The Use of COMS Clear Sky Radiance in NWP Model; CSR Product in Global Forecast Model and Clear Pixel Radiance for Local Forecast Model

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WV CSR in Global Forecast Model

- **Operationally assimilated since June 27th, 2013.**
- Use fixed bias coefficients
- WV CSR product
  - Central wavelength : 6.75 μm
  - Mean brightness temperature of surrounding 7x7 clear pixels (spatial resolution is about 30 km)
  - Only 100 % clear data is used in the 4DVAR

Monitoring the Bias

- **Timeseries of C-B**

upgrade model
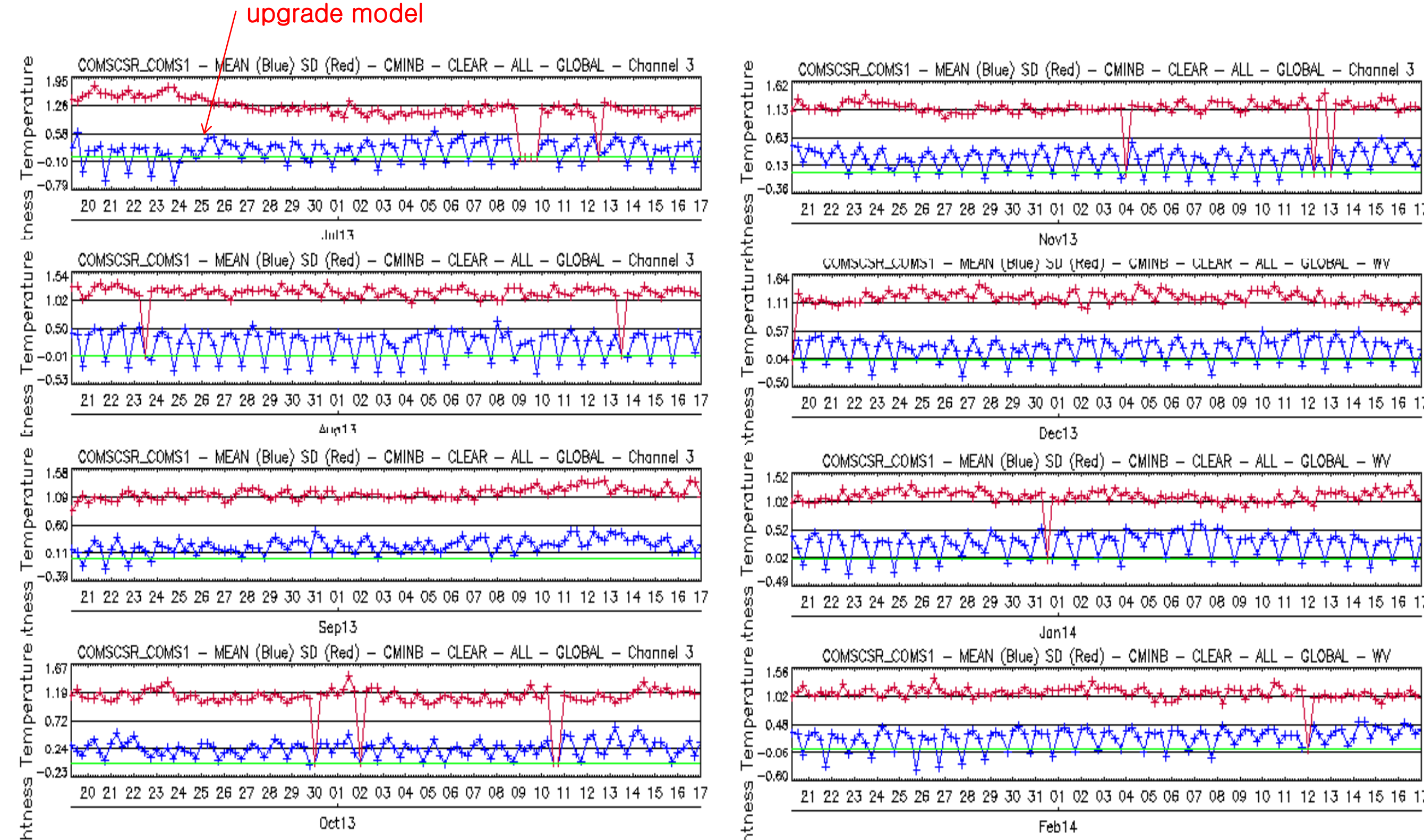
✓ *C-B is getting larger. Needs for recalculating new bias.*

Experiment Using New Bias Coefficients

- Periods: ① July (1~30, 30 days), ② December (9~25, 17 days)
- Compared with operational model
- Verification against own analysis, sonde, ECMWF
- **Changes in mean analysis (Exp-Ctr)**, *red circles indicate COMS observation domain*

