

Transitioning to operation of recent research on land processes

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Collaborators:

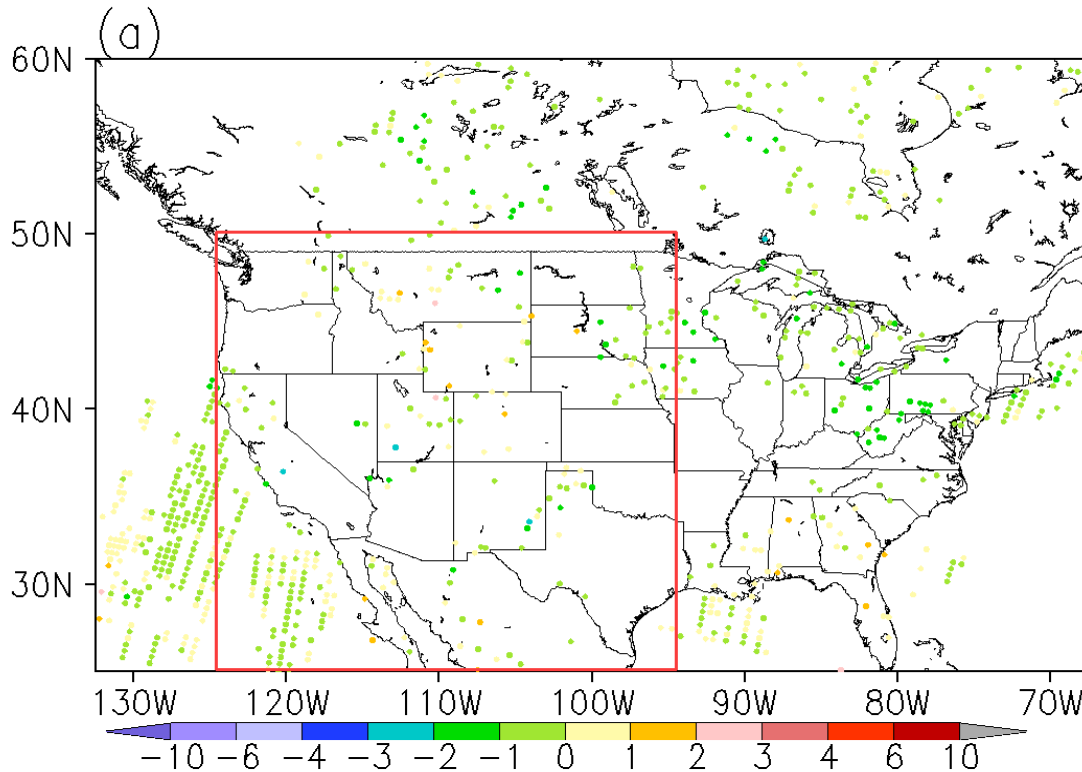
NCAR: Mike Barlage and Fei Chen
NCEP EMC: Weizhong Zheng, Helin Wei, and Mike Ek

JCSDA 9th Workshop on Satellite Data Assimilation
May 24, 2011



I. Motivation in surface Tskin improvement

Satellite data would be rejected in data assimilation if model biases are too large



Spatial distribution of satellite pixels used in GSI: brightness temp. bias of Ch8 in NOAA-17 HIRS3 from GFS control run.

