

Impacts of soil moisture initialization on operational global NWP model forecasts

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- To initialize the land surface model, KIAPS is developing the retrospective land surface analysis technique for the soil moisture in collaboration with COLA group.
- KIAPS received GLDAS(Global Land Data Assimilation System) dataset and code which generate the initial fields of soil moisture at Unified Model(UM) grids for global NWP model simulation from COLA at the beginning of this year.
 - : 1-degree daily GLDAS dataset (1979/01~2012/09)
 - : 0.25-degree daily GLDAS dataset (2000/03~2012/09)



We carried out experiment with the soil moisture data(GLDAS)
using operational global NWP model.

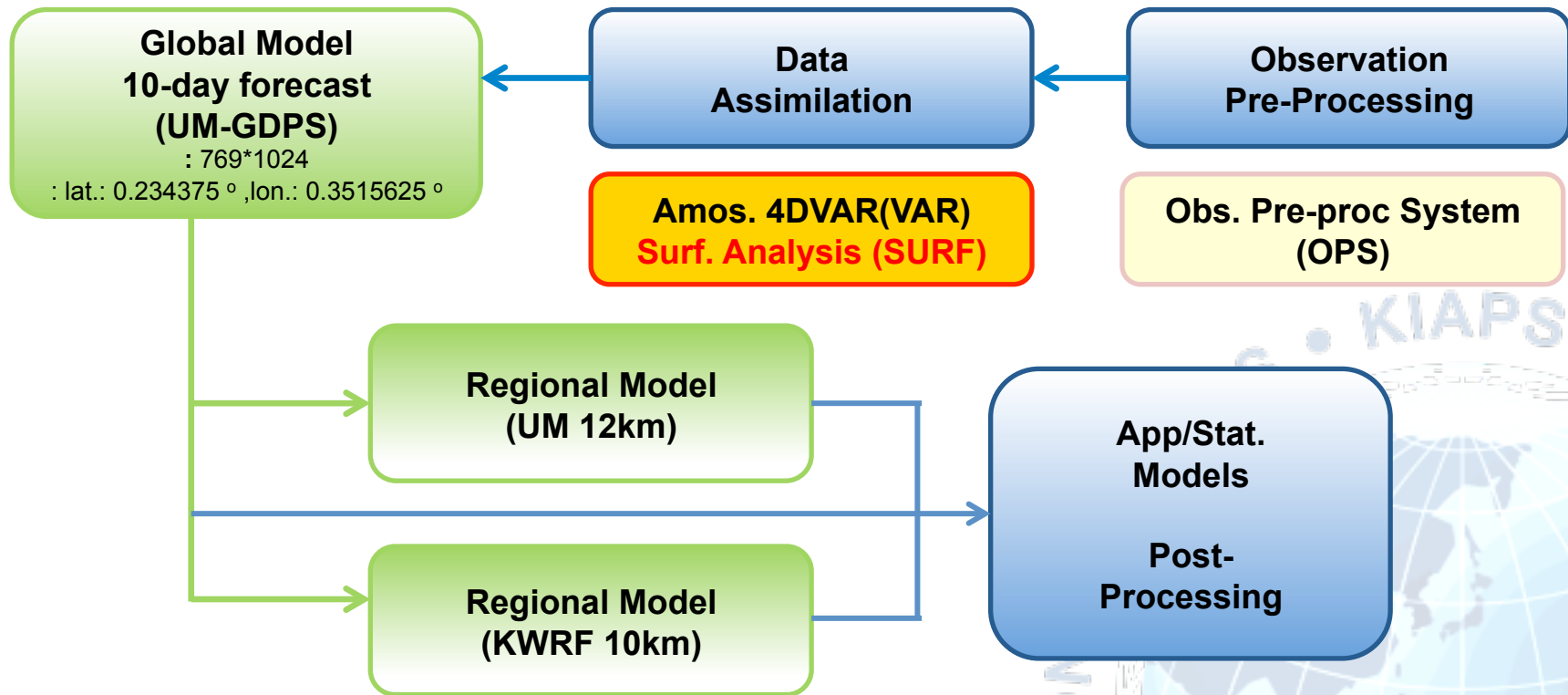
Experiment design

- As a test, two sets of numerical weather prediction experiments were conducted with different land surface initial conditions for Unified Model (UM).
- Soil moisture obtained from GLDAS was processed for simulating UM, and results are compared with UM control run with its original surface process (SURF) and observation as well.

