

Recent activities on microwave radiance data assimilation at JMA

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JMA global NWP system and satellite radiance data

Forecast model and data assimilation

- Outer model: TL959L100 (horizontal reso. 20km, top 0.01hPa)
- Inner model: TL319L100 (horizontal reso. 55km, top 0.01hPa)
- 6-hr assimilation window, incremental 4D-Var
- Analysis variables (Wind, surface pressure, specific humidity and temperature)
- 11 day forecast from 00, 06, 12, 18 UTC initials.
- Radiative Transfer Model
RTTOV-10.2 (planned to use RTTOV-11 in the next year)
- Bias correction Method
VarBC for radiance data

Satellite radiance data for operational use (clear-sky)

- Microwave radiance: AMSR2/GCOM-W, AMSU/Aqua, AMSU/Metop, MHS/NOAA, MHS/Metop, SSMIS/DMSP, SAPHIR/Megha-Tropiques
- Infrared radiance: AIRS/Aqua, IASI/Metop, CSR/GOES, CSR/MTSAT, CSR/Meteosat

Monitored and evaluated radiance data

- CSR/Himawari-8, GMI/GPM, ATMS/S-NPP, CrIS/S-NPP

Under preparation for monitoring

- SSMIS/DMSP F19, MWHS/FY-3B, MWHS2/FY-3C, MWRI/FY-3B

Development of all-sky microwave imager radiance assimilation in JMA global DA system

All-sky assimilation of AMSR2, GMI, SSMIS F16, F17, F18

Clear-sky MW imager radiance assimilation

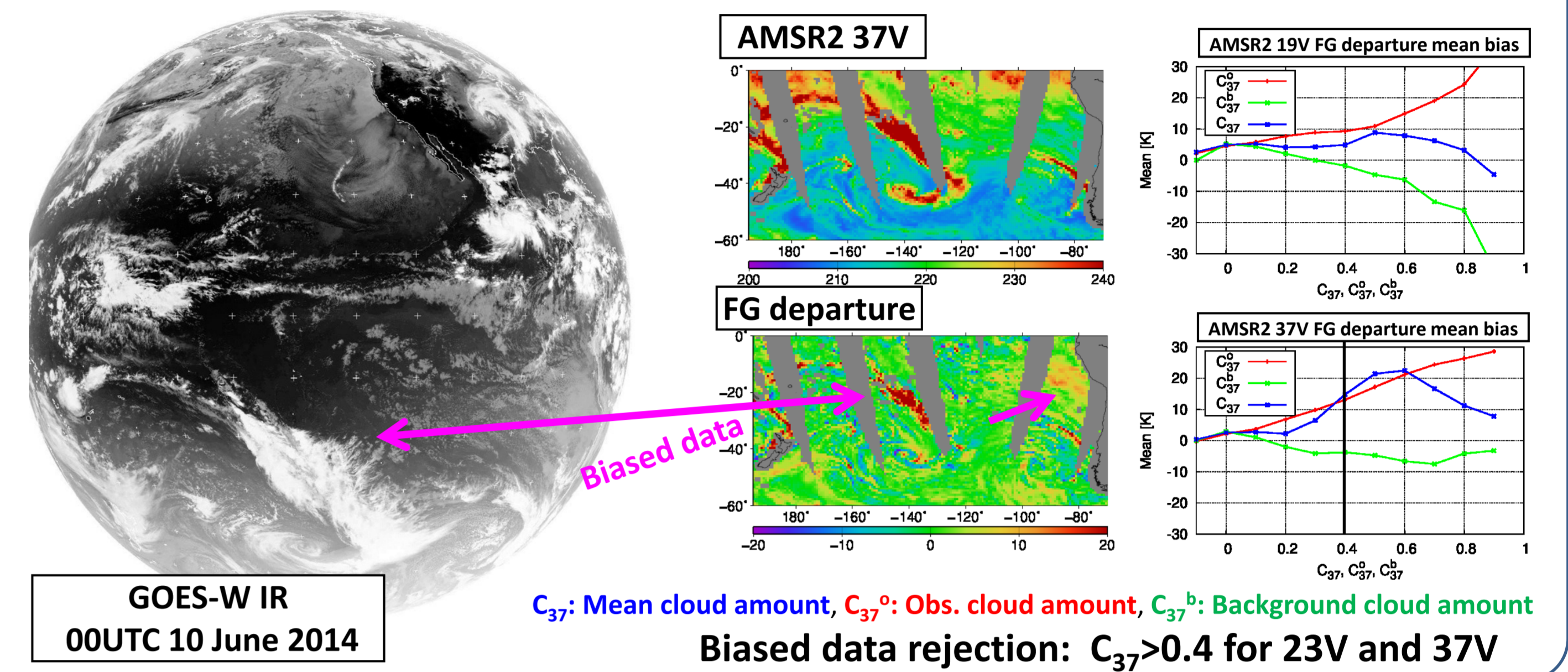
RTM: RTTOV-10 (rttov_direct, rttov_k)
 Input profile: Temperature, Water vapor
 Data thinning: 200 km grid-box thinning
 Used MW imager: AMSR2, SSMIS (F16, F17, F18), TMI
 Used channels: 19V, 23V, 37V, 89V clear-sky oceanic data