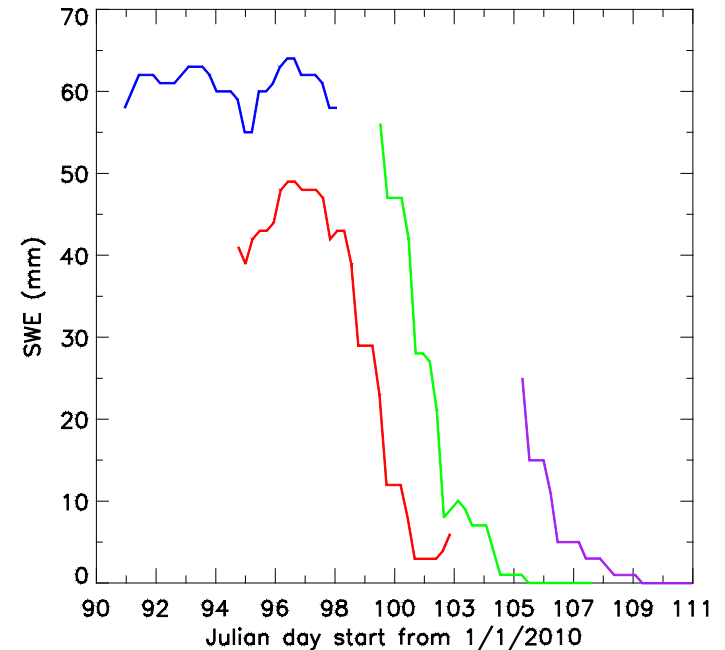
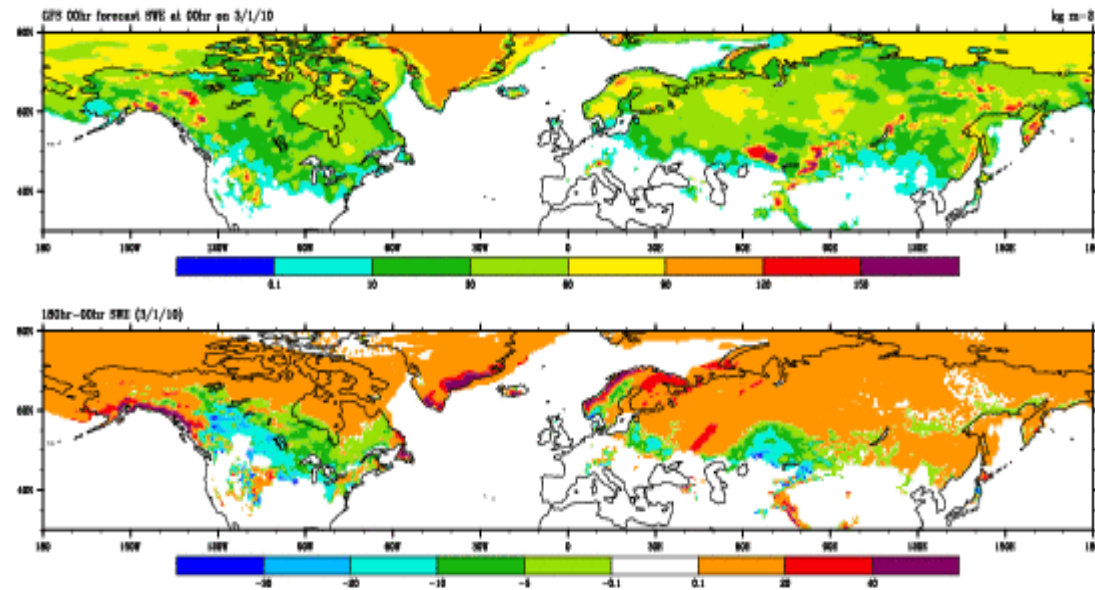
Zheng et al. (2011)

Our goal: improve land model to accelerate the use of satellite data.

II. Motivation in Snow Improvement

SWE from GFS 7-days forecast
March 1, 2010 (180Hr – 00Hr)

Rocky mountain,
Colorado

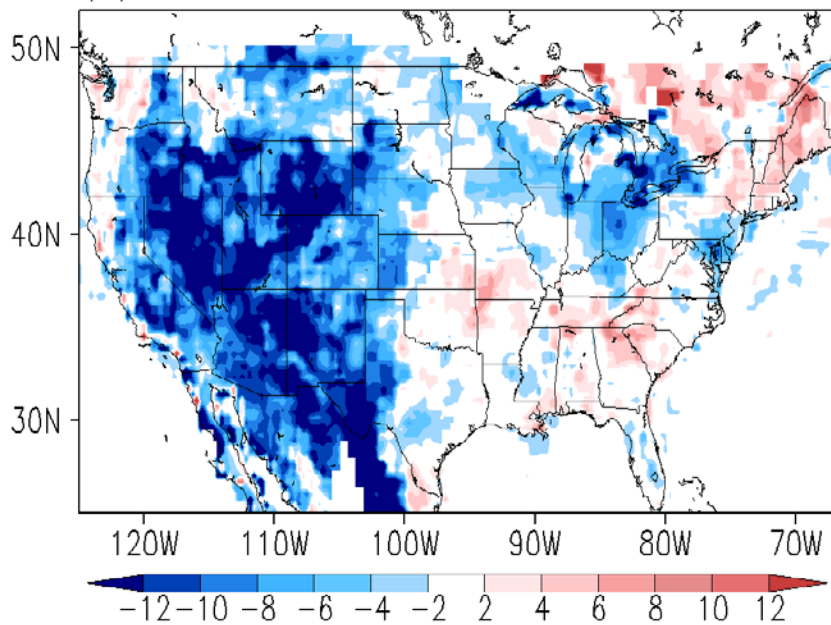


Even if satellite data are assimilated, their impact would be small because of significant model bias.