- **Geopotential Height (m), red: higher**
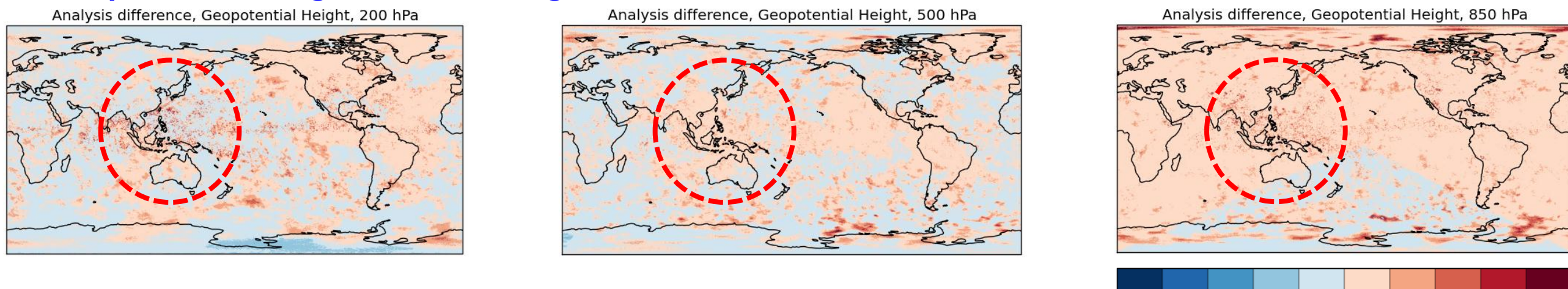
- **Relative Humidity (%), red: moisture**
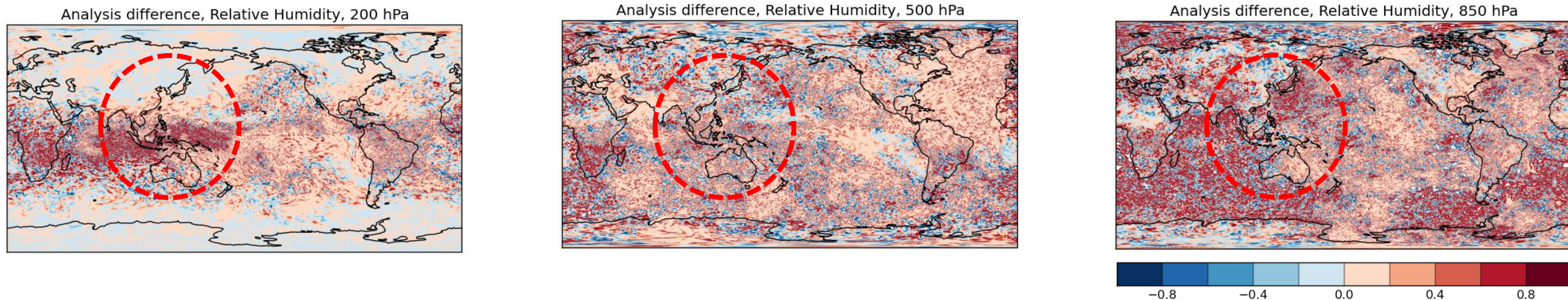
✓ After changing the bias coefficients, GPH become higher as reaching to low level, and, RH changed to be more humid in middle and low levels.

Impact of New Bias Coefficients

- **Mean RMSE Difference (Exp-Ctr),** *Negative: improvement*

  - **July, 2013**
  - **December, 2013**
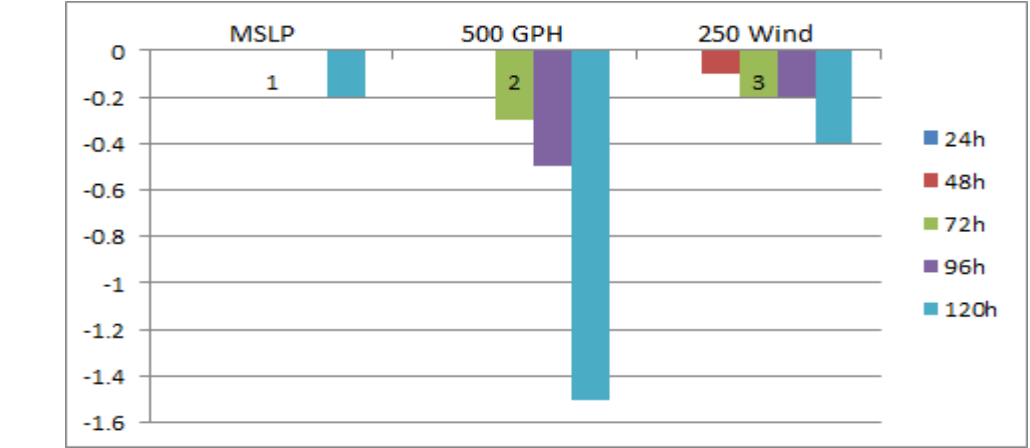
✓ In the northern hemisphere, RMS error reduced in December by applying new bias coefficients, but shows neutral impact in July.

