively updated to better constrain the surface conditions during the retrieval process.

Validation was performed against both radiosonde observations and ERA5 reanalysis over the Korean Peninsula for January and July 2022. The new method (with ASOS data) consistently outperformed the conventional method (without ASOS data) in terms of mean bias and RMSE for both T and Q profiles regardless of season. Compared to the LDAPS forecast below 850 hPa, the new method reduced the radiosonde-validated RMSE of T and Q by 29% and 21% in summer, and by 8% and 14% in winter, respectively. By contrast, the conventional method only marginally improved the LDAPS forecast, showing 5% and 1% of RMSE reductions in summer and little improvement in winter.

Keywords: Atmospheric profiles in the lower troposphere, GK2A AMI, ground-based observations, LDAPS, one-dimensional variational (1DVar) retrieval