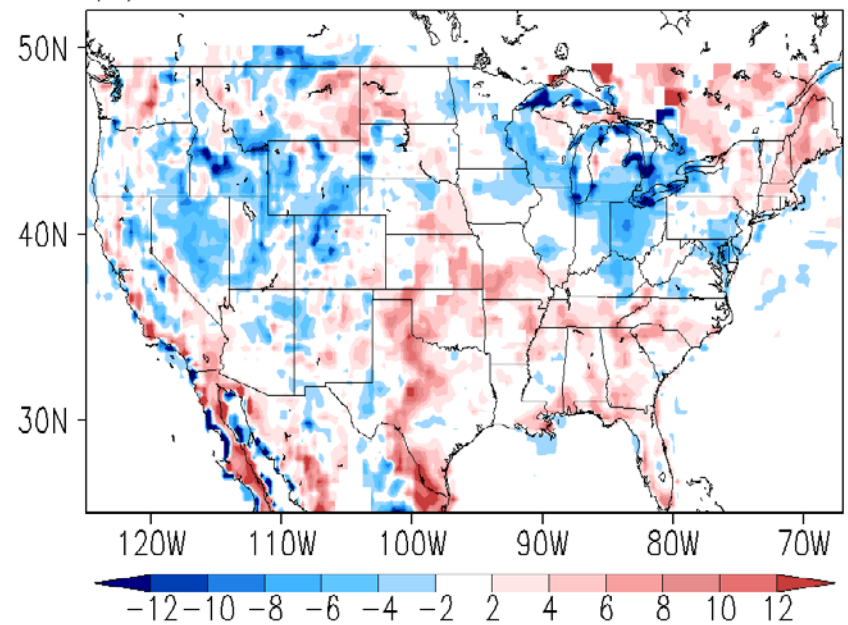


Tskin improvement implemented in GFS in Spring 2011

(a) GFS-GOES: CTR



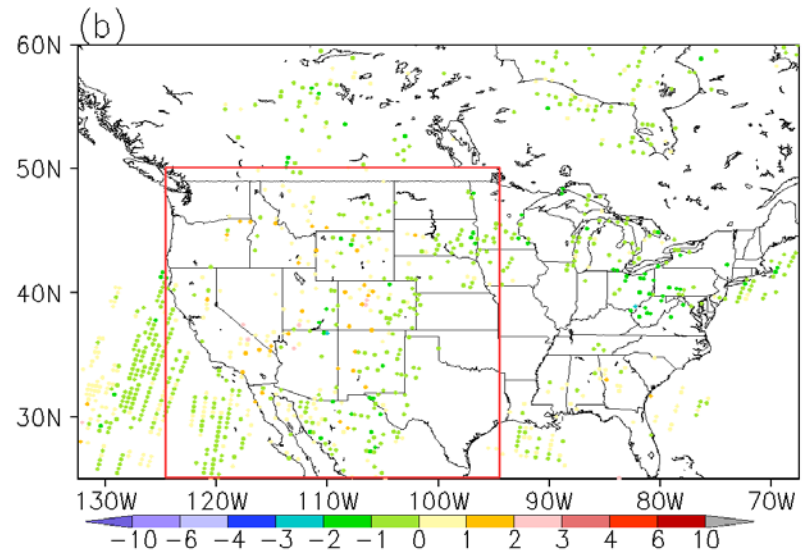
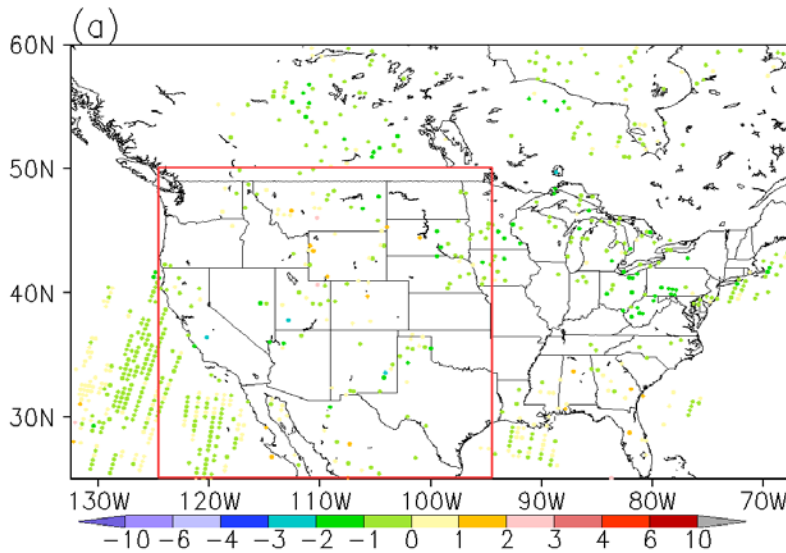
(b) GFS-GOES: EXP



3-day average Tskin predicted by GFS vs. GOES measurements
1-3 July 2007 (1800 UTC)

Zheng et al. (2011)

