4 km (1/24°) Surface Meteorological Forcing Down-scaled from NLDAS-2 and Radar/Satellite Products

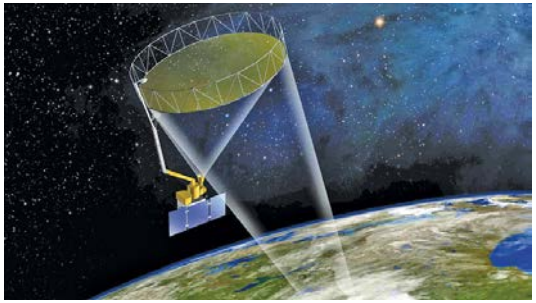
Ming Pan

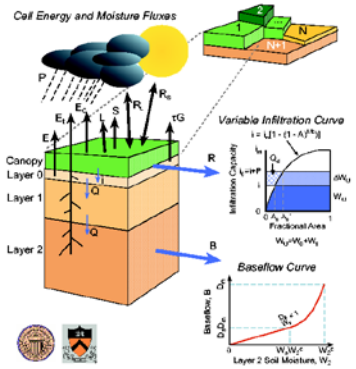
Princeton University

Presented @ NLDAS Telecon 9/16/2015

Background

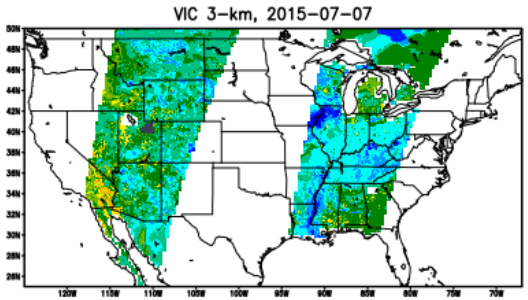
Original Goal: To establish a VIC 3km near real-time simulation system over CONUS for SMAP Val/Cal purpose.

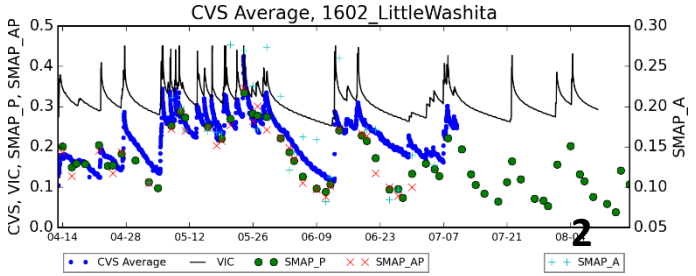




Main Target Specs:

- Variable Infiltration Capacity (VIC) model
- 4km (1/24°) resampled to SMAP 3km EASE grid
- Hourly time step, ~4 days behind real time
- Retrospective simulation from Jan 1, 2002
- 8 outputs archived @ JPL: soil moisture and temperature in 3 layers, land surface temperature, and rainfall (full set @ Princeton)
- NetCDF-4 packaged with CF standard