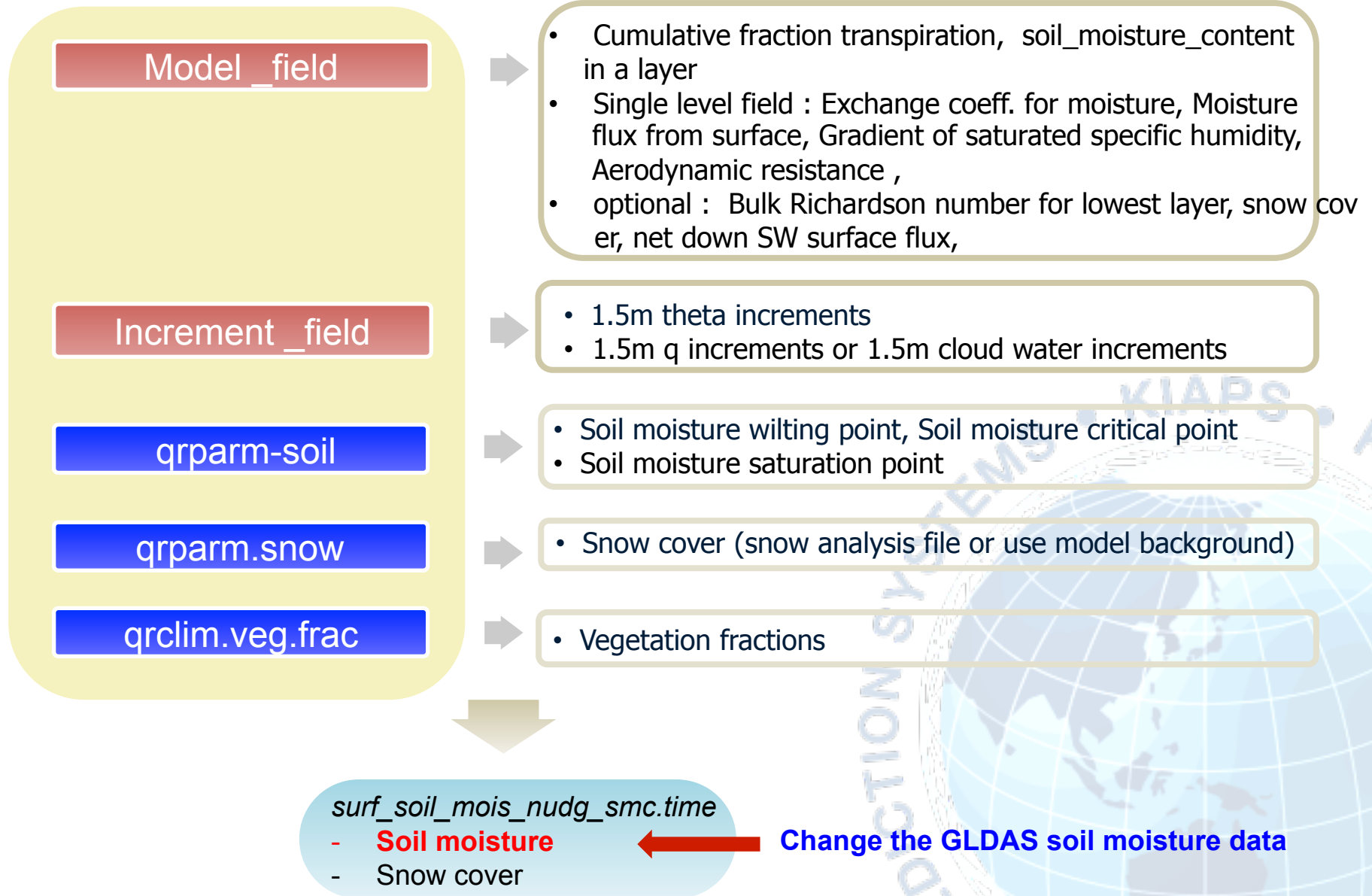
□ Experiment design

Model	UM –GDPS(Operational version at Korea Meteorological Administration)
forecasting time	10 days
Period	01 JUN 2012 - 31 AGU 2012 (3 months)
soil moisture data	Original soil moisture in SURF (control run : SURF test)
	GLDAS soil moisture data (GLDAS test)

Operational global NWP model



Surf. Analysis(SURF) process



❑ **Horizontal distribution of mean difference for variables**

❑ **RMSE & Bias analysis for three variables**

: evaluation

surface temperature, mean sea level pressure : ERA interim

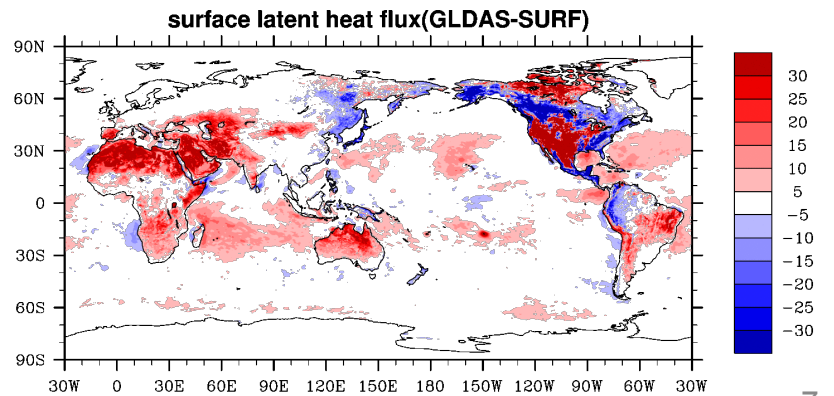
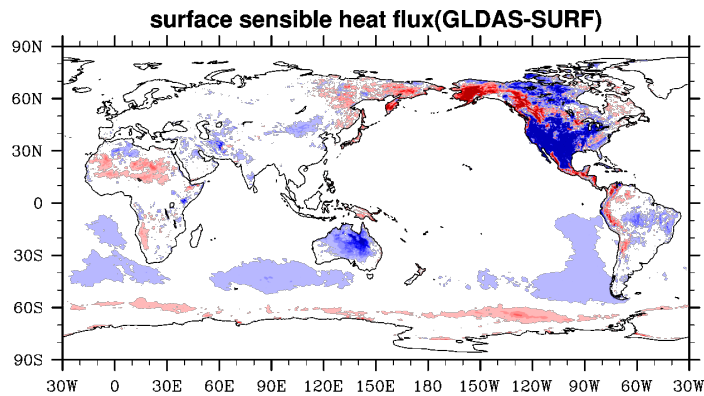
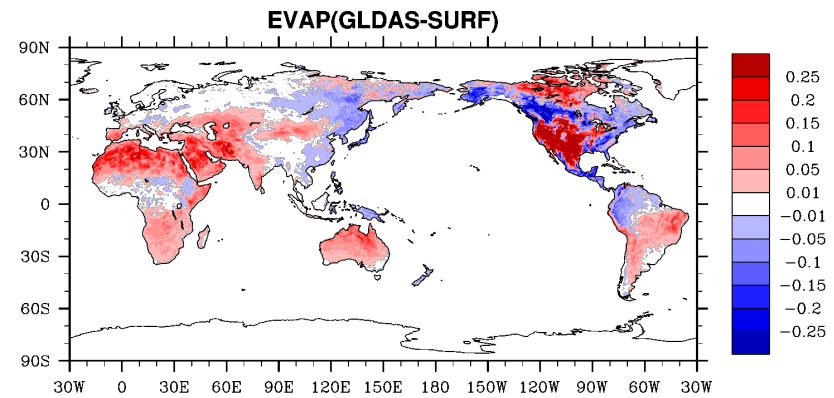
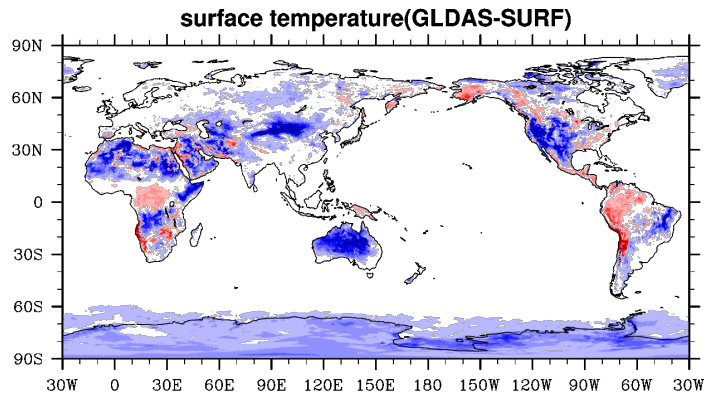
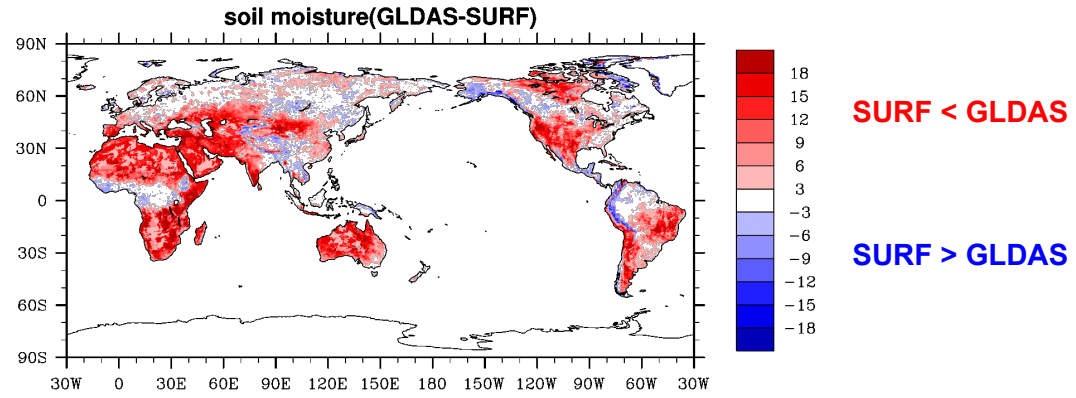
precipitation : 3hr precipitation of TRMM

