Operational use of Suomi NPP ATMS radiance data in JMA’s global NWP system
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1. Introduction

Since 29 Mar. 2017, microwave radiance data from the Advanced Technology Microwave Sounder (ATMS) of the Suomi National Polar-orbiting Partnership (S-NPP) spacecraft have been assimilated operationally into the global Numerical Weather Prediction (NWP) system run by the Japan Meteorological Agency (JMA).

In this poster, we briefly describes related data quality control and the impacts of the assimilation.

2. Specification of JMA’s global NWP system

2.1 Data Assimilation

- Outer model: TL959L100 (horizontal reso. 20 km, top 0.01 hPa)
- Inner model: TL319L100 (horizontal reso. 55 km, top 0.01 hPa)
- 6-hr assimilation window, incremental 4D-Var
- Radiative Transfer Model: RTTOV-10.2

2.2 Forecast Model

- TL959L100 (horizontal reso. 20 km, top 0.01 hPa)
- 84-hour forecast at 00, 06, 18UTC, 264-hour forecast at 12UTC

3. Quality Control (Cloud screening and bias correction)

- The same approaches used for AMSU-A/MHS quality control (Okamoto et al. 2005) are applied.
- QC: Rain, CLW, Land/Sea, Sea Ice, Altitude
  - Over ice-free sea
    - Rain detection: ObsTBB(ch16) – ObsTBB(ch17) > 3(K) or CLW >= 300 (g/m2)
  - Cloud detection: CLW >= 100 (g/m2)
- Observation errors: Estimated from O-B statics. (Table 1)
- Thinning: 250 km distance
- Bias correction: Scan position bias correction (static) and Variational bias correction (VarBC) (Sato 2007, Ishibashi 2009)
- AAPP FFT-based filter is applied to achieve noise performance similar to that of AMSU-A.
- Edge data on FOV number at 1, 2 and 95, 96 are not assimilated due to their anomalous biases.

4. Observing System Experiments (OSE)

4.1 Design of experiments

- Control: Same as JMA operational global DA system as of Dec. 2016
- Test: Control + ATMS radiance (clear-sky)
- Period: One month for summer 2015 (August, 2015 sum) and winter 2015-2016 (January 2016 win)

4.2 Results

- Improved fits in FG departure of various observation types.

5. Development

5.1 Use of stratospheric channels (ch10-15)

- Preliminary experiments using ATMS stratospheric channels (ch10-15) showed increasing STDV of FG departure from AMSU-A. (Fig. 3)
- We found different characteristics between corresponding ATMS and AMSU-A channels’ FG departure in high latitudes after VarBC.
- Choice of VarBC predictors for ATMS T-ch affects the performance of the bias correction. Use of thickness as the predictor improved the consistency between ATMS T-ch and AMSU-A T-ch.
- Considering the change of the predictor for microwave temperature sounding channels from IWLR to thickness.

5.2 Observational change

- Use of stratospheric channels (ch10-15)
  - Control: Same as JMA operational global DA system as of Dec. 2016
  - Test: Control + ATMS radiance (clear-sky)
  - Period: One month for summer 2015 (August, 2015 sum) and winter 2015-2016 (January 2016 win)

5.3 Results

- Positive impacts for the prediction of geopotential height and temperature, especially in the Southern Hemisphere.

6. Summary

Operational use of clear-sky ATMS radiance since 29 Mar. 2017

- Positive impacts for the fits in FG departure of various observation types.
- Considering the change of the VarBC air-mass predictor for microwave temperature sounding channels from IWLR to thickness.

References