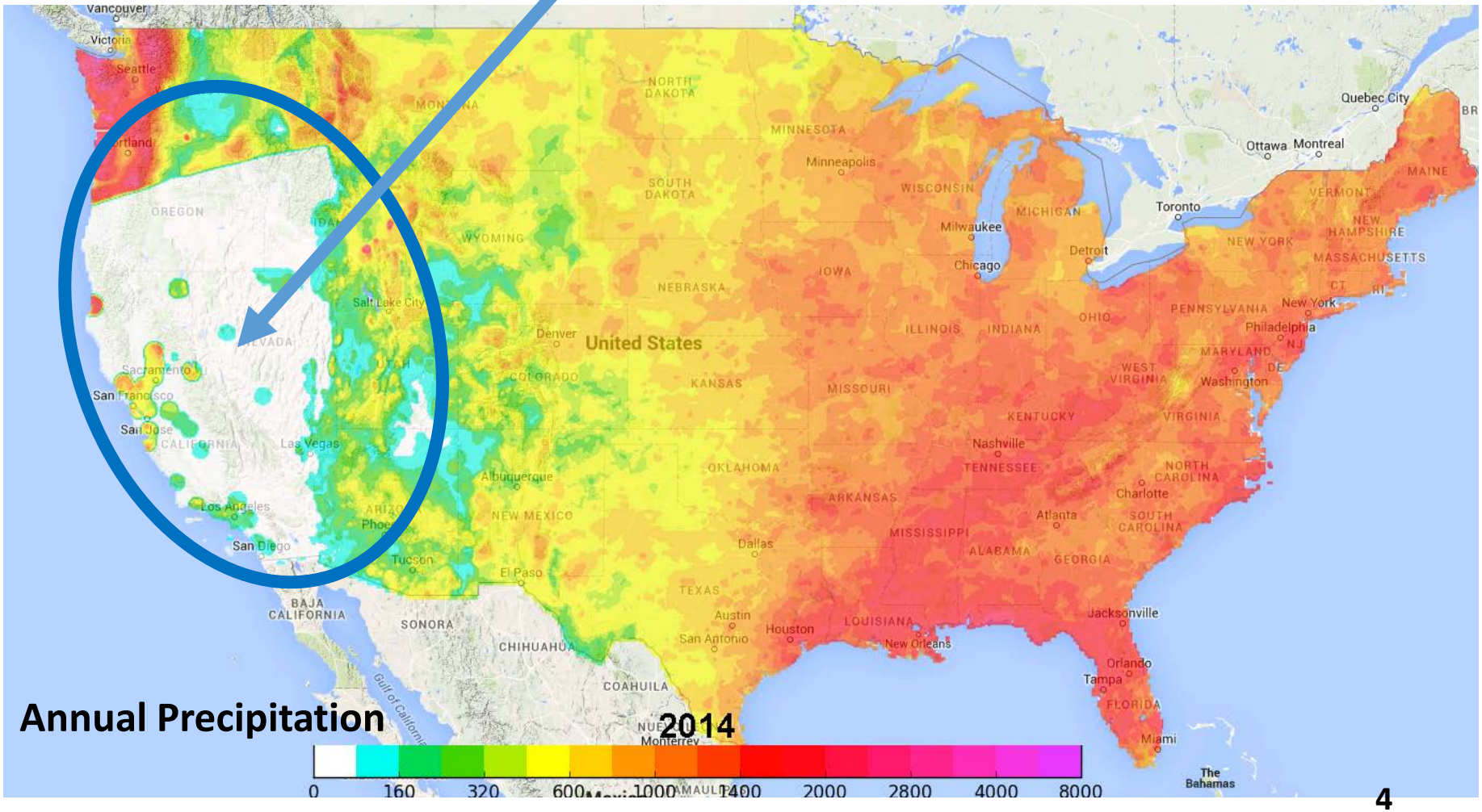
Major Source Datasets

Input Meteorological Forcing Fields

Forcing Field	Source	Res	Processing
Precipitation	Stage IV/II (radar/gauge)	4 km	Gap-filling, NLDAS-2 matchup
Shortwave Radiation	GSIP (GOES satellite)	0.125°	Solar angle adjustment, bilinear interpolation
Longwave Radiation	NLDAS-2 (analysis)	0.125°	Radiative temperature adjusted for elevation
2m Air Temperature	NLDAS-2 (analysis)	0.125°	Elevation adjustment (lapse rate -6.5° C/km)
Specific Humidity	NLDAS-2 (analysis)	0.125°	From interpolated relative humidity interpolation and elevation adjusted temperature/pressure
Surface Pressure	NLDAS-2 (analysis)	0.125°	Elevation based interpolation
10 Wind Speed	NLDAS-2 (analysis)	0.125°	Bilinear interpolation