All-sky MW imager radiance assimilation

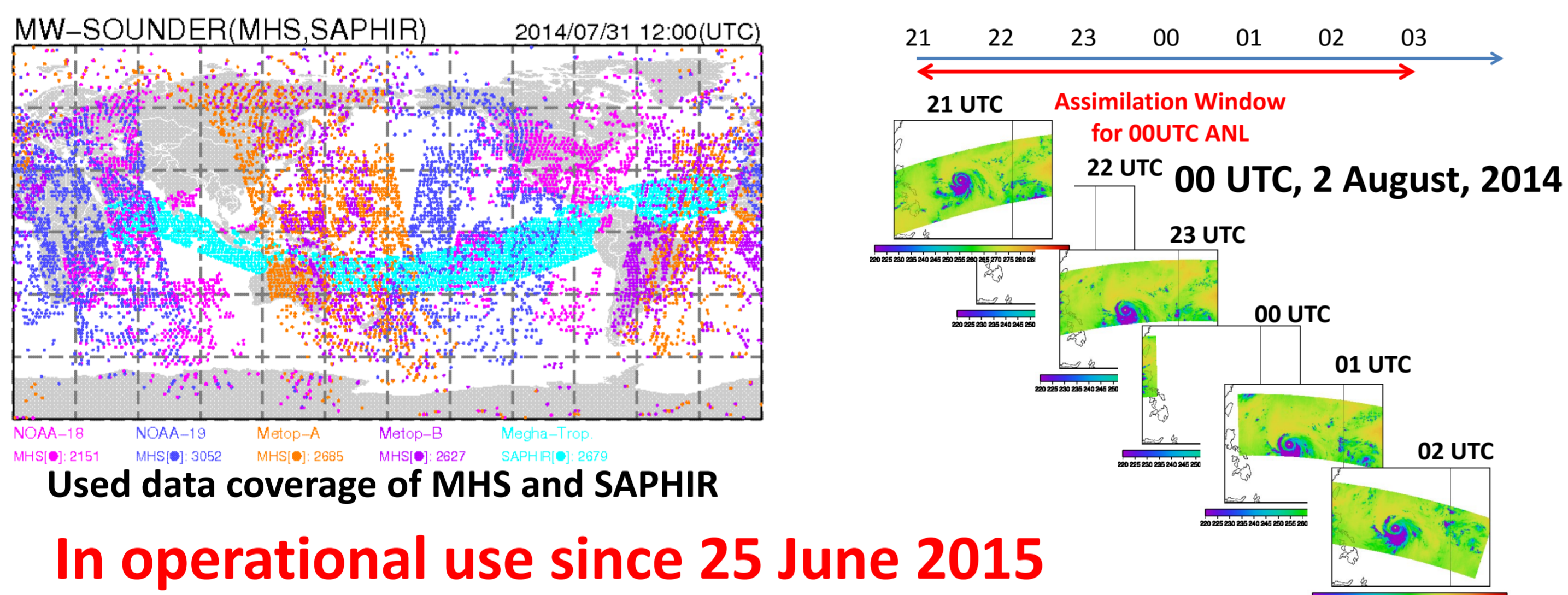
RTM: RTTOV-10 (rttov_scatt, rttov_scatt_ad)
 Input profile: Temperature, Water vapor, cloud liquid water, cloud ice water, cloud fraction, rain, snow
 Data thinning: Averaging with 80 km grid-box and 200 km distance thinning
 Used MW imager: AMSR2, SSMIS (F16,17,18), TMI, GMI
 Inner model moist physics update: little impacts for clear-sky assimilation
 Used channels: 19V, 23V, 37V over ocean

Data assimilation experiment for comparison

DA system: JMA global 4D-Var DA system
 Period: From 10 June to 11 August, 2014
 11-day forecast from 12 UTC initial every day



