Buddy check for radiance with analysis error variance

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Introduction

The analysis error variances are calculated as the product of increment and analysis departure, so they should normally be positive value at each observation point. But the analysis error variances are negative when the given observation has different signal from other observations in the vicinity because the analysis does not exist between the background and the observation.

Buddy check method

- **C:** Corrected observed TB
- **B:** Background TB, $A(B)_x$ (Budy check)
- **A:** Analysis TB, $A_x$
- **H:** Observation operator
- **T:** Brightness temperature, observation space

Observation error square

$\text{Diag}_{on}$

$$\text{RMSD} = \text{root mean square difference}$$

AexB

$$\text{A}_{\text{ex}}\text{B}_{\text{on}}$$

Diag

$$\text{Diag}_{\text{on}}$$

Water vapor

6-hour forecast cycle run

Red in figures means

**Setting**

- Model: KIM 91L ne120 (~25 km)
- DA: HydBDAS 600 (~50 km) without ensemble run
- Used data: Sonde, Aircraft, Surface,
- GFSC, AMSU, ATMS, IASI, CrIS, AMSU, ATMS, MHS, COMS
- Period: 2017.06.22-2017.07.31
- 6-hour forecast cycle run

**Experiments**

- Diag off: No buddy check (CTRL)
- Diag -3.0: Buddy check as follows

**Application Buddy check to AMSUA ch. 10**

- **Diag** -3.0: Buddy check: $(A-B)(C-A)$ < -3.0 * obs.err
- **AexB** -3.0: reject only A exceeds B $(A-B)(C-A)$ < -3.0 * obs.err
- **AexB** -3.0: $(A-B)(C-A)$ < -3.0 * obs.err

**Short range forecast verification against Observations**

- **Diag** -3.0 vs Diag off
- **AexB** -3.0 vs Diag off

**Summary**

- Buddy check works well to remove the observations which have a different effect from most other observations.
- We have verified how removing the data with buddy check had an effect on short rage forecast.
- There was a positive effect on temperature in the verification against observation and IFS analysis, especially AexB -3.0 which reject only the observation when its C-B is opposite the sign of many others.
- Water vapor was strongly positive for the verification against MHS, ATMS and IASI. On the other hand, the verification against IFS analysis showed negative or neutral effect.

Future Works

- Fitting the threshold for each observation
- Investigation of removal data with buddy check to improve QC or blacklisting
- Setting large observation errors instead of removing the data