Stage IV and Stage II

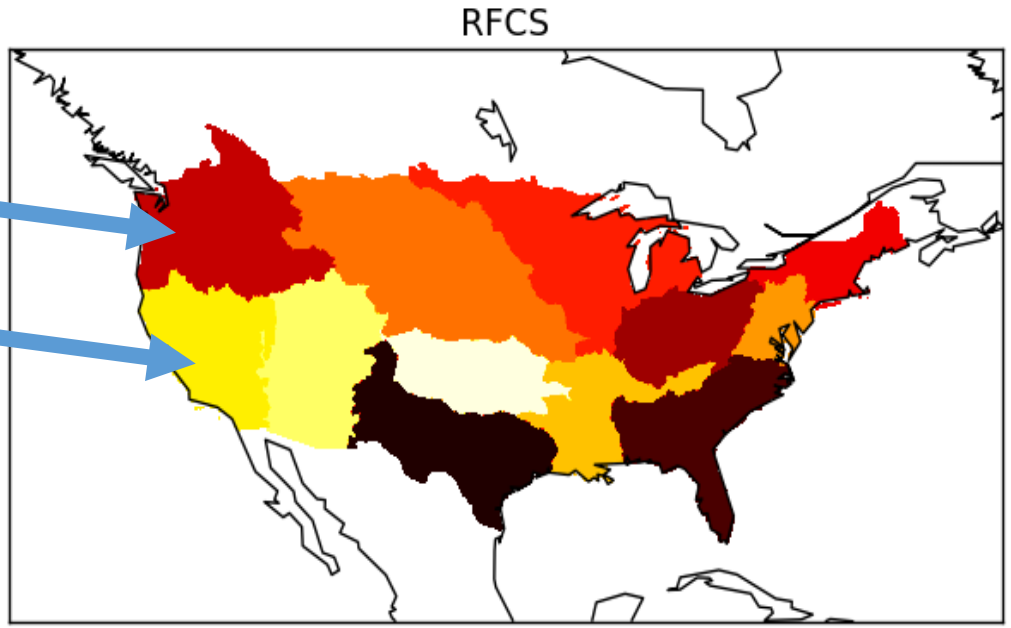
Stage IV Data Problem

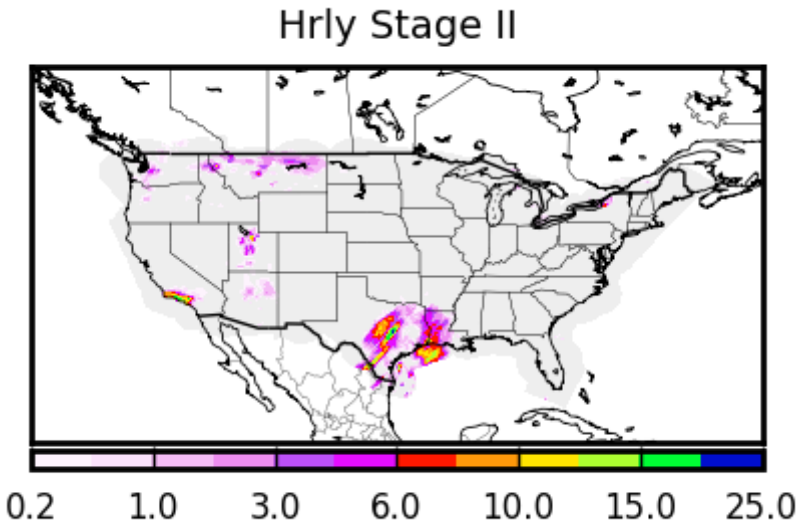


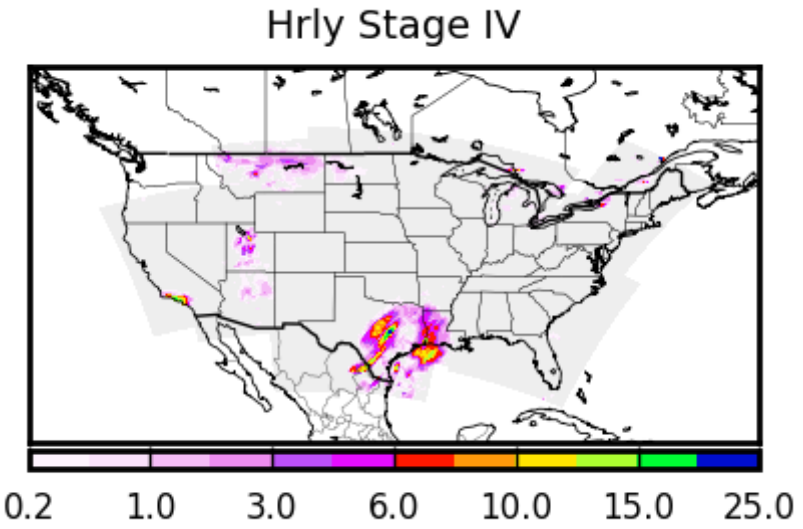
Stage IV and Stage II

Northwest RFC (NWRFC)

California Nevada RFC (CNRFC)