Improve the Tb data assimilation

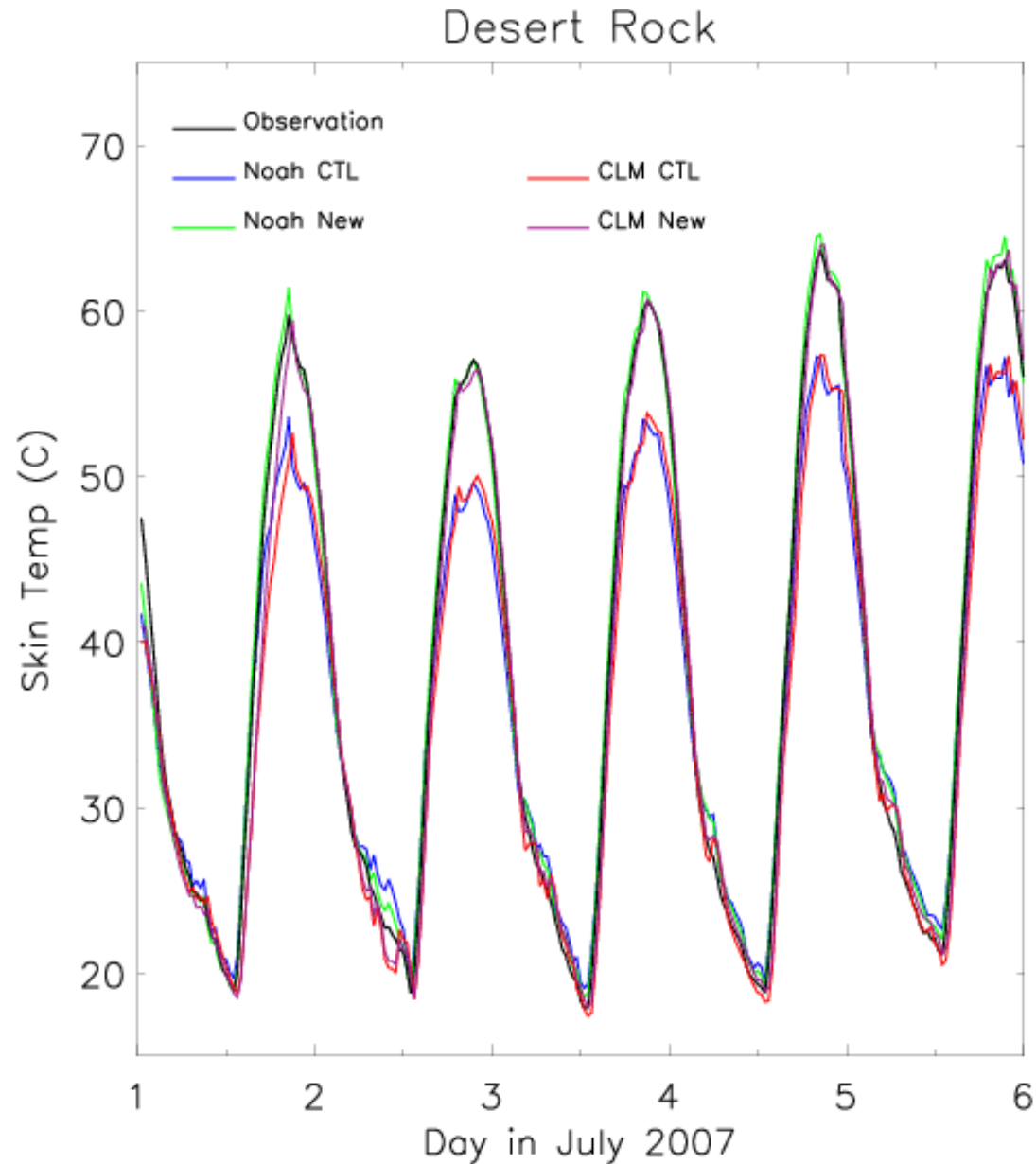


Spatial distribution of satellite pixels used in GSI: Tb bias of Ch8, NOAA-17 HIRS3 from (a) CTL, and (b) New run.

- Tskin cold bias in GFS
- Large error in Tb simulated by CRTM
- NCEP GSI rejects the satellite Tb over land (for surface sensitive channels)
- Few data assimilated

Zheng et al. (2011)

Using the idea from our Noah work to improve CLM



Snow process revisions in Noah

- Explicitly consider the shading effect of the forest canopy on the underlying snowmelt and snow sublimation
- Explicitly consider the convergence of Z_{0m} under snow condition
- Other revisions

No change in the structure of Noah to facilitate implementation into operational model.

Wang et al. (2010, JGR)