- **Percentage Difference of Geopotential Height RMSE**, *Positive: improvement*
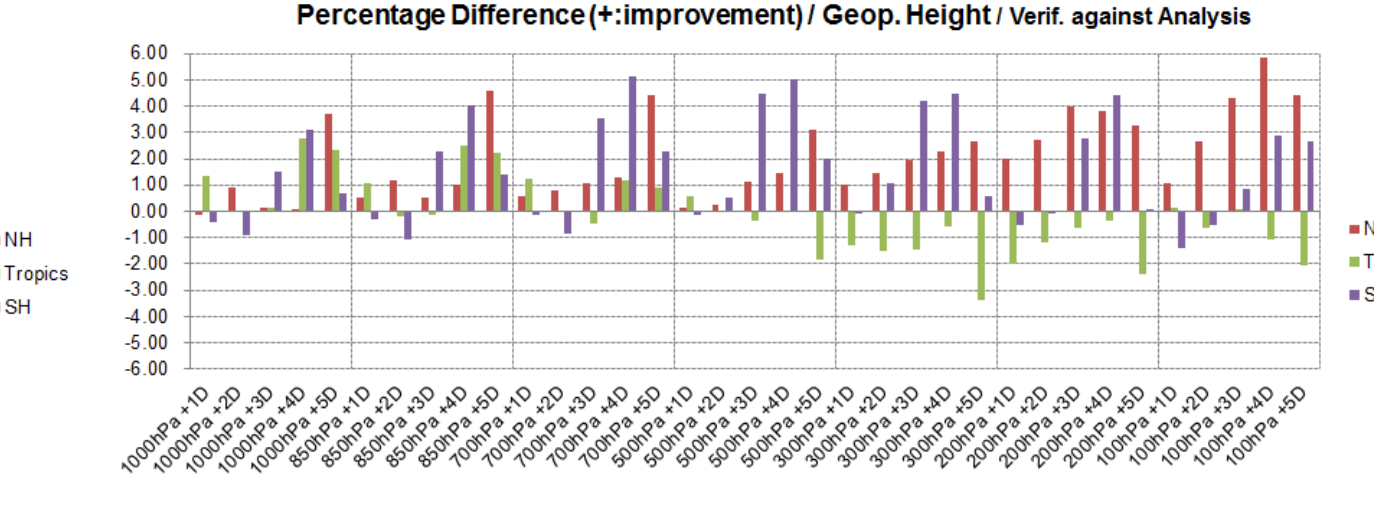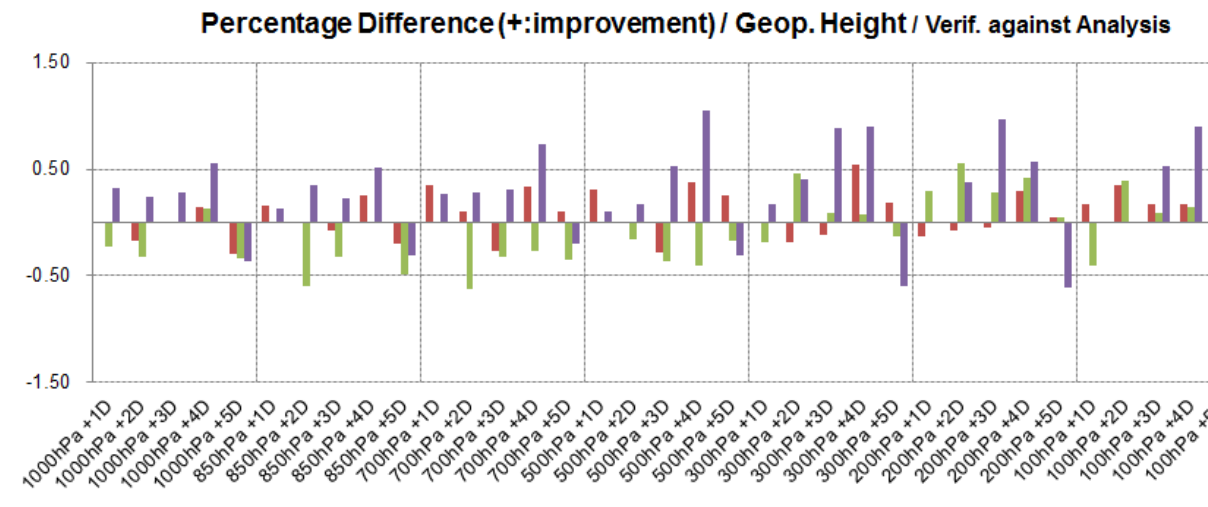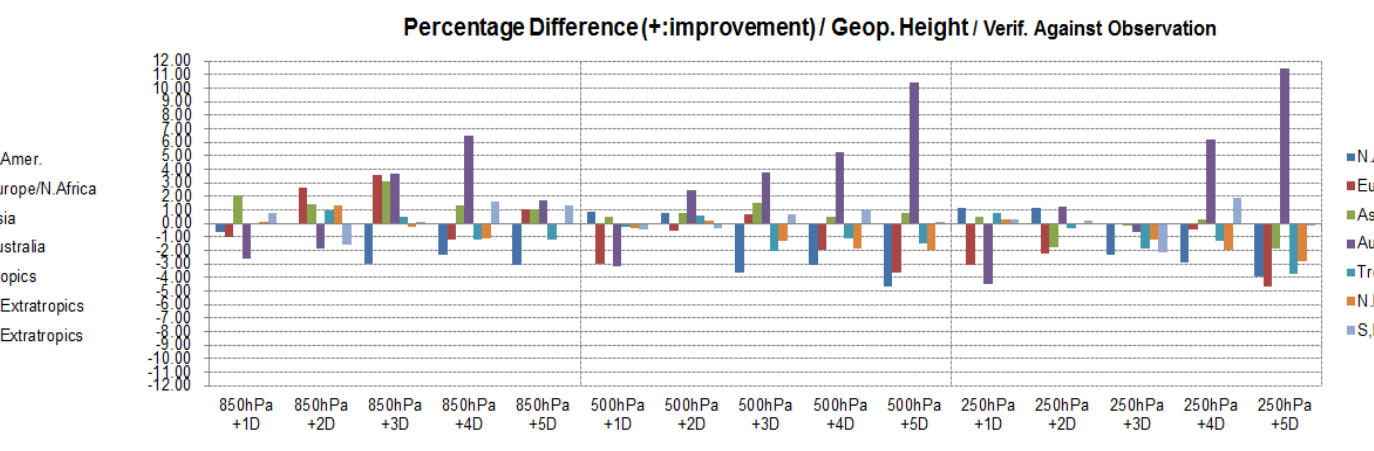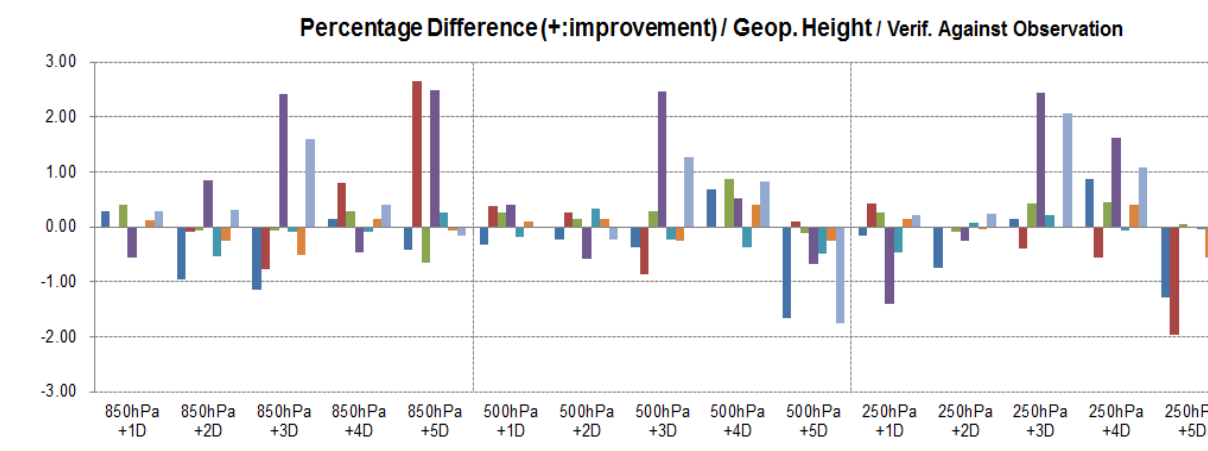
  - **Own analysis**
  - **Sonde**
  - **ECMWF**