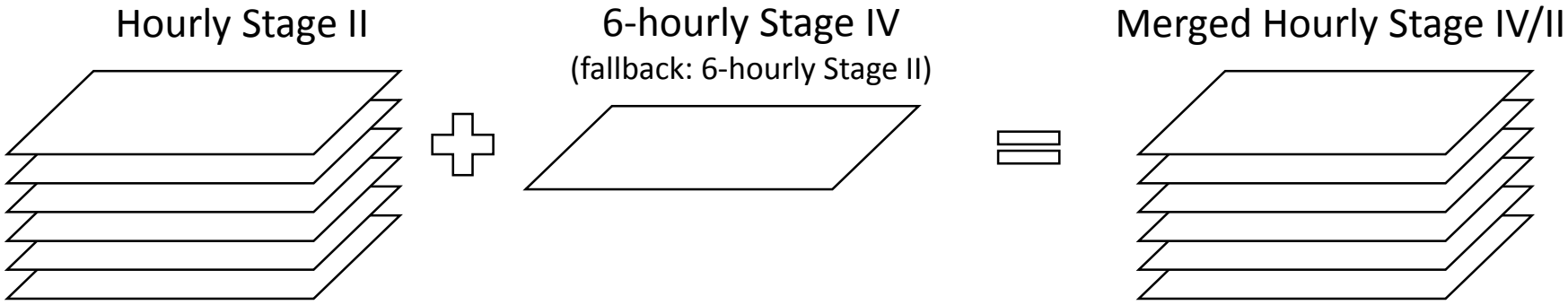






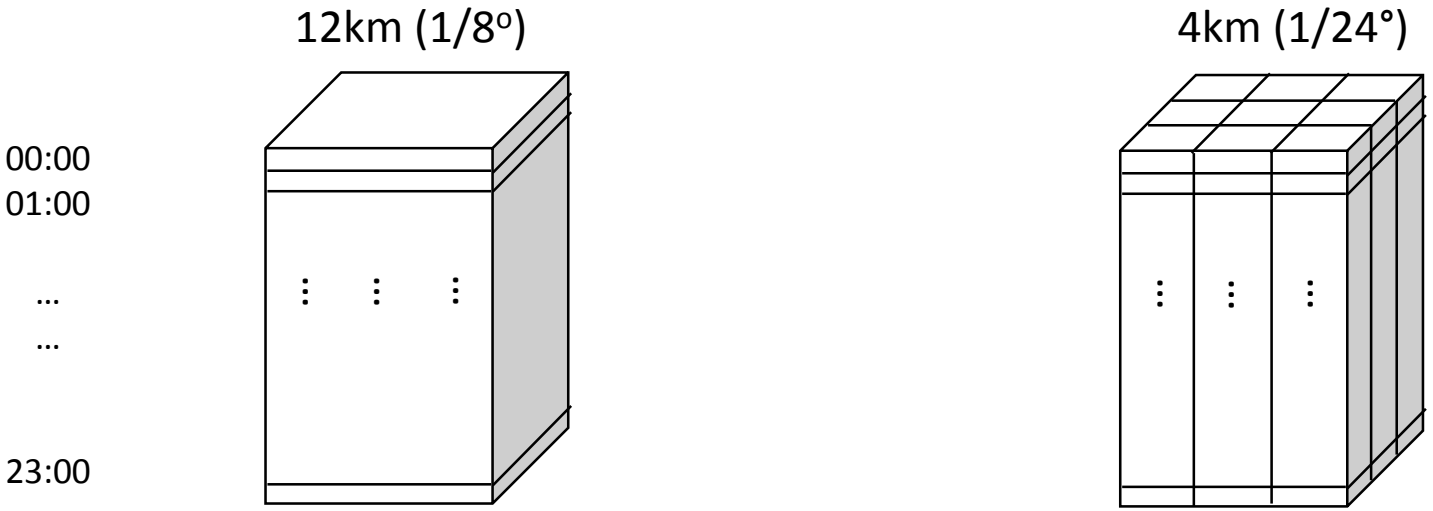
Stage IV and Stage II

1. For CNRFC and NWRFC:



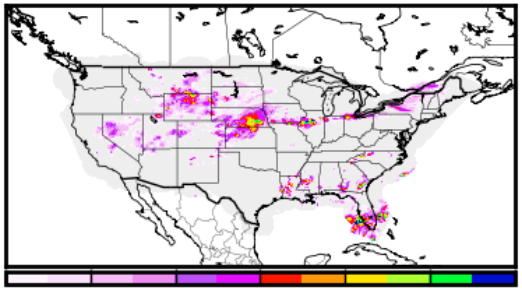
2. Other RFCs: rescale to match 6-hourly Stage IV total