Assimilation of SAPHIR Tb data in JMA global DA system



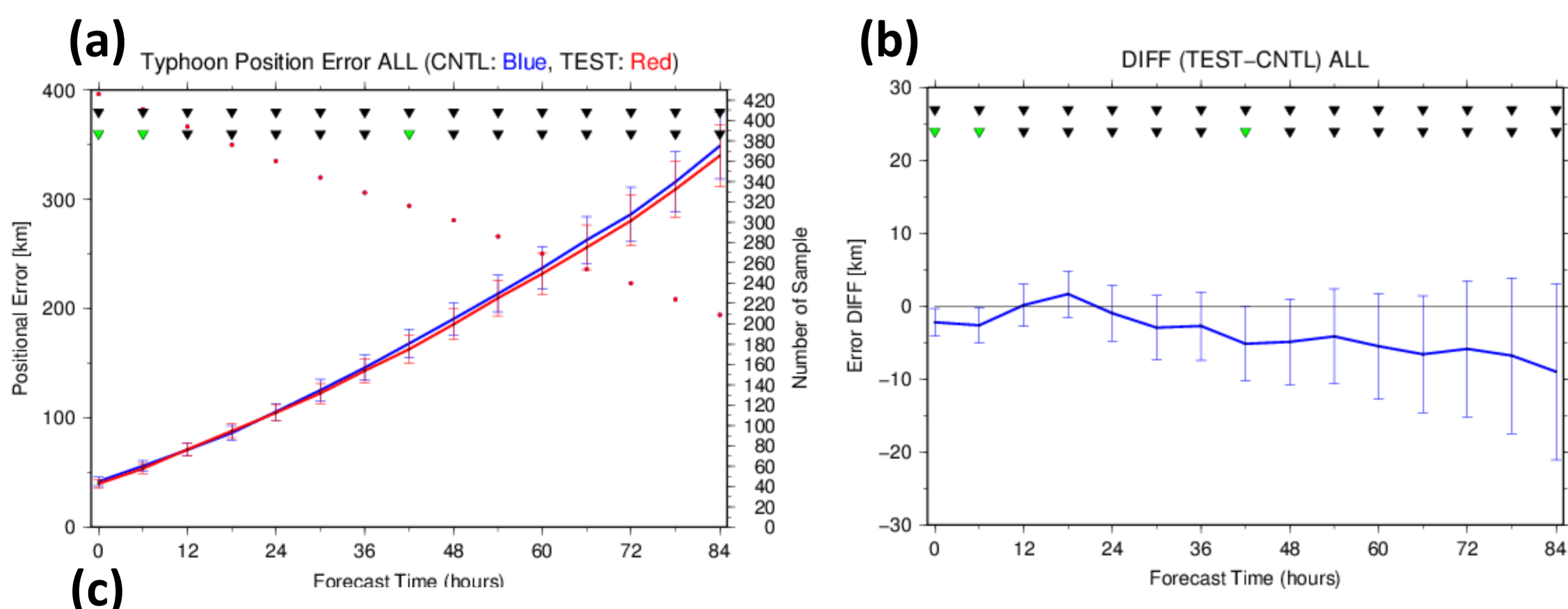
- Clear-sky and oceanic data assimilation (6 channels)
- Cloud-screening is based on adjacent channel's FG departure
- High frequent observation in Tropics
e.g. 4 time observation for TC in 6-hr assimilation window

Assimilation experiment

- **Control:** Same as JMA operational global DA system as of Sep. 2014
- **Test:** Control + SAPHIR radiance (clear-sky and oceanic data, 6 ch.)

Results

- Positive impacts for typhoon track prediction
- Improved water vapor field in AN and FG in Tropics (not shown here)