: analysis time - 00UTC



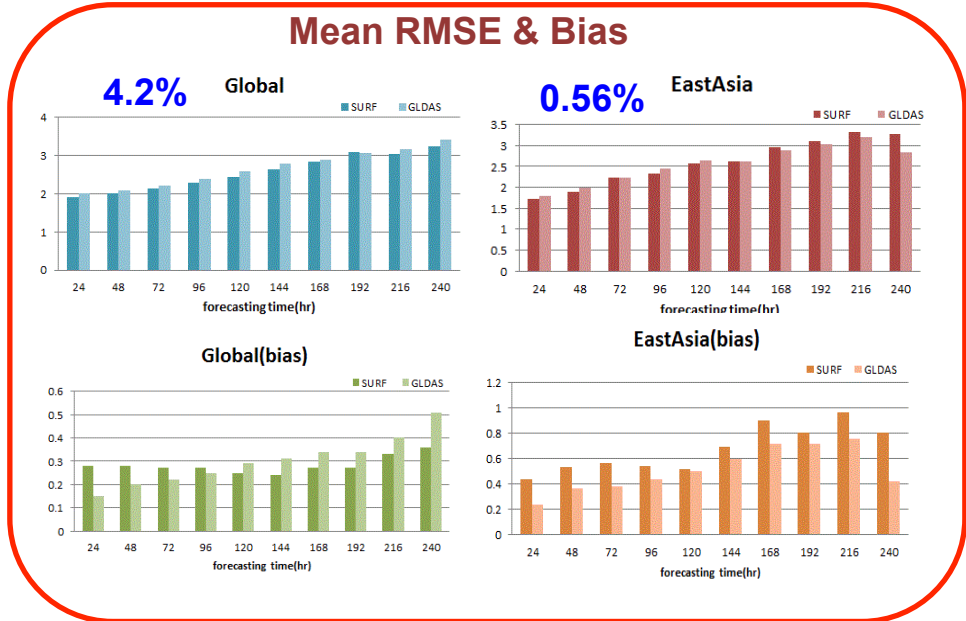
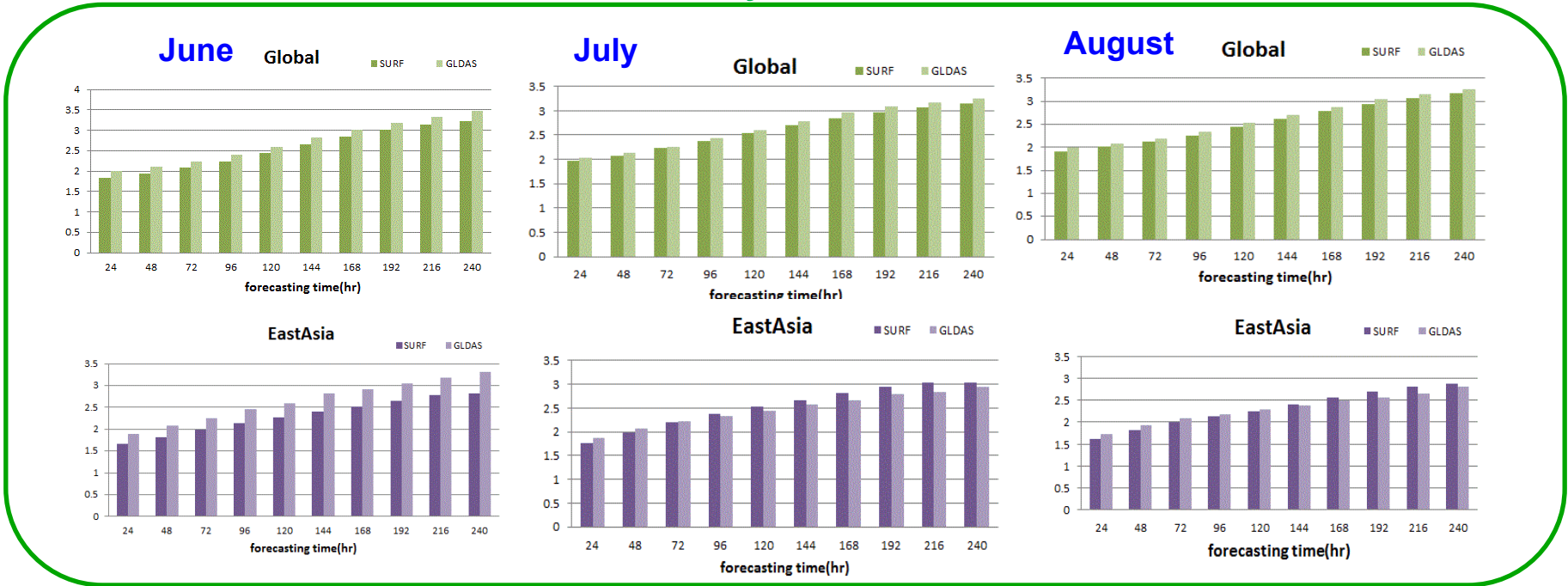
Horizontal distribution of mean difference for 3 months