Offline Noah Test over Niwot Ridge, Colorado July 2006 – June 2007

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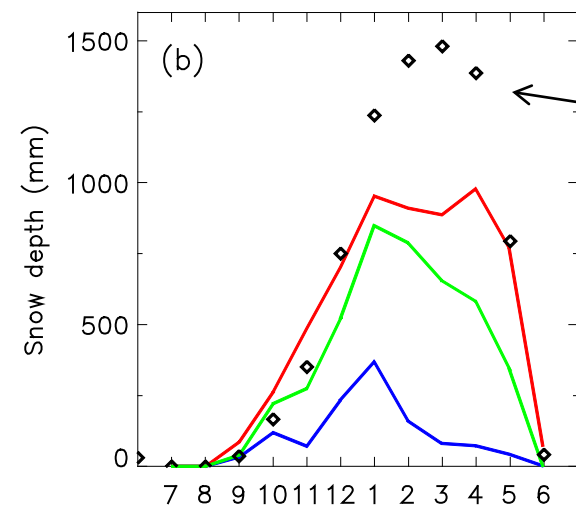
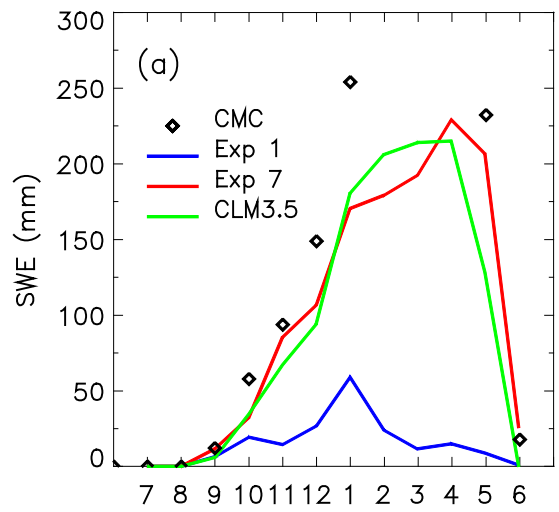
Con

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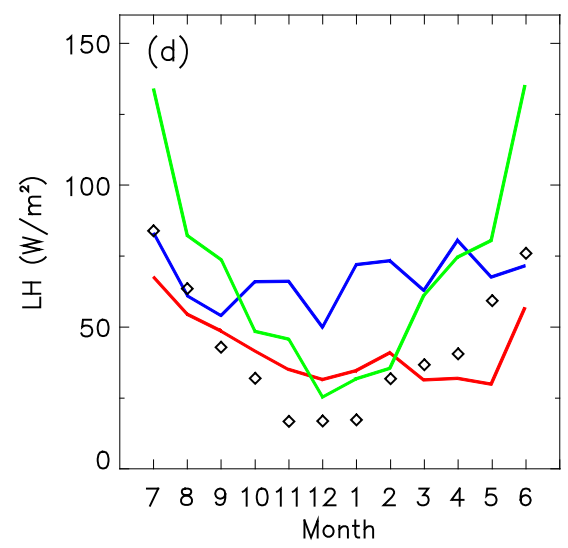
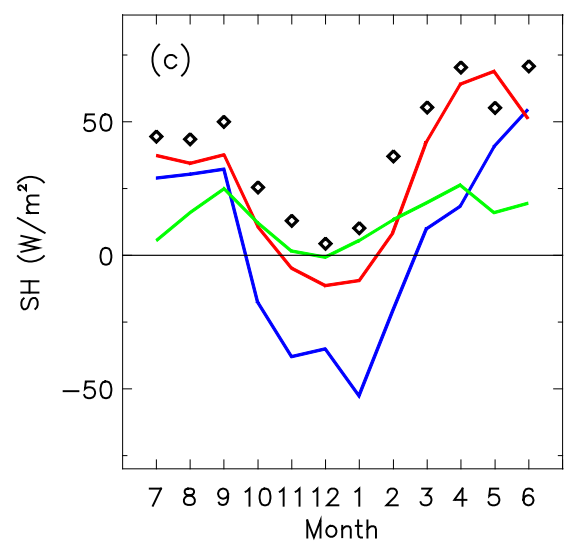
New

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CLM3.5



Obs



Implemented the snow revisions in WRF/Noah

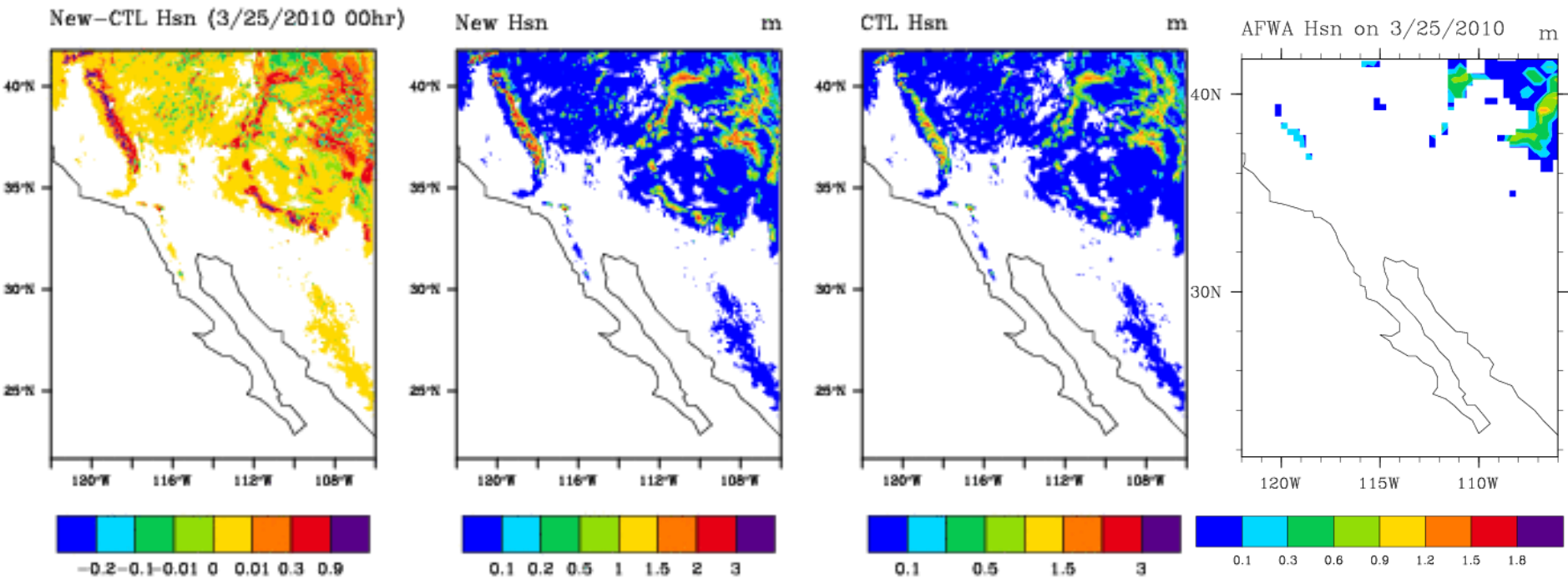
Initial test with WRF/Noah:

- from Jan 17 to March 29, 2010
- model domain: Southwestern U.S.
- $dx = dy = 5.4$ km

For this test, we collaborate with Mike Leuthold in our department at the University of Arizona



March 25, 2010 (after more than 2 months of integration)

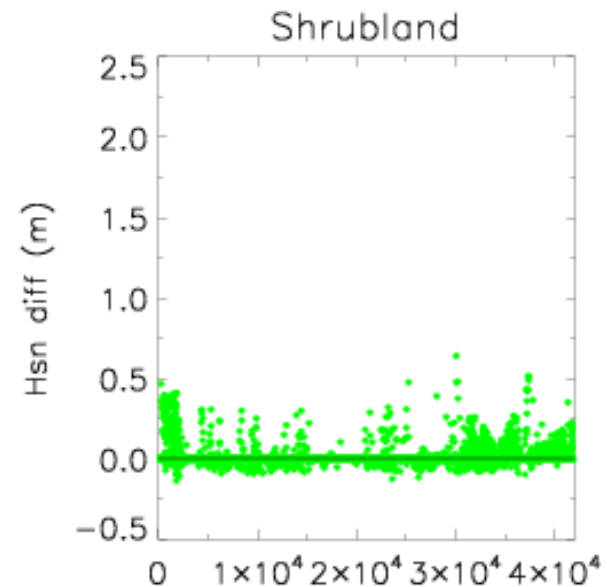
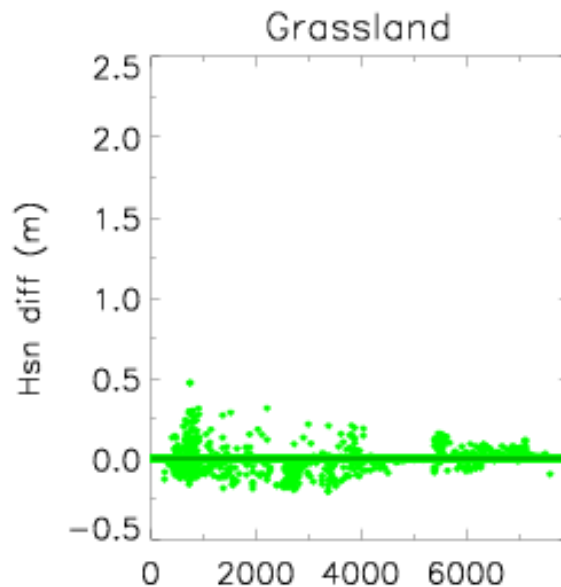
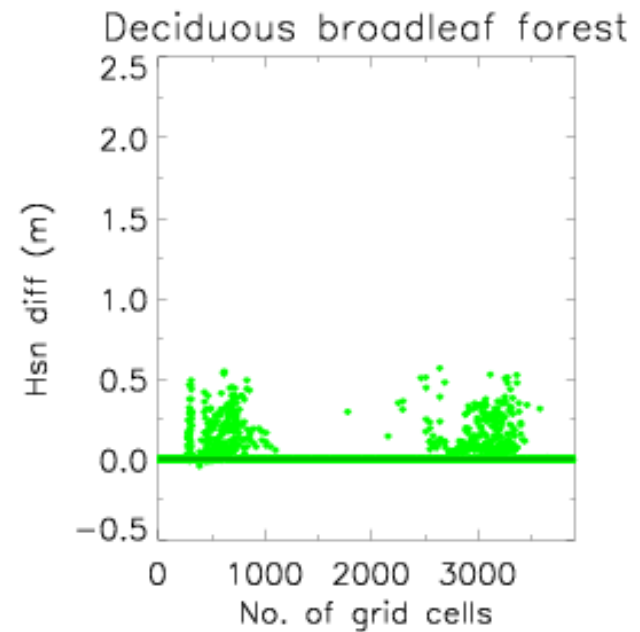
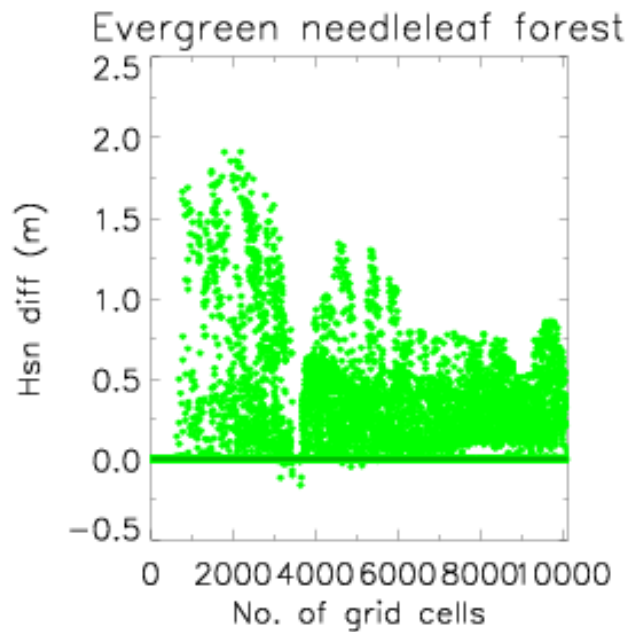