3. Match NLDAS-2 daily total at 1/8° scale (only if daily total exceeds 0.4mm)

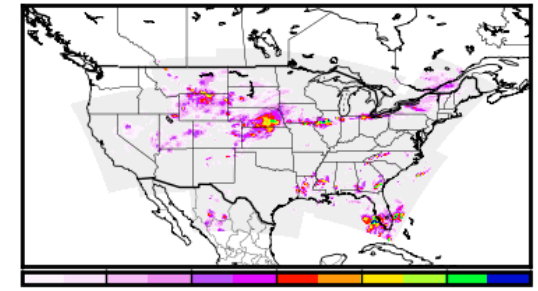


Stage IV and Stage II

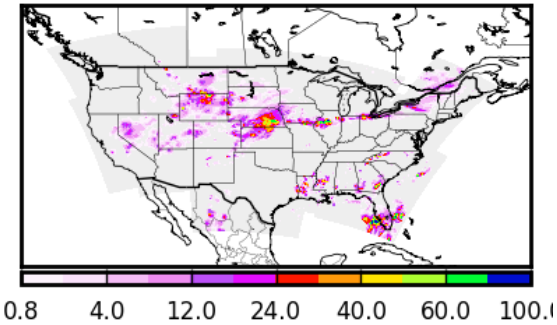
6-hr Sum Stage II



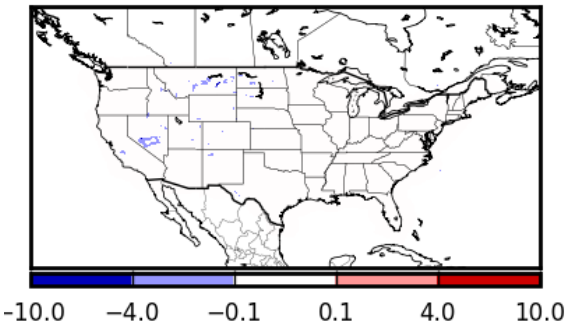
6-hr Sum Stage IV



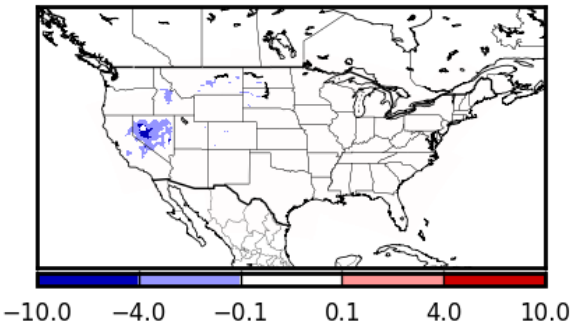
6-hrly Stage IV



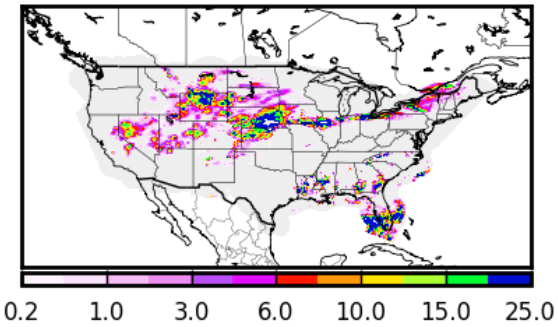
6-hr Stage II Sum - 6-hrly Stage IV



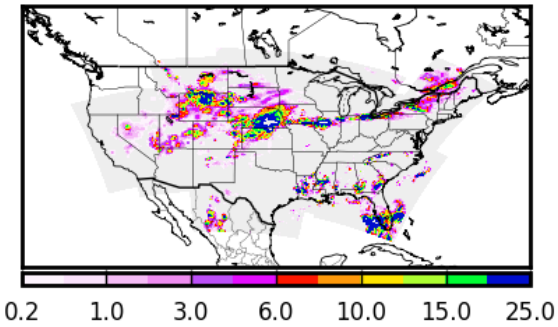
6-hr Stage IV Sum - 6-hrly Stage IV



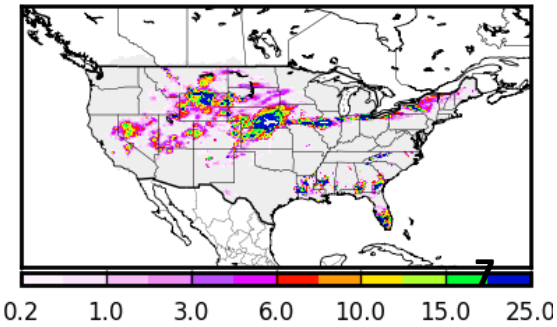
Hrly Stage II



Hrly Stage IV

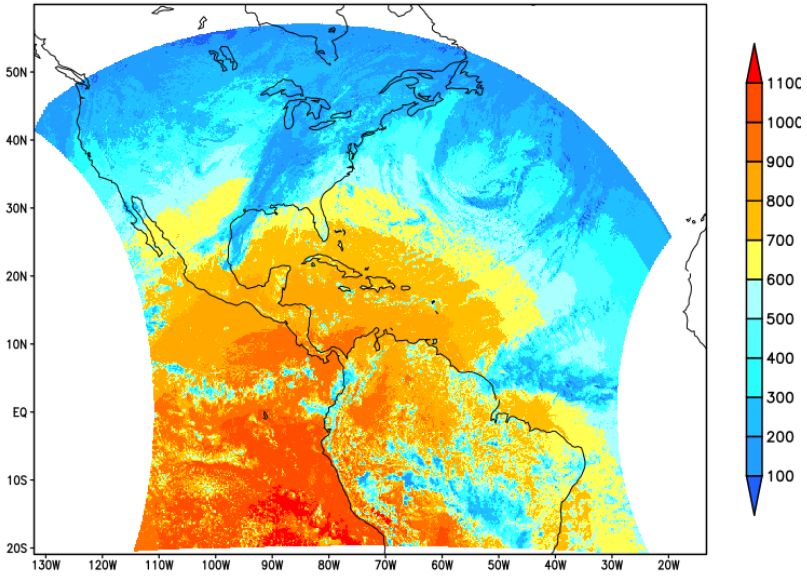


Hrly Merged, 2015-06-11T01

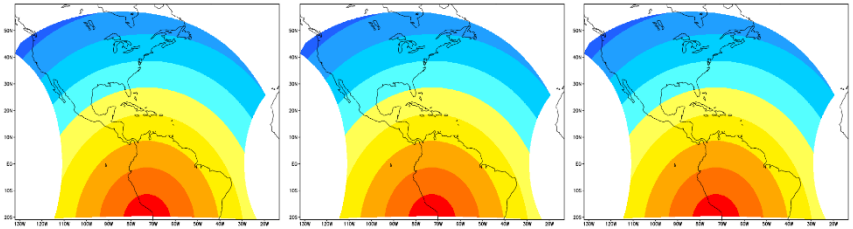


GOES Solar Insolation Product (GSIP)