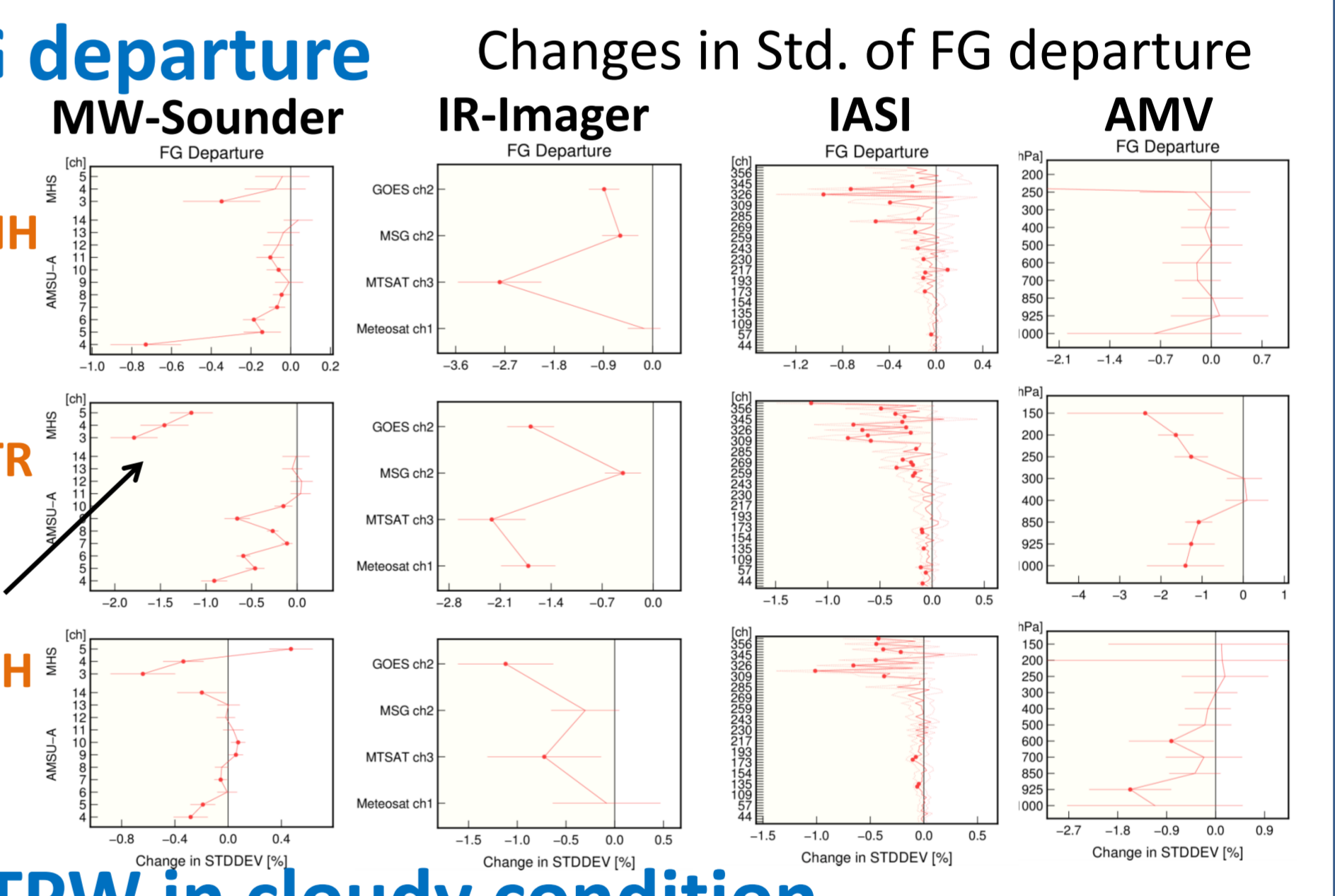
Figures (a) Typhoon track forecast errors averaged for equalized samples (Test, Control), (b) Difference of Typhoon track forecast error between Test and Control, (c) An example case of improved track forecast in Test run.