Soil moisture



☐ Surface temperature

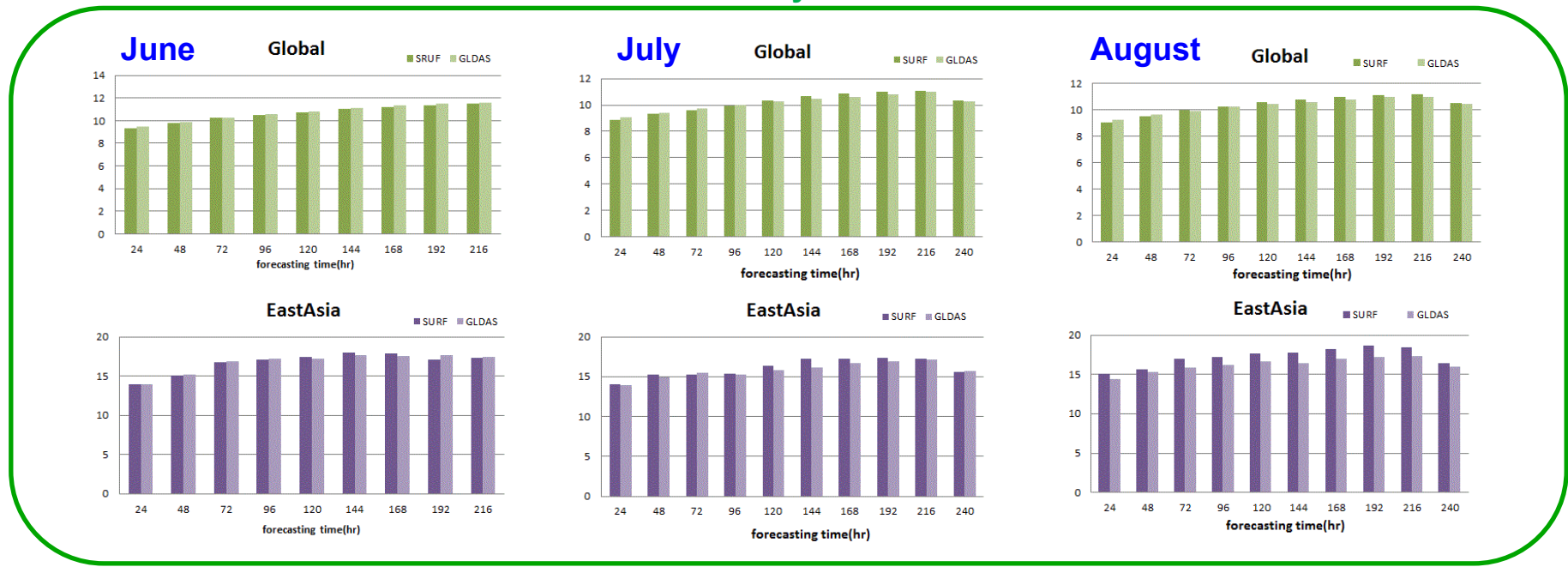
Monthly RMSE



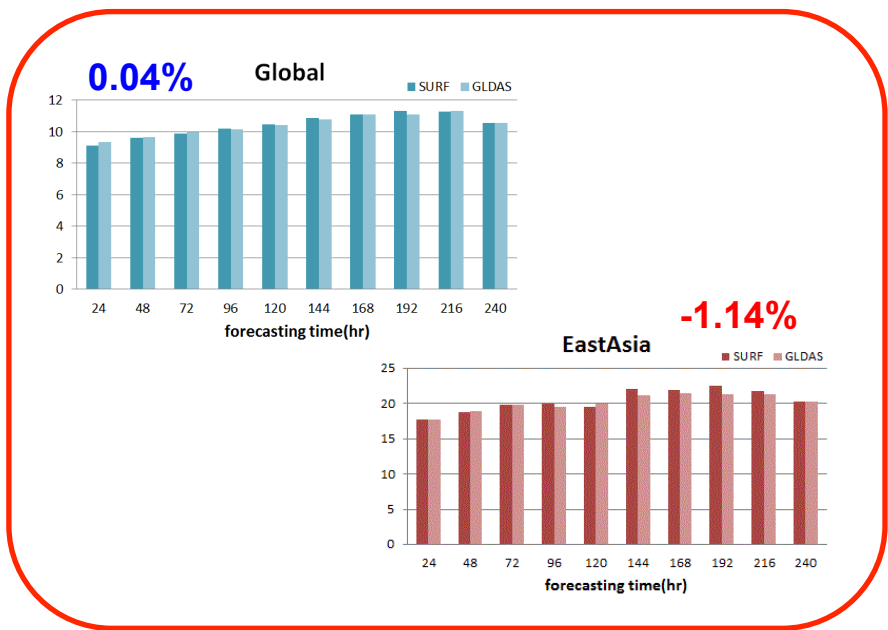
%	June	July	August
global	6.9	2.9	3.3
EA	15.15	-1.64	0.31