Jesse Meng, John Eylander, and George Gayno provided the AFWA snow data.



The difference in Hsn and SWE (New - CTL) for each veg type

March 29, 2010



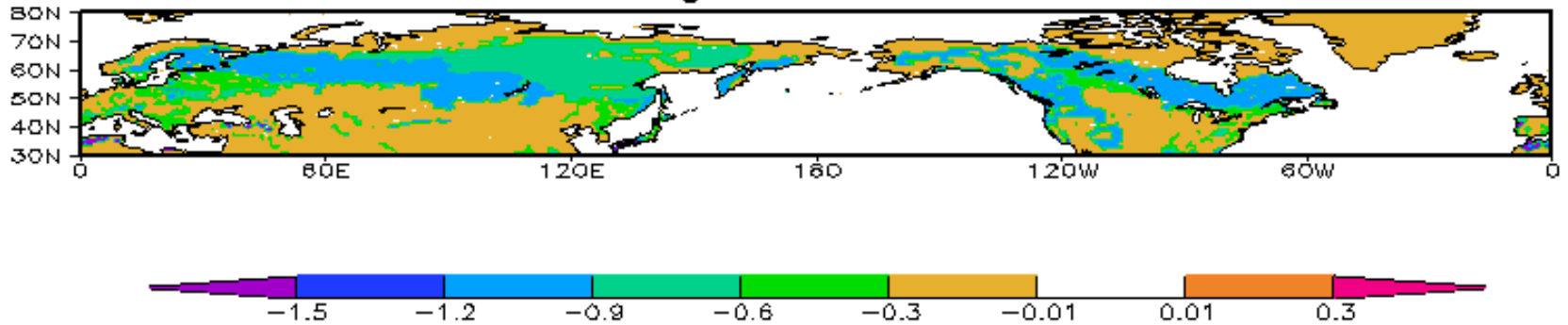
Further testing

- (1) Currently collaborating with colleagues to test these snow revisions in WRF regional climate simulations over continental U.S.

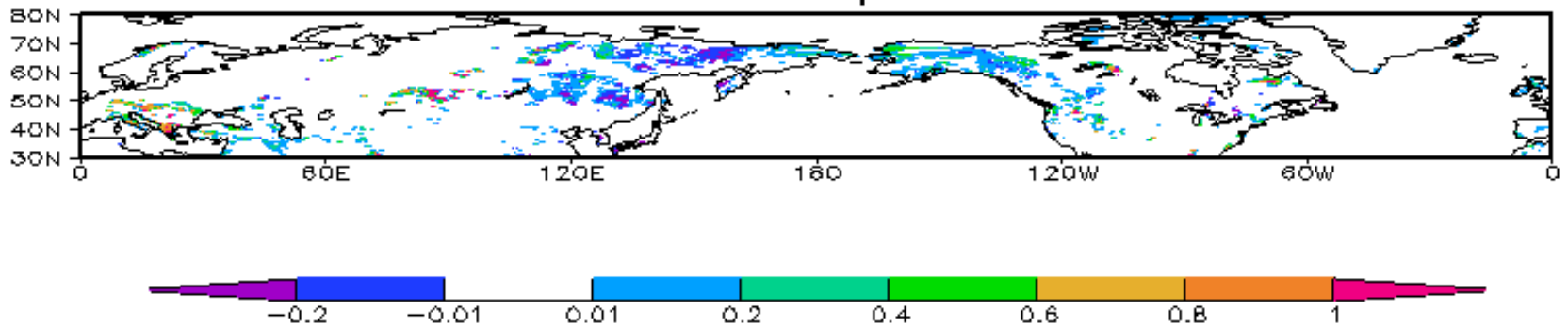
- (2) In the process of implementation in GFS, including the 1-week visit to UA of Dr. Helin Wei from Mike Ek's group at NCEP
 - (i) implementation of snow roughness length revision is successful
 - (ii) continue work on other revisions



