

# Examining the Quality of IASI and AIRS Temperature and Moisture Retrievals over East Asia Using Radiosonde Observations and Numerical Model Outputs

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## Introduction

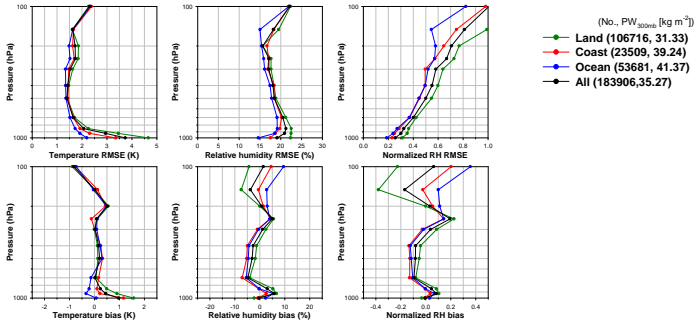
Hyperspectral measurements in the infrared region provide atmospheric temperature and moisture profiles with very high vertical resolution, and the atmospheric profile data can be used for various scientific areas such as weather forecast and climate change studies. Given the importance of the retrieved temperature and water vapor profiles, examining the quality of the retrieved profiles would be beneficial to various research areas in the atmospheric sciences. The validation efforts also guides the way to improve the retrieval algorithms.

Temperature and moisture profiles retrieved from Infrared Atmospheric Sounding Interferometer (IASI) and Atmospheric Infrared Sounder (AIRS) were evaluated by using radiosonde (RAOB) observations over the area of (0–55°N, 90–150°E) over East Asia. For the evaluation, satellite products and radiosonde measurements are temporally and spatially collocated, and statistics of temperature and water vapor profiles are calculated using the collocated radiosonde measurements as a reference. The pass of IASI around 0100 and 1300 UTC over East Asia allows numerous and relatively homogeneous collocations with RAOB, while AIRS provides limited collocations; therefore, the evaluation results of IAS products are mainly presented here.

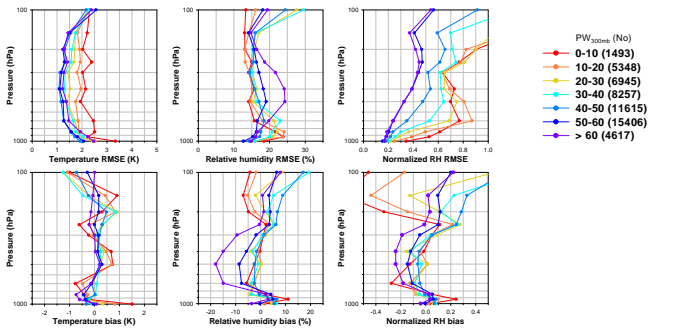
Numerical model outputs provided by Korea Meteorological Administration (KMA) are also matched with the satellite and radiosonde profiles for examining the model performances, in comparison with satellite data.

## Results

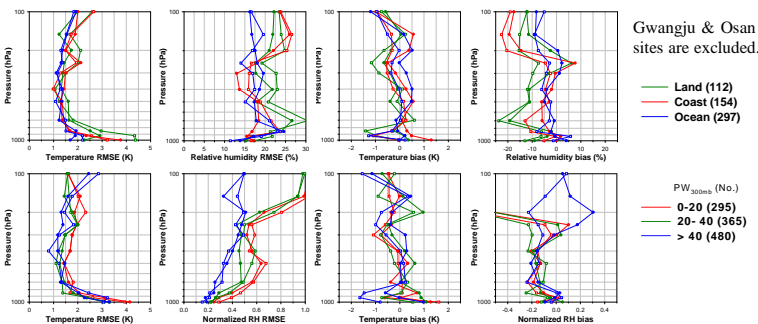
### IASI-RAOB collocation results: by surface type



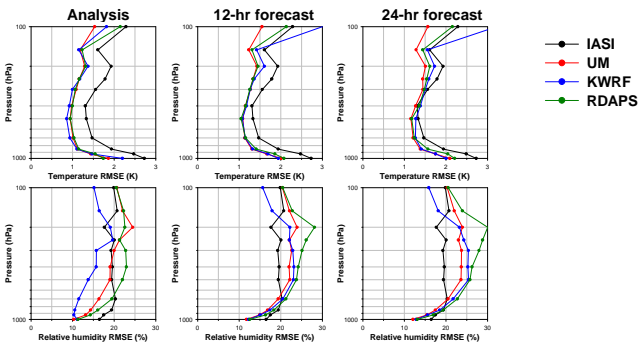
### IASI-RAOB collocation results over ocean: by precipitable water



### AIRS (◊) & IASI (●) collocation at the same RAOB stations (within 6 hours)



### IASI-RAOB-Model collocation results



## Data & Methodology

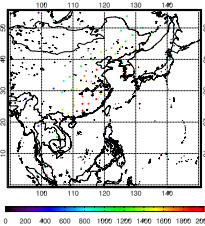
### Satellite data

- IASI Level 2 from NOAA/NESDIS, AIRS Level 2 from NASA/GES DISC
- Data period: 2008.09.01–2009.08.31
- Satellite pass time over East Asia  
IASI: 01±02:30 & 13±02:30 UTC, AIRS: 05±02:30 & 17±02:30 UTC

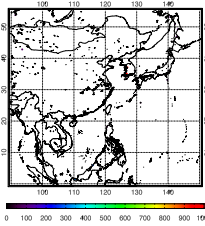
### Satellite-RAOB collocation

- Criteria: time difference < 3 hours, spatial difference < 1 degree  
All of the satellite pixels within the temporal and spatial criteria are matched to a RAOB station.
- RAOB quality control:
  - Check whether temperature and dew point depression are within two standard deviations of the mean (determined from the 3-year RAOB dataset) at any given level from surface to 100 hPa.
  - Check whether all the mandatory level data are valuable from 925 hPa to 300 hPa.
- IASI & AIRS quality control: mid-troposphere temperature flag
- 100-level IASI/AIRS retrievals are interpolated to mandatory pressure levels of RAOB.
- Statistics are categorized by surface type of satellite pixels and by integrated water vapor from surface to 300 hPa ( $PW_{300mb}$ ) at RAOB stations.

No. of IASI-RAOB matches



No. of AIRS-RAOB matches



76% of the AIRS-RAOB matches come from Gwangju and Osan stations.

### Korea Meteorological Administration (KMA) numerical model data

- Data period: 2009.06.01–2009.08.31
- Regional Data Assimilation and Prediction System (RDAPS)
- Korea Weather Research and Forecasting (KWRP)
- UK Met Office model (UM) run with KMA observation data

## Conclusions

- Both of temperature and moisture retrievals from satellite show degraded performances over land and in dry conditions. Over land, the temperature RMSE significantly increases near the surface. Moist bias of the lower-troposphere is significant in dry condition, whereas dry bias of the mid-troposphere is more in moist condition.
- Although the retrieval results of IASI and AIRS over East Asia are comparable, there are slight differences such as the opposite temperature bias in the lower-troposphere. Since the IASI and AIRS collocation at the same location is spatially and temporally limited, the results should be interpreted with caution.
- At analysis time, model outputs show better statistics than IASI retrievals; however, the model outputs become comparable or even worse in comparison to IASI retrievals as forecast time goes on. Although KWRP shows best agreement with RAOB at analysis time, the forecast performance of UM, which is a newly adopted model of KMA, is slightly better than KWRP and RDAPS.