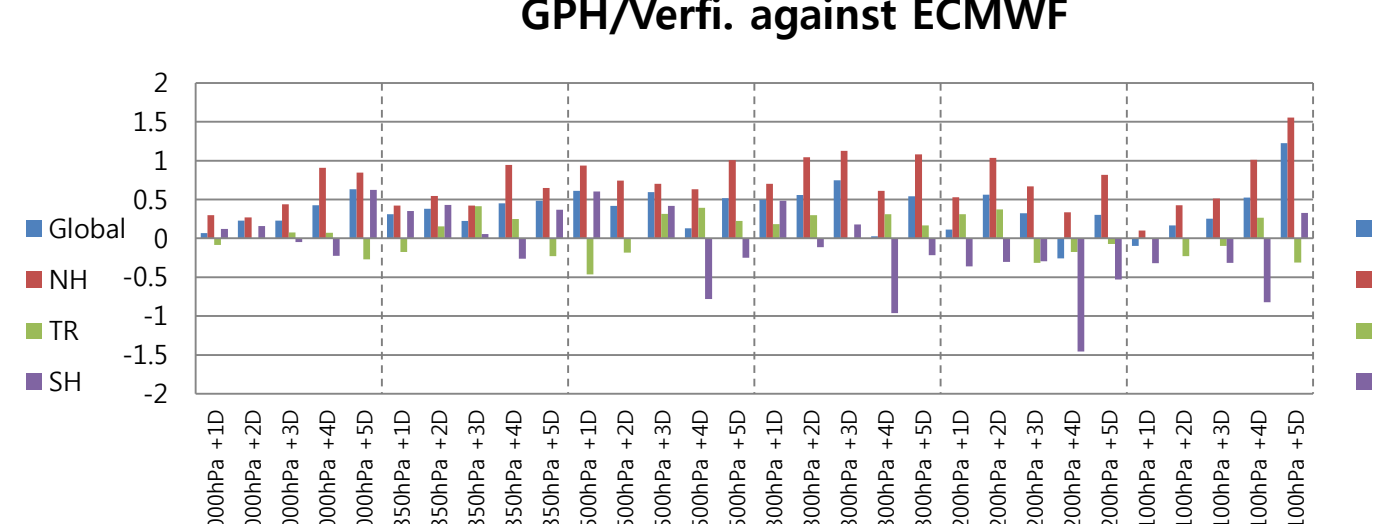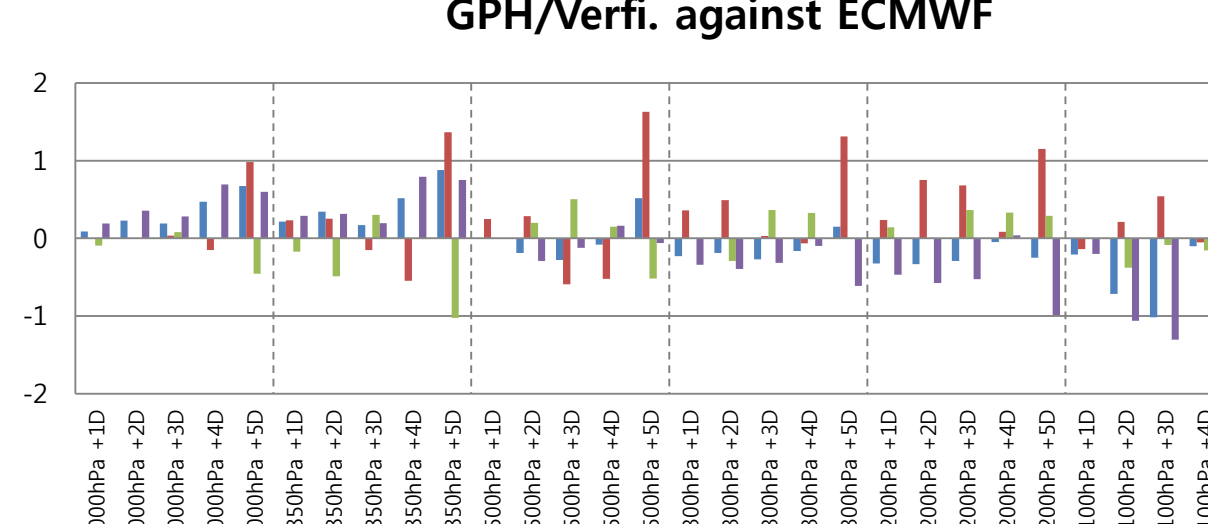
✓ Overall, applying new bias coefficients made positive impact on forecasting performance except some part of tropics. At least in the northern hemisphere including Asia region, obvious improvements are shown.