GSIP Downward Shortwave Radiation
1/8°, validated at 00:45

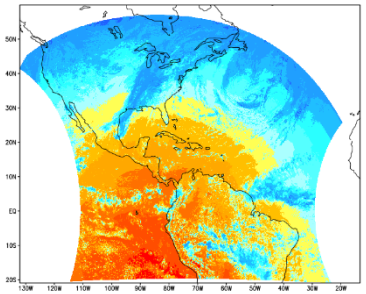


Solar Zenith Angles at
00:00, 00:45, 01:00

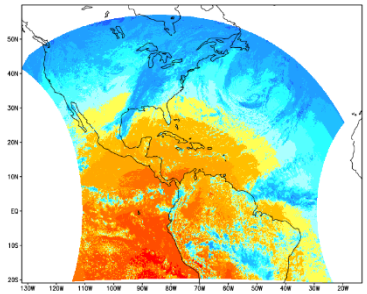


Solar Angle Based Correction

Mean Flux
00:00 – 01:00



Interpolation

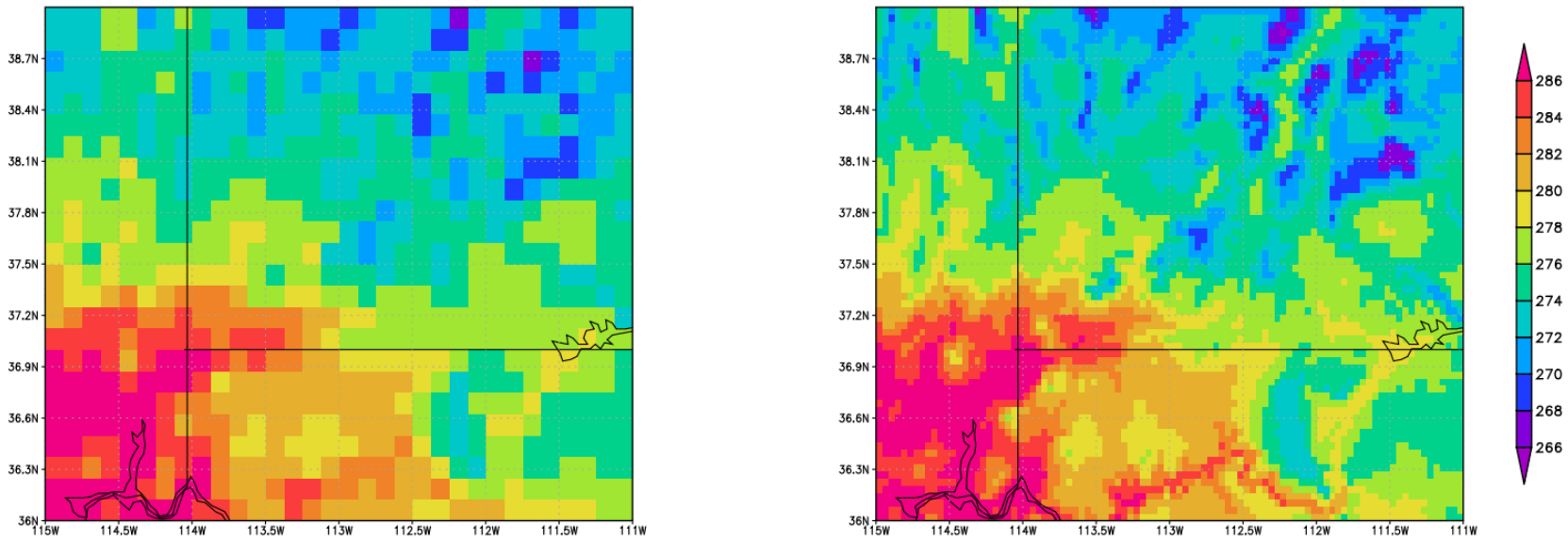


Downscaling

12km (1/8°)

4km (1/24°)

2m Air Temperature (K)