24h accumulated precipitation

Monthly RMSE



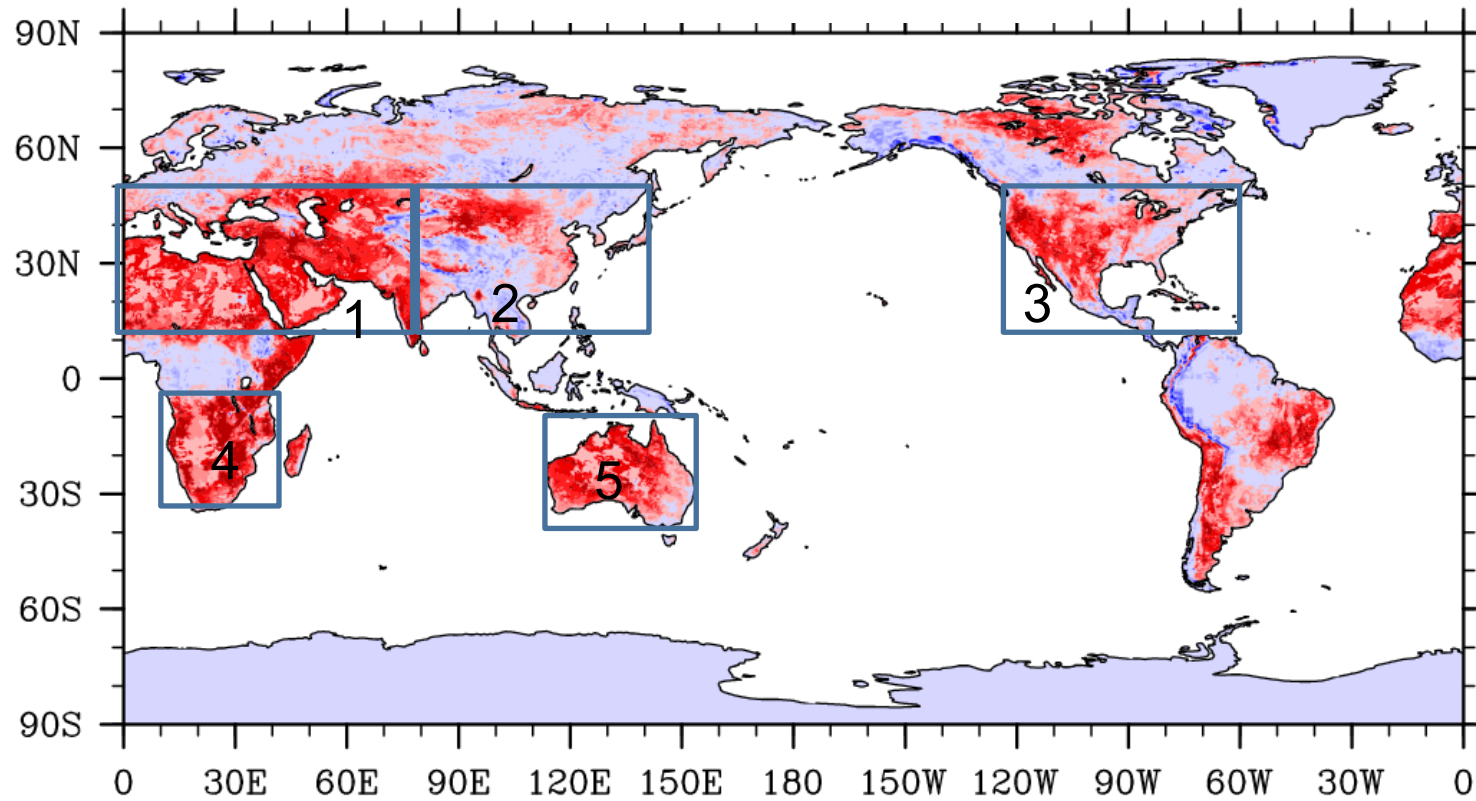
Mean RMSE



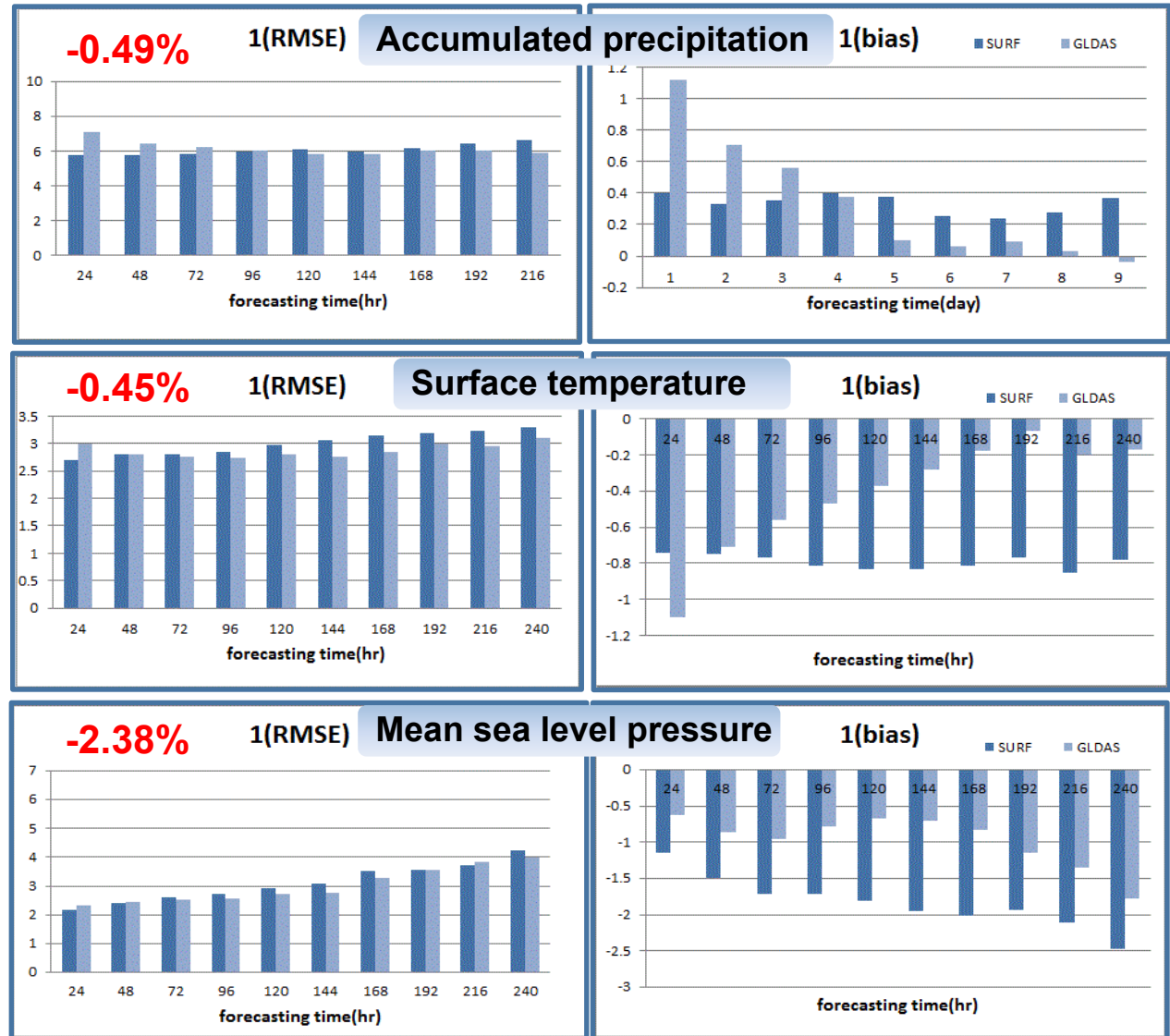
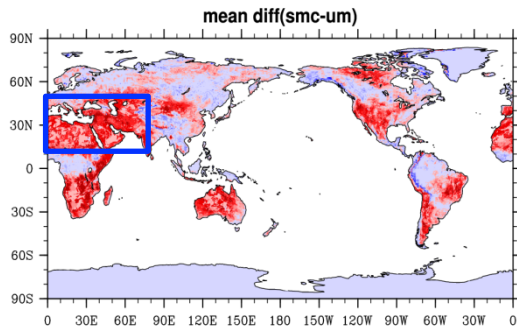
%	June	July	August
global	7.6	-0.23	-0.66
EA	6.4	-1.8	-5.51

Area classification

10

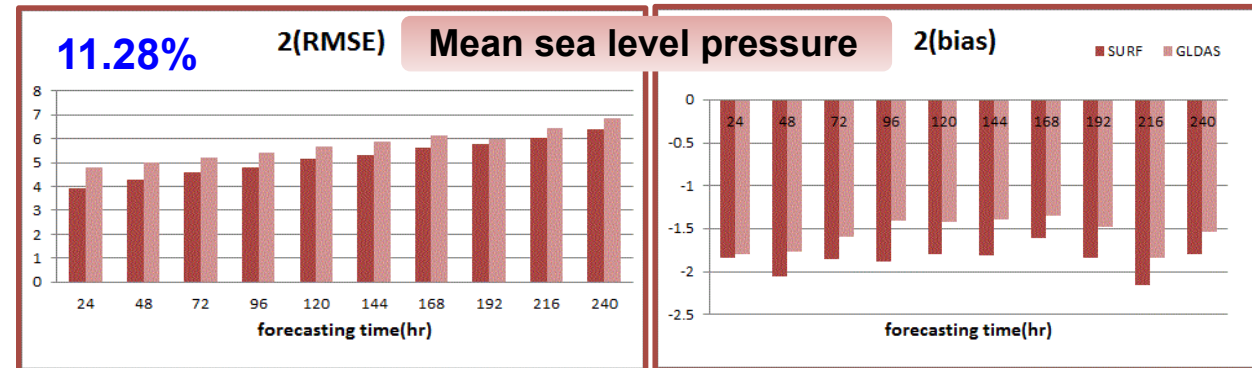
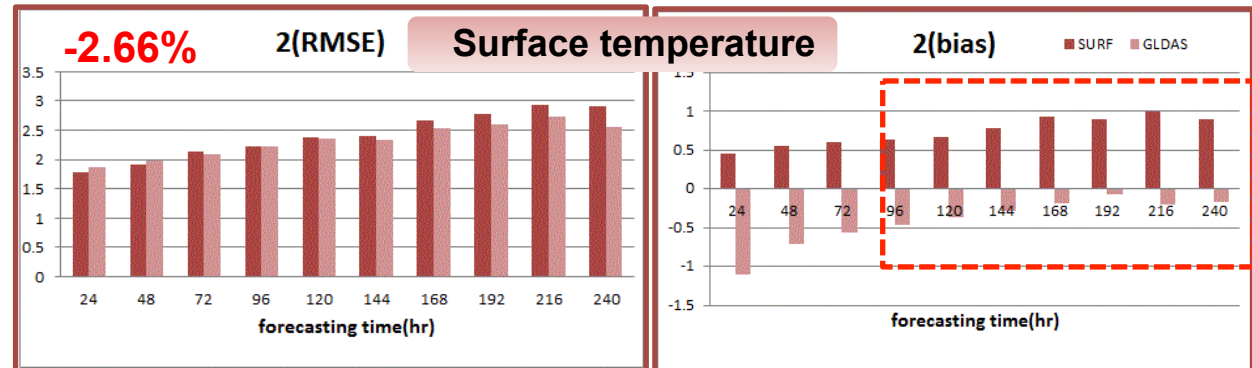
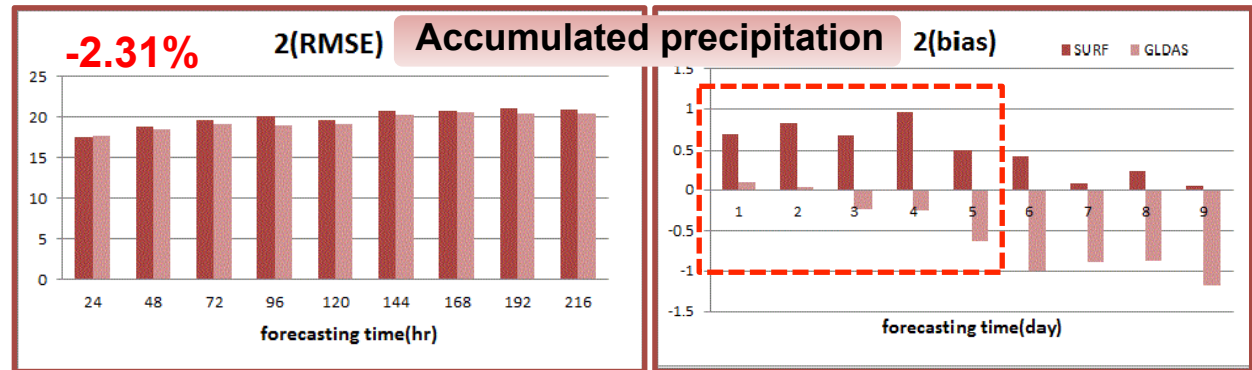
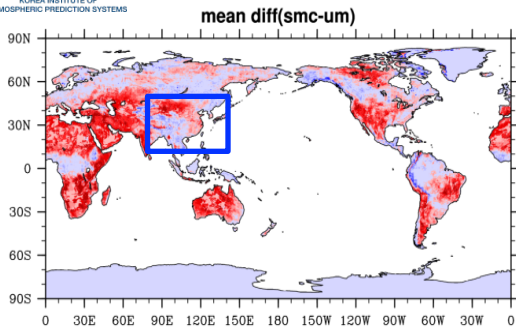