✓ Couldn't find any specific trend with the verification results against sonde.

- **Mean RMSE Difference of Geopotential Height**, *blue: improvement*
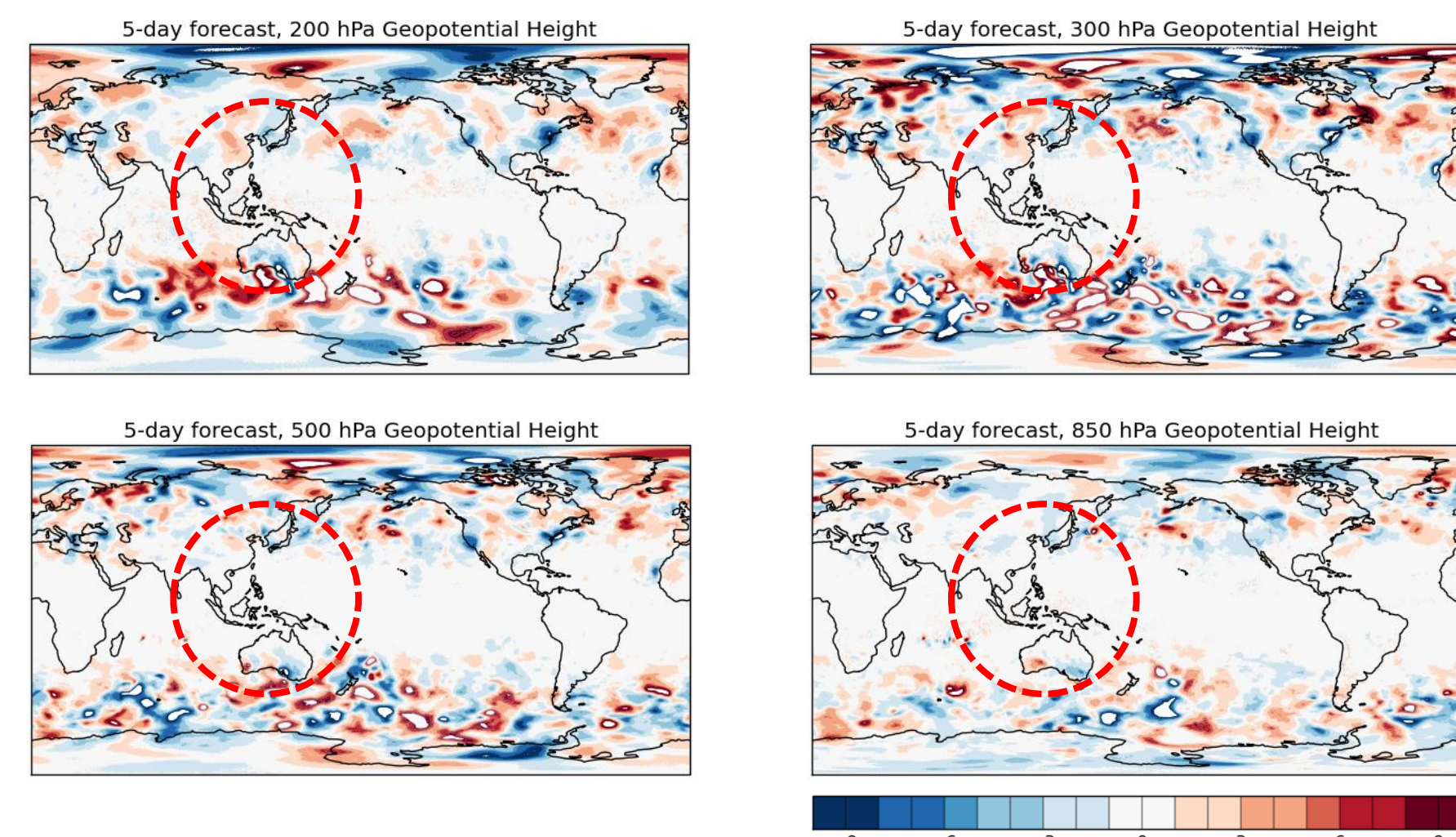
✓ In the area of COMS observation domain shows positive impact (East Asia and Australia). The positive impacts enhanced over the land.