– Elevation Effect

+ Elevation Effect

Seal Level Ta at 12km

Interpolation

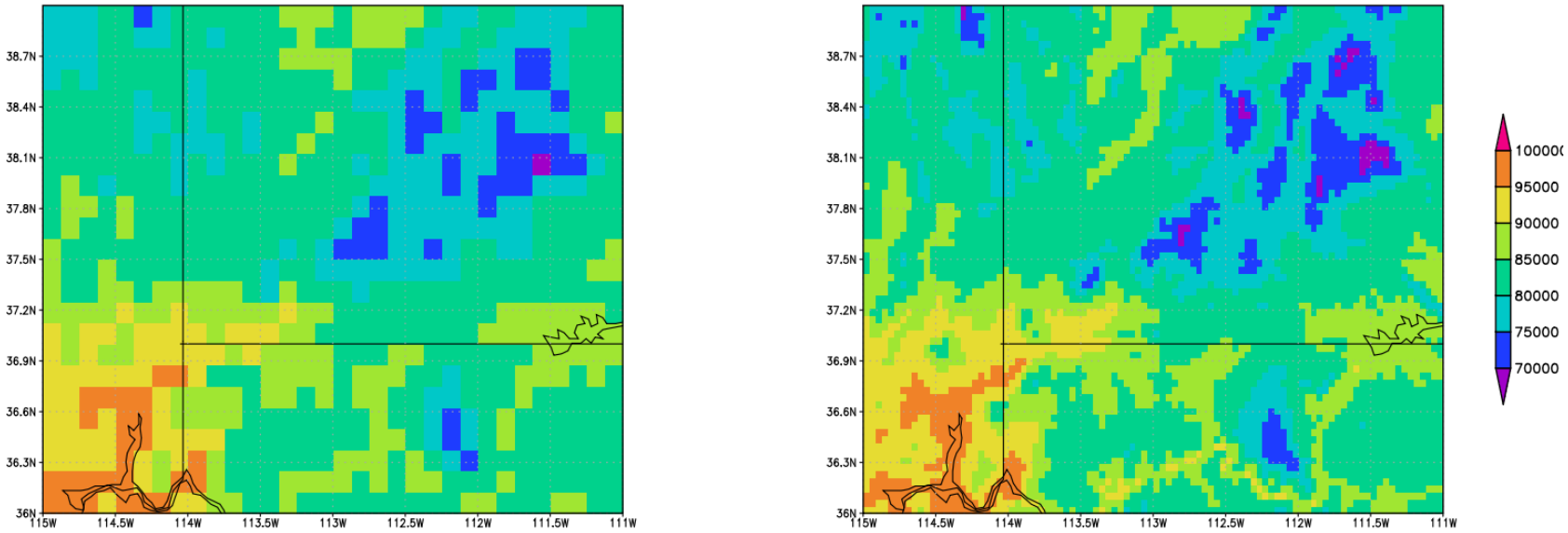
Seal Level Ta at 4km

Downscaling

12km (1/8°)

4km (1/24°)

Surface Pressure (Pa)