Results

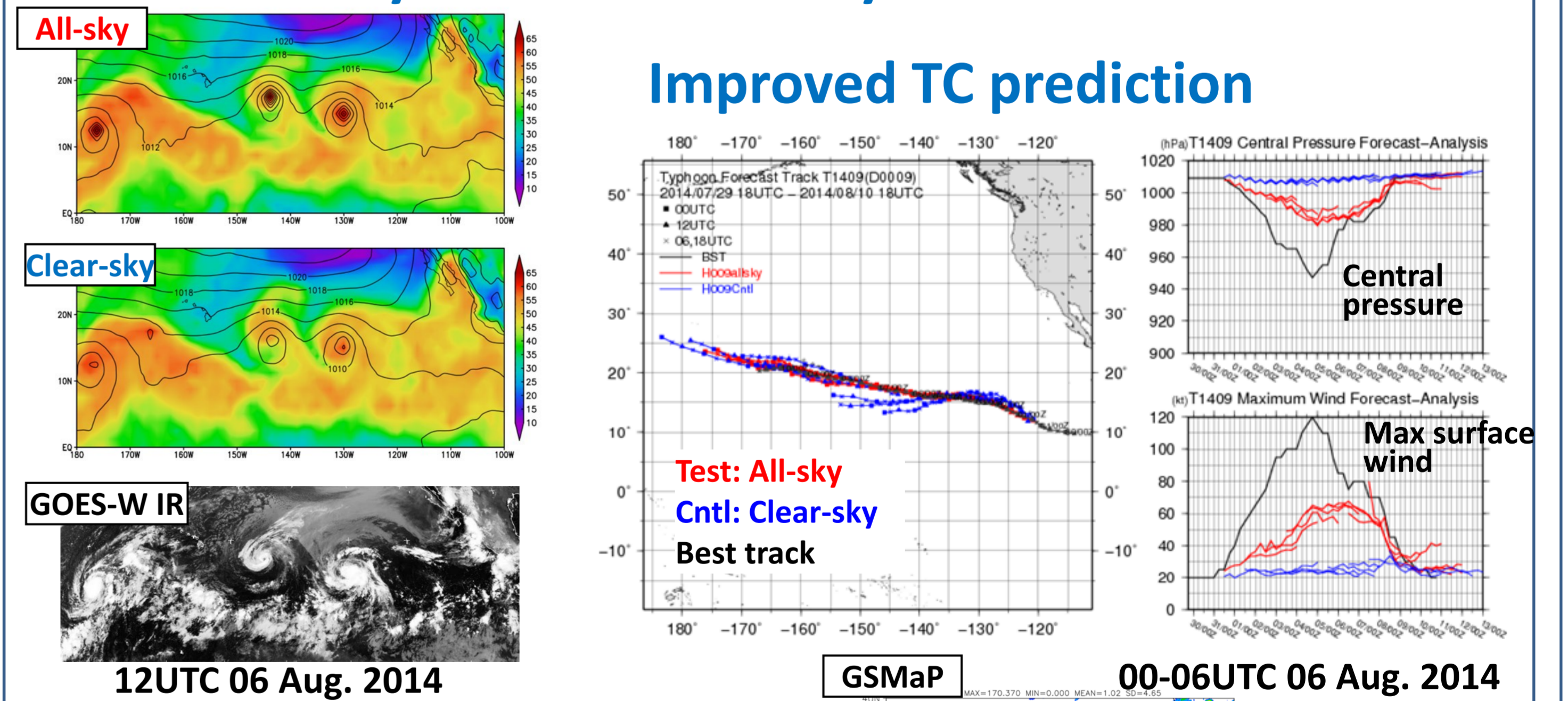
Improved fits in FG departure

- Consistent improvement in various observations
- Big impacts on Tropics
- Improved fits to AMV

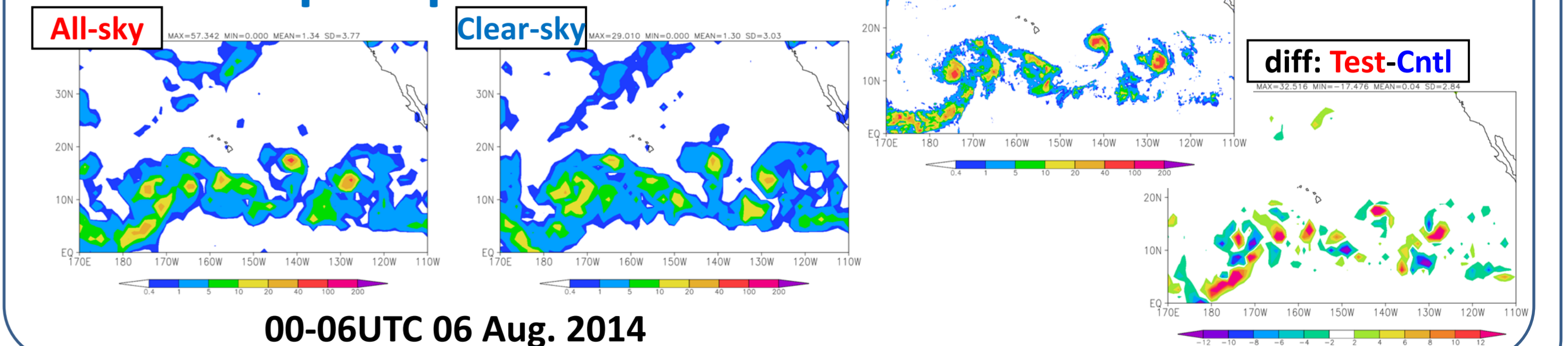
Negative value indicates improvement



Realistic analyzed TPW in cloudy condition



Initial 6-hr precipitation forecast



Summary and plans

Operational use of clear-sky SAPHIR radiance since 25 June 2015

- Positive for moisture analysis in Tropics and TC track prediction
- Development of all-sky microwave radiance assimilation
- Promising results from the initial experiment
- Need to study forecast model biases related to cloud physics and precipitation process

Preparation for new radiance (GMI, ATMS, CrIS, Himawari-8)