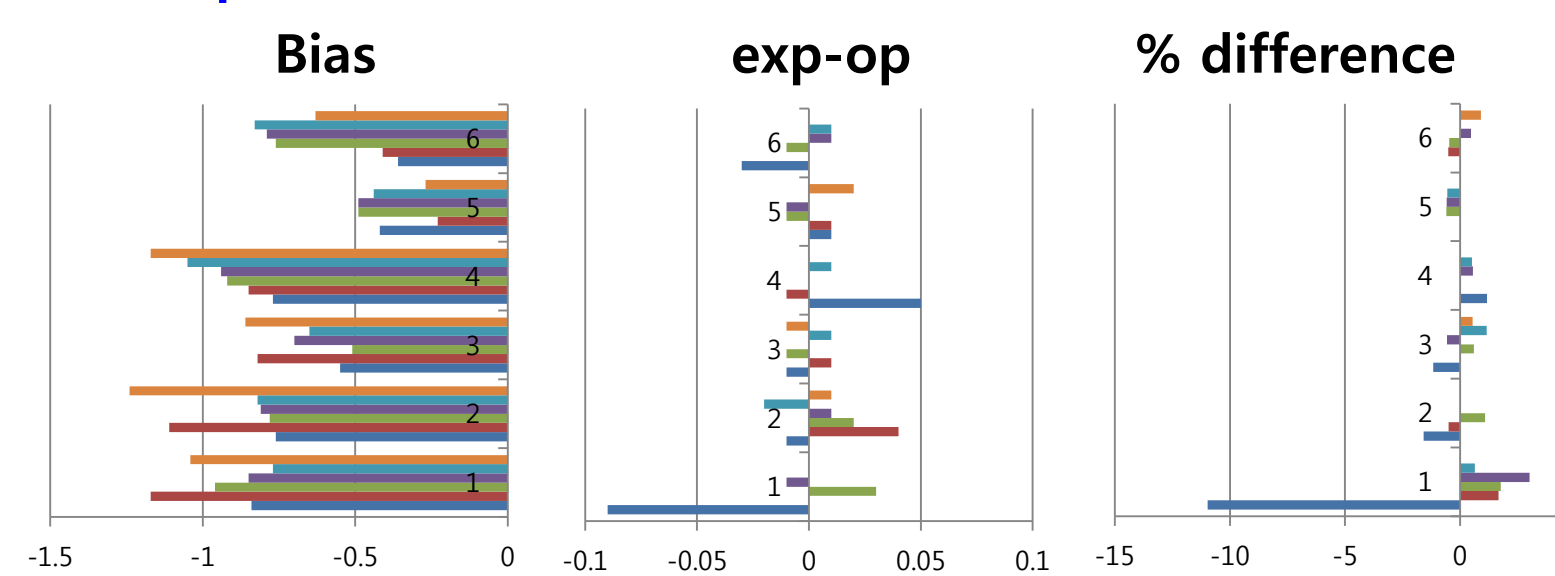## Clear Pixel Radiance in Local Forecast Model

