1. Introduction

- Increase of extreme severe weather, such as typhoon and rainstorm; Development of high resolution regional model;
- Hyperspectral infrared radiance data can provide high resolution of temperature and humidity profiles;
- Special issues in regional data assimilation: the initial and boundary conditions from the global model; model top of regional model; regional background error covariance (B matrix); the highly variable at each assimilation cycle for the number of observations; impact of limited data volume on the current method of bias correction;

2. Model and Assimilation

- Weather Research and Forecasting (WRF); Gridpoint Statistical Interpolation (GSI); Community Radiative Transfer Model (CRTM)
- Model horizontal resolution: 12 km; Domain size: 917 by 550 by 50; model top: 10 hPa
- Data: all conventional data and AIRS.

3. Quality control

Channel selection
- AIRS channel peak around or above model top were rejected based on sensitivity analysis (McCarty, 2009) 61 channels assimilated: 18 temperature; 11 windows; 20 water vapor; 12 shortwave

Cloud detection
- Histogram of O-B; Looks symmetrically
- Distribution after quality control

4. B matrix tuning

B matrix: Spread out information from observations; Controls % of innovation that makes up the analysis; Maintain dynamically consistent increments between model variables. Estimated from NMC method.

Impact of B matrix tuning on typhoon forecast
- RMSE profiles between 24 h forecast and radiosonde observations for one week; About 3000 radiosonde data used to evaluation per level on average.

5. Bias correction

- Sources: calibration, radiative transfer model and short term forecast
- Characteristics: varies with time, airmass, scan position, satellite orbit
- Variation Bias Correction (Augligné, 2007): Scan angle bias + Airmass bias
- One month local spin-up to update scan bias and airmass coefficients

Scan angle bias correction
- Time series change: Time dependence

RMSE comparisons of typhoon Saola’s 72 h intensity forecast when different bias correction coefficients were applied

6. Impact of AIRS radiances assimilation on typhoon forecast

O-B/O-A analysis
- Bias comparisons of O-B and O-A for all 61 AIRS channels assimilated O-A are close to zero after assimilation for temperature and moisture channels

Analysis Increment
- Control Run (Ctrl): all conventional observations
- Experiment Run (Exp): Control Run + AIRS

Comparisons of 72h track and intensity forecast for Ctrl and Exp experiment with the best observations from JTWC

(a) Temperature at 500 hPa: Cold
(b) Relative humidity at 850 hPa: Dry

Exp analysis minus Ctrl analysis

7. Summary

- Limited Area NWP carried out using community models
- Assimilation of AIRS radiances through quality control, B matrix tuning and bias correction
- Positive impact for clear sky AIRS assimilation both on typhoon track and intensity forecast