Area 1



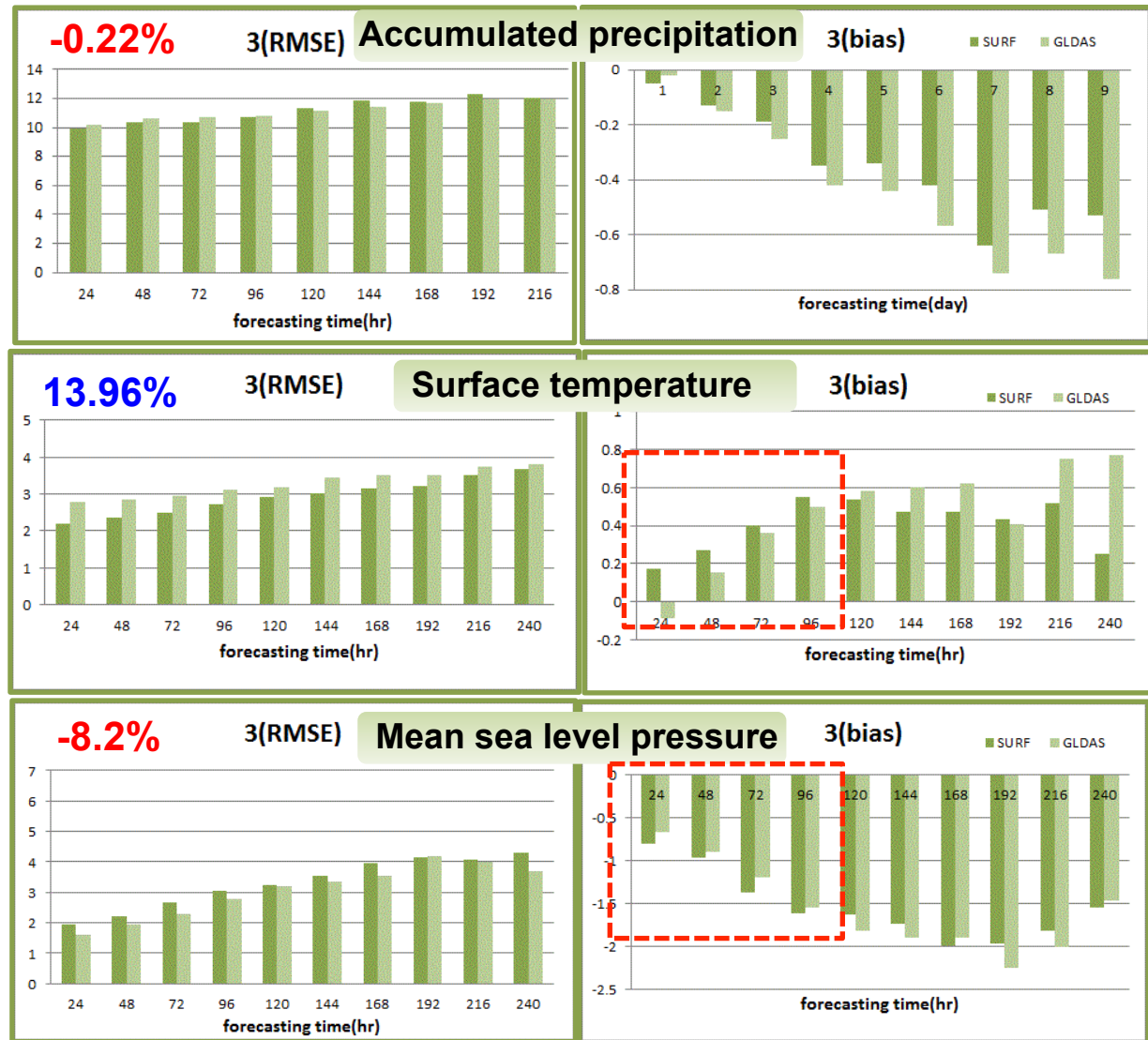
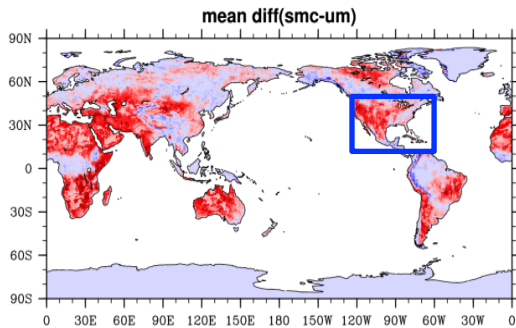
- RMSE of all variables → reduction
- Most mean bias reduce surface temp. and Mean sea level pressure
- However, it increase at the early forecasting time for precipitation and surface temperature

Area 2



- RMSE of precipitation and surface temperature → reduction
- RMSE of Mean sea level pressure(MSLP) → increase
- Mean bias of MSLP → reduction