- **Currently working on the evaluation**
- Calculated bias coefficients using Local Forecast Model

- Local Forecast Model
  - Spatially 1.5 km, 70 vertical levels (~39km), 3DVAR

- WV Clear Pixel Radiance
  - Central wavelength : 6.75 μm
  - Spatial resolution : about 4 km
  - 100 % clear, standard deviation surrounding 5x5 pixels < 0.5 K

- Experiment Method
  - Period : July, 2013
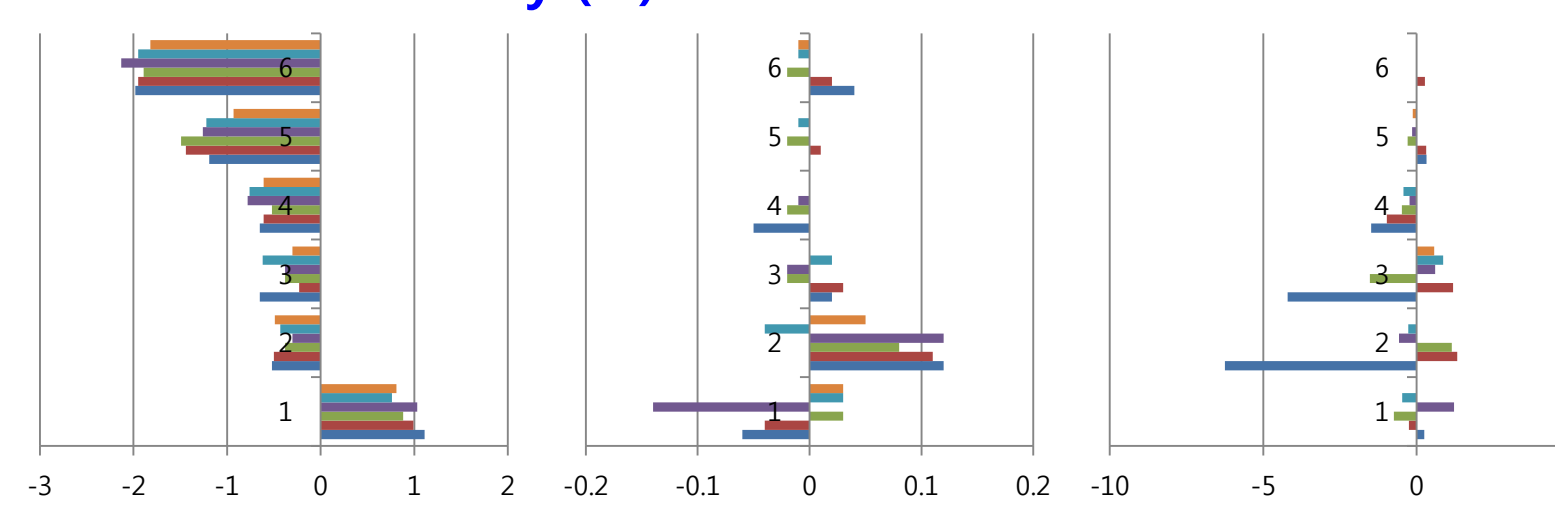 - Compared with operation (without COMS CSR)

- Verification against Sonde

✓ Overall, the impact of CSR is quite neutral except in the 6-hour forecast of temperature and relative humidity.