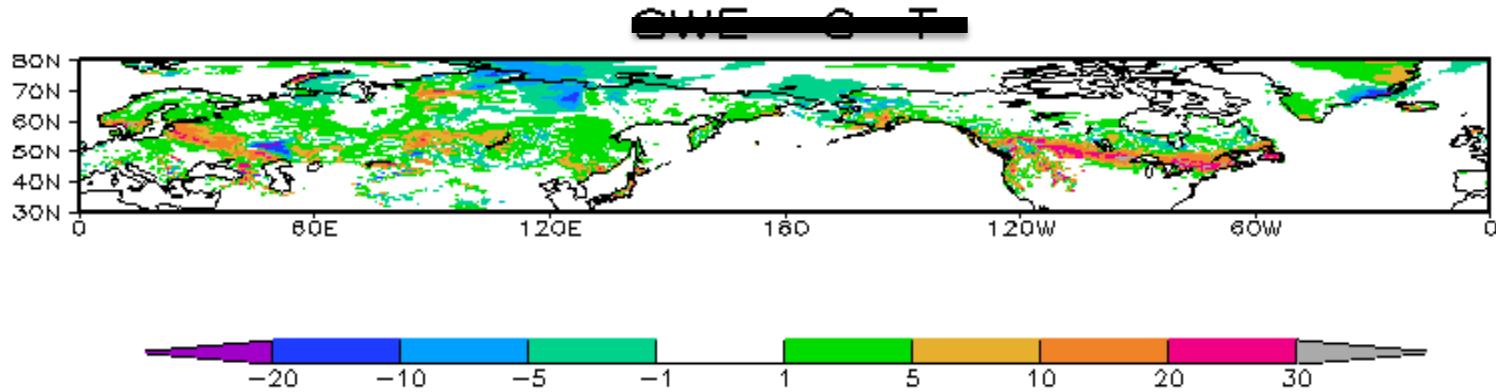
Roughness T-C



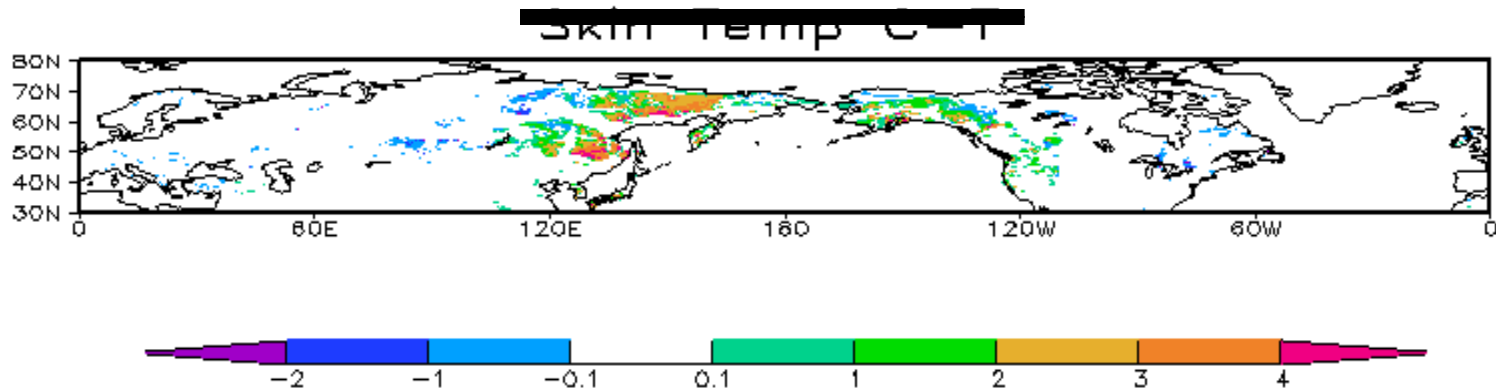
2-m Temp T-C



SWE (Test – CTL)



Skin Temp (Test – CTL)



Summary

1. Formulations of Z0m and Zot were implemented in GFS in spring 2011
 - improve daytime surface skin temperature;
 - increase the number of satellite brightness temperature data used in data assimilation
2. In the process of snow revisions implementation in Noah
 - improve offline Noah;
 - improve WRF/Noah over forest areas in southwestern US;
 - currently testing in regional WRF;
 - In the process of implementing into GFS