□ Area 3

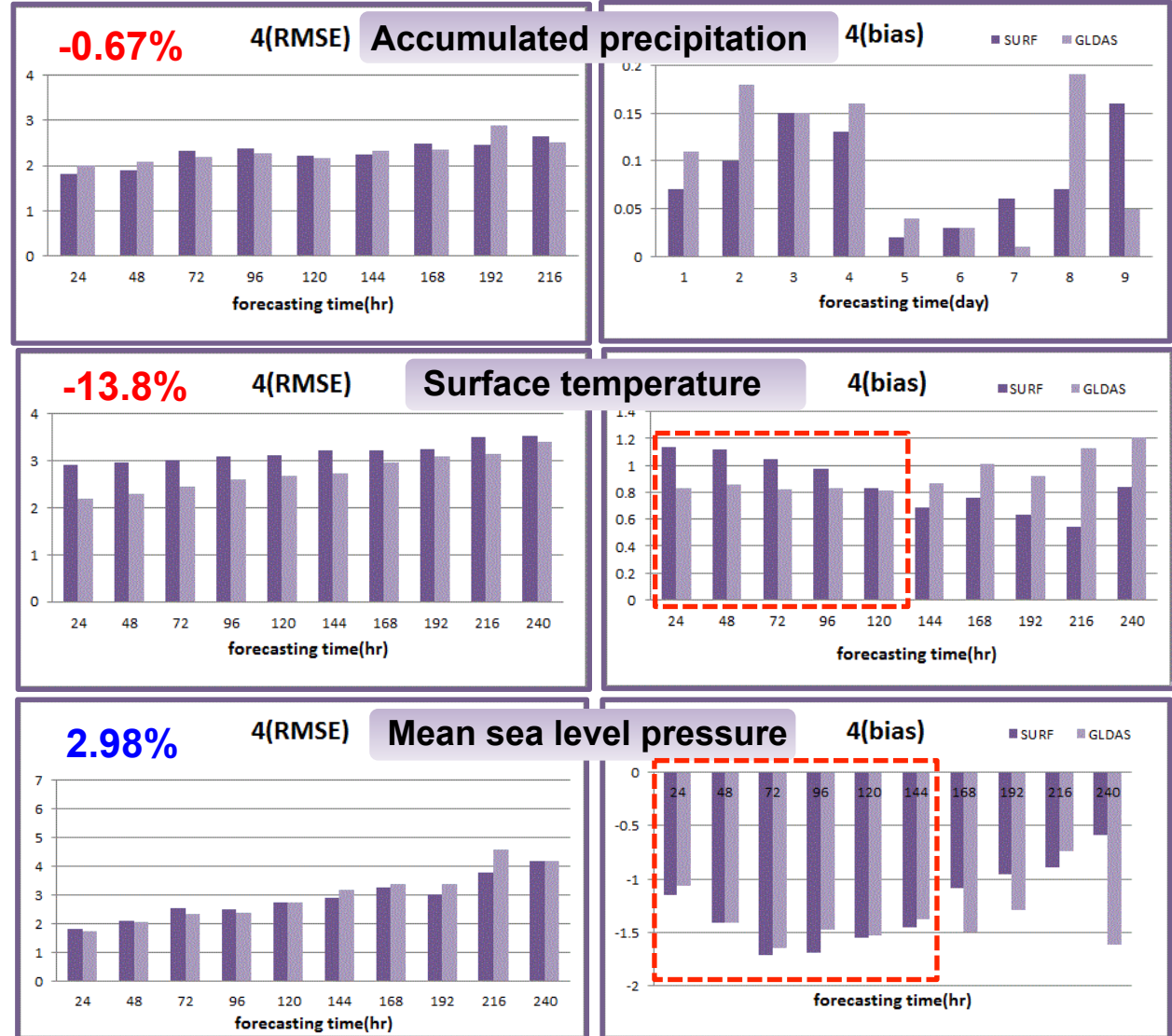
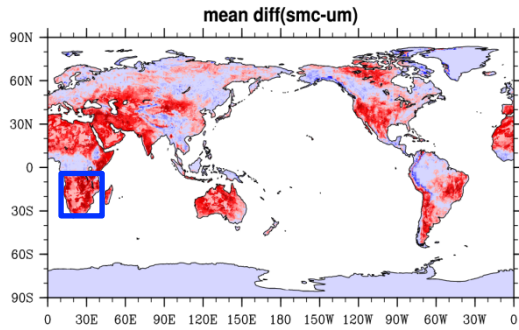


- RMSE of precipitation and mean sea level pressure → reduction
- RMSE of surface temperature → increase
- Mean bias at the early forecasting time → reduction



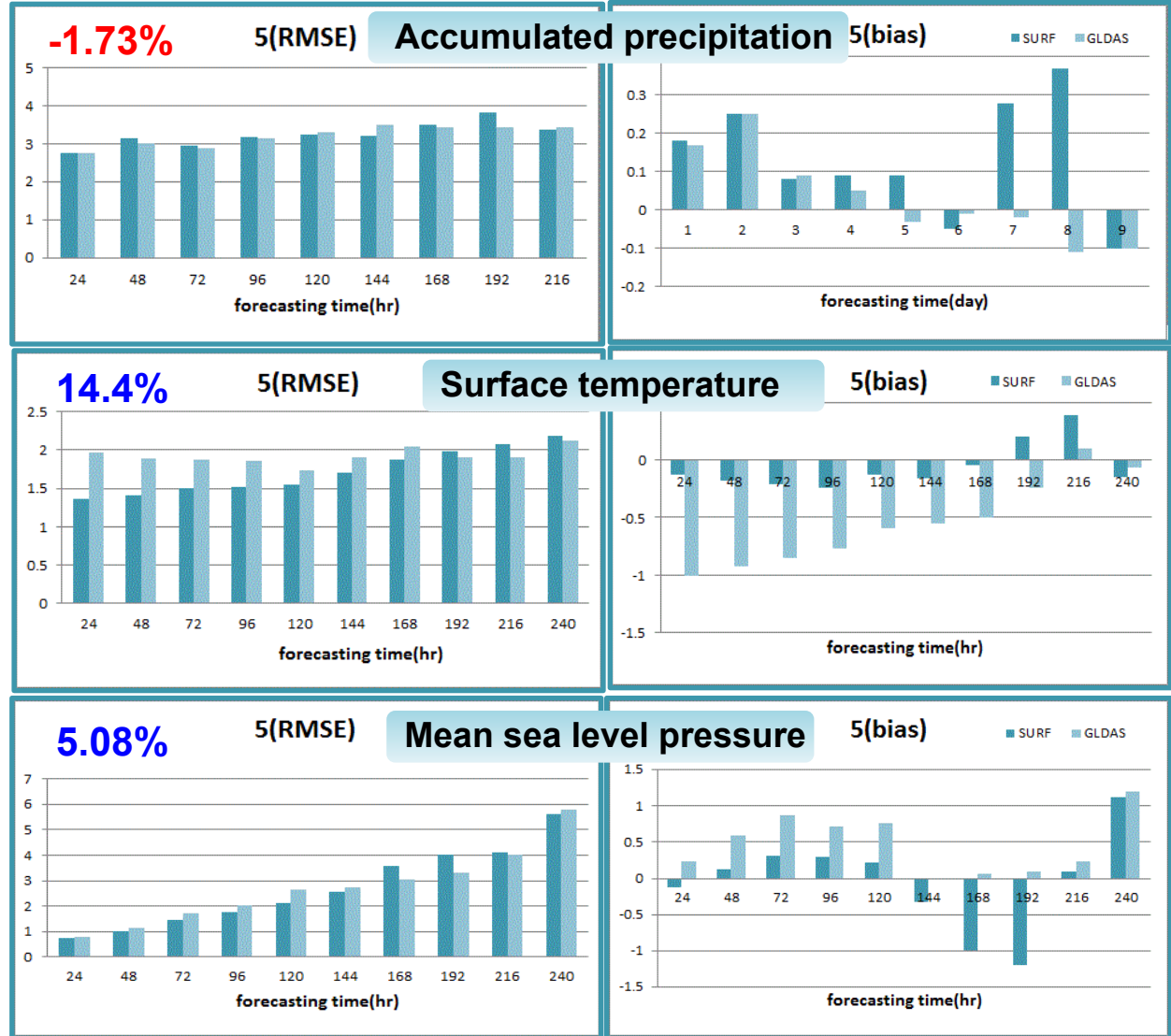
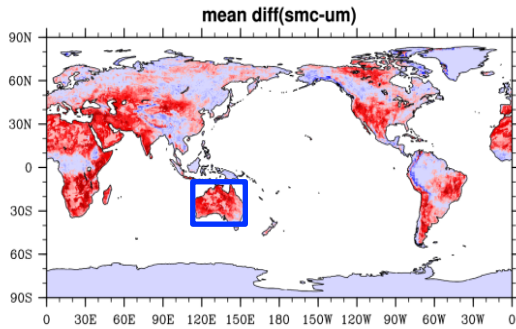
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Area 4