✓ In the verification of geopotential height, it made the bias lower, and led positive impact in low levels.
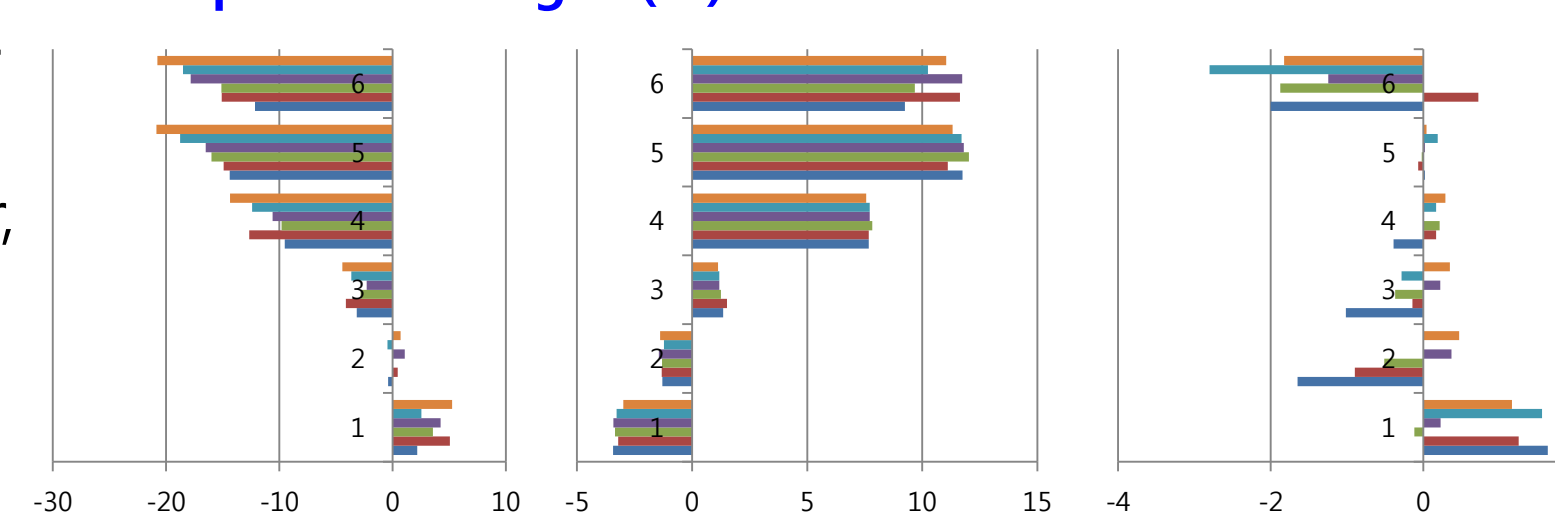
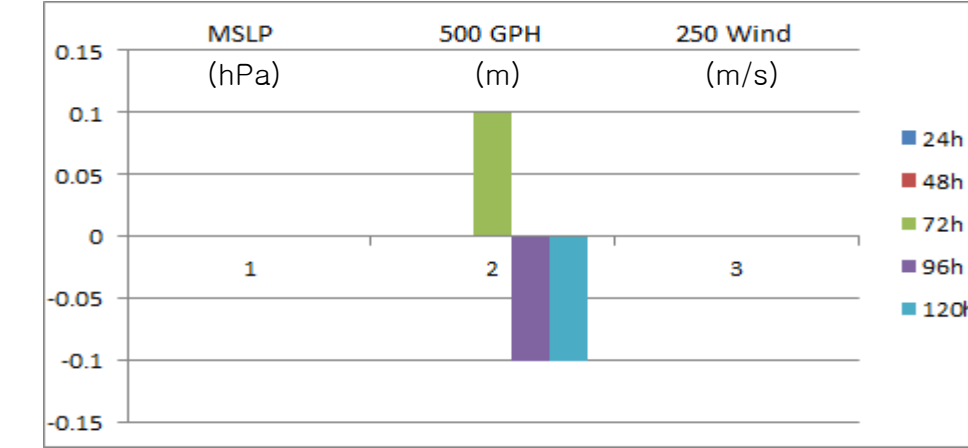✓ In the future, optimization works will be carried out.

- **Temperature (K)** — Bias | exp-op | % difference
- **Relative humidity (%)**
- **Geopotential height (m)**

36h 30h 24h 18h 12h 6h

Summary

- C-B of COMS CSR in KMA's global forecast model is getting slightly larger since its operation.

- New bias coefficients are calculated, and tested on the model for 1 month.

- The model analysis got more moisture throughout all vertical levels after changing bias coefficients.

- Forecasting performance seems improved very much for all forecast time especially in the long term forecast.

- In the Northern Hemisphere including Asia, and Australia which is in the COMS observation domain, the forecast performance improved a lot.

- The use of pixel radiance in the local forecast model is not yet optimized, and more works will be done in KMA.