- RMSE of precipitation and surface temperature → reduction
- RMSE of mean sea level pressure → increase

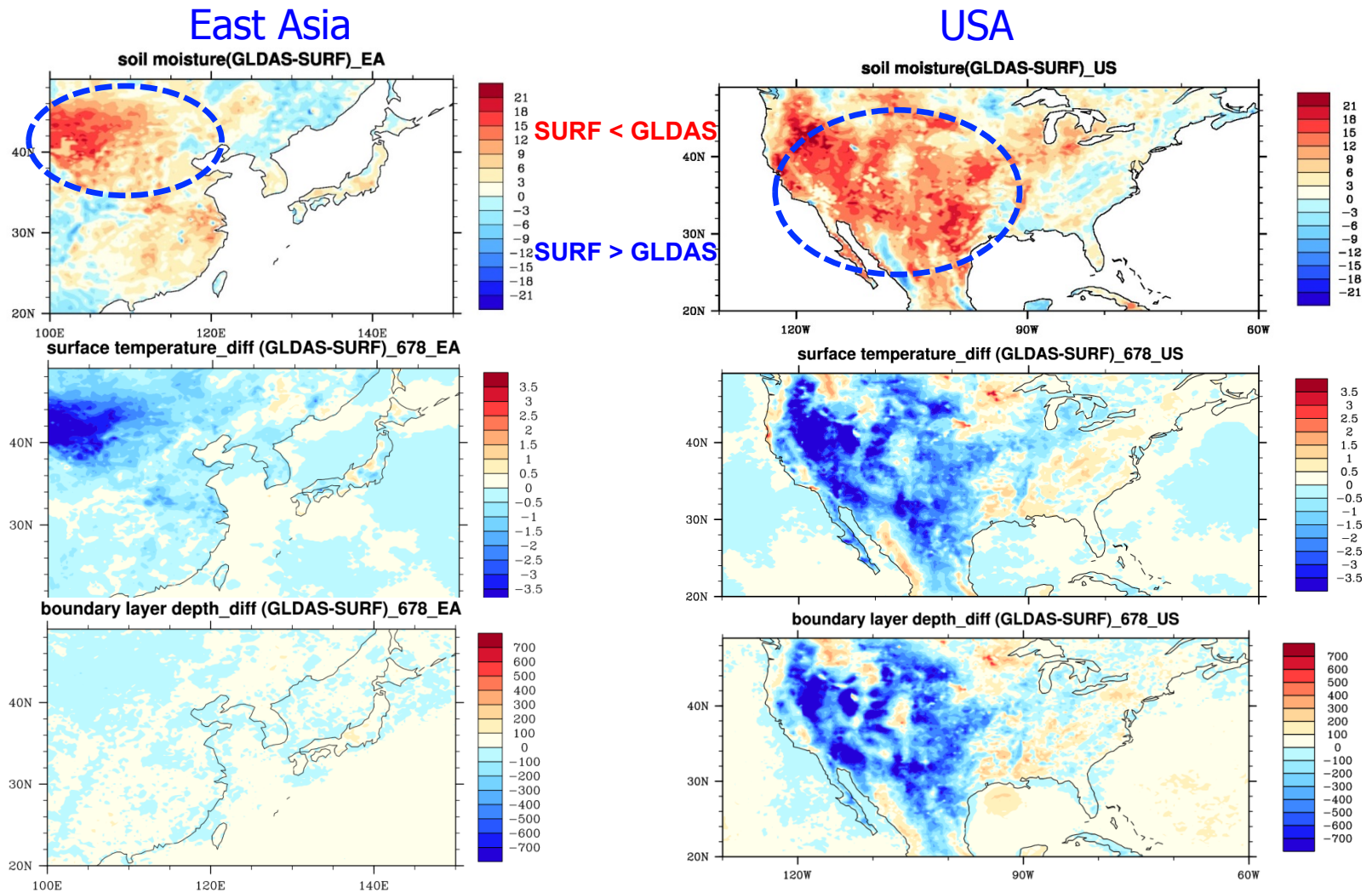
□ Area 5



- RMSE of precipitation → reduction
- RMSE of surface temperature and mean sea level pressure → increase

□ Summary

- | Dry condition | Wet condition |
|---|---|
| decrease evaporation
surface temp. -> increase(warming)
sensible heat flux – increase | increase evaporation -> evaporative cooling
low surface temp. (cooling)
sensible heat flux – decrease |
- **RMSE of precipitation and bias of surface temperature reduce at East Asia.**
 - **In regional analysis, RMSE of precipitation reduce at most area**
 - **Initial soil moisture affects both surface temperature and precipitation forecast.**
 - **GLDAS test show improved result to reduce RMSE and bias for each variable**
 - **We will implement more detailed analysis about each area later because the impact differs according to classified region.**

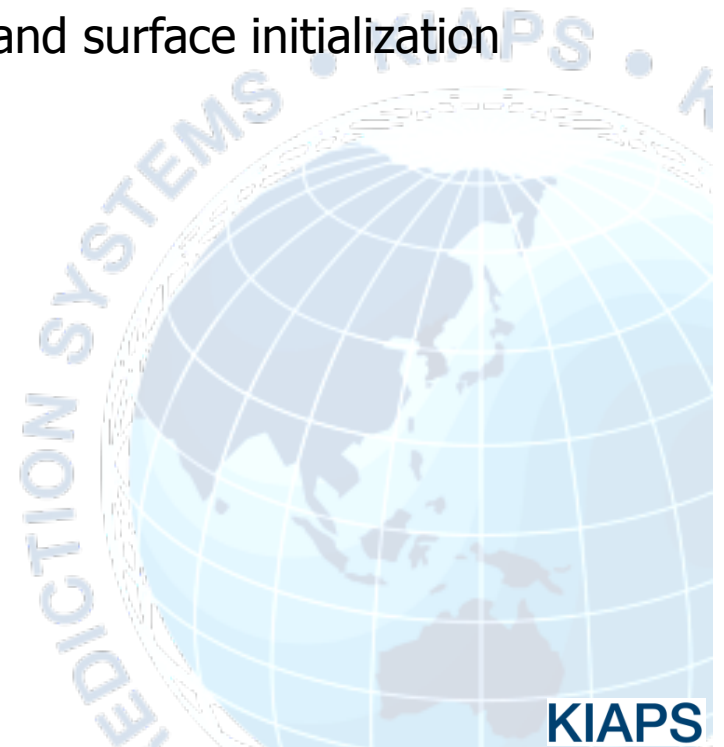


- Dry condition -> high temp.-> increase PBL mixing-> change of low level structure???
- In East Asia case, enhanced evaporation from the soil to the atmosphere in wet initial soil moisture reduce land-sea contrast between East Asia and Pacific Ocean leading to a weakened sensitivity of the monsoonal circulations to the initial soil moisture (Kim and Hong, 2007)



□ plan

- Additional analysis about operational global NWP model test
- KIAPS-GM experiments using retrospective land surface initialization method of soil moisture





Thank you for your attention !