– Elevation Effect

+ Elevation Effect

Seal Level Pa at 12km

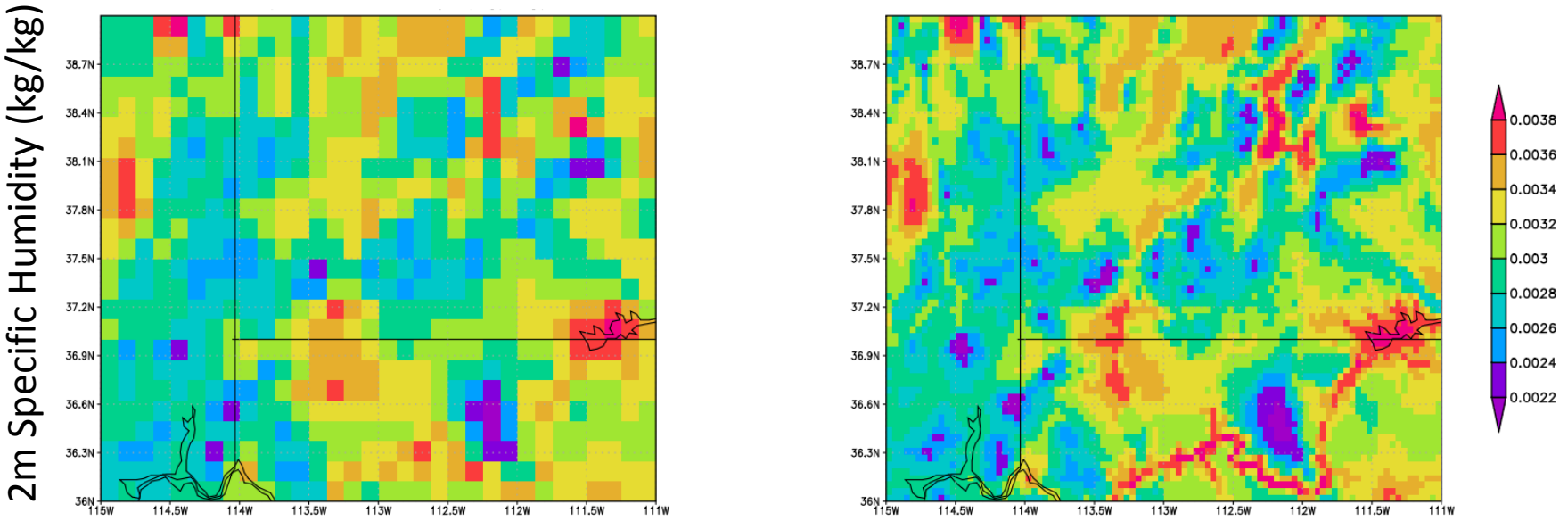
Interpolation

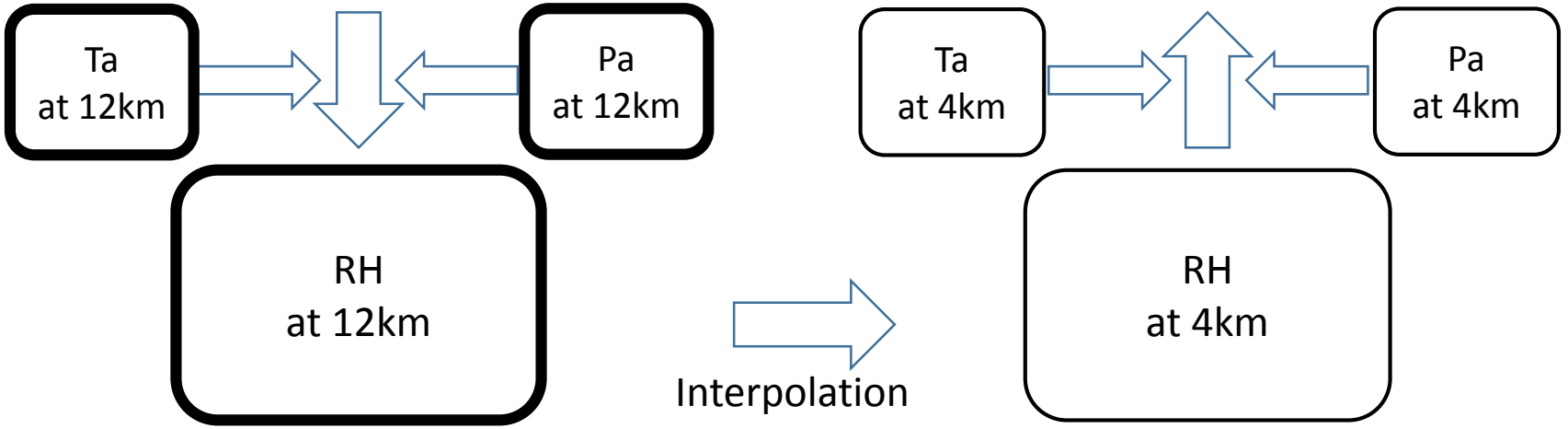
Seal Level Pa at 4km

Downscaling

12km (1/8°)

4km (1/24°)

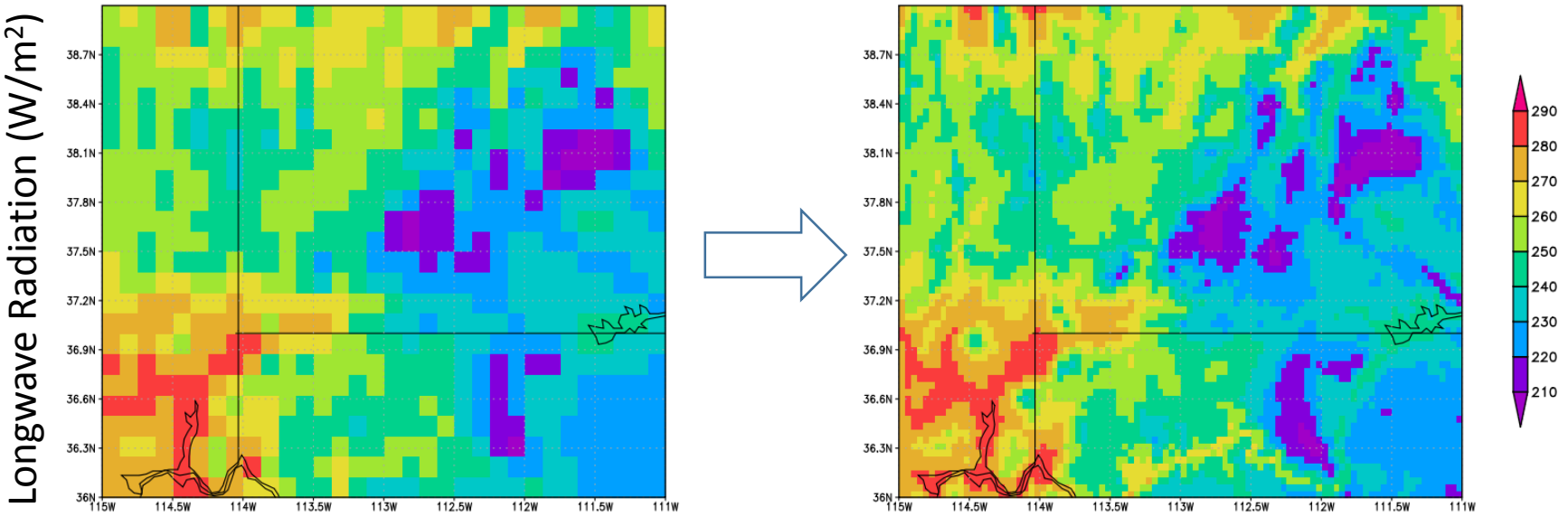




Downscaling

12km (1/8°)

4km (1/24°)



Stefan-Boltzmann

Stefan-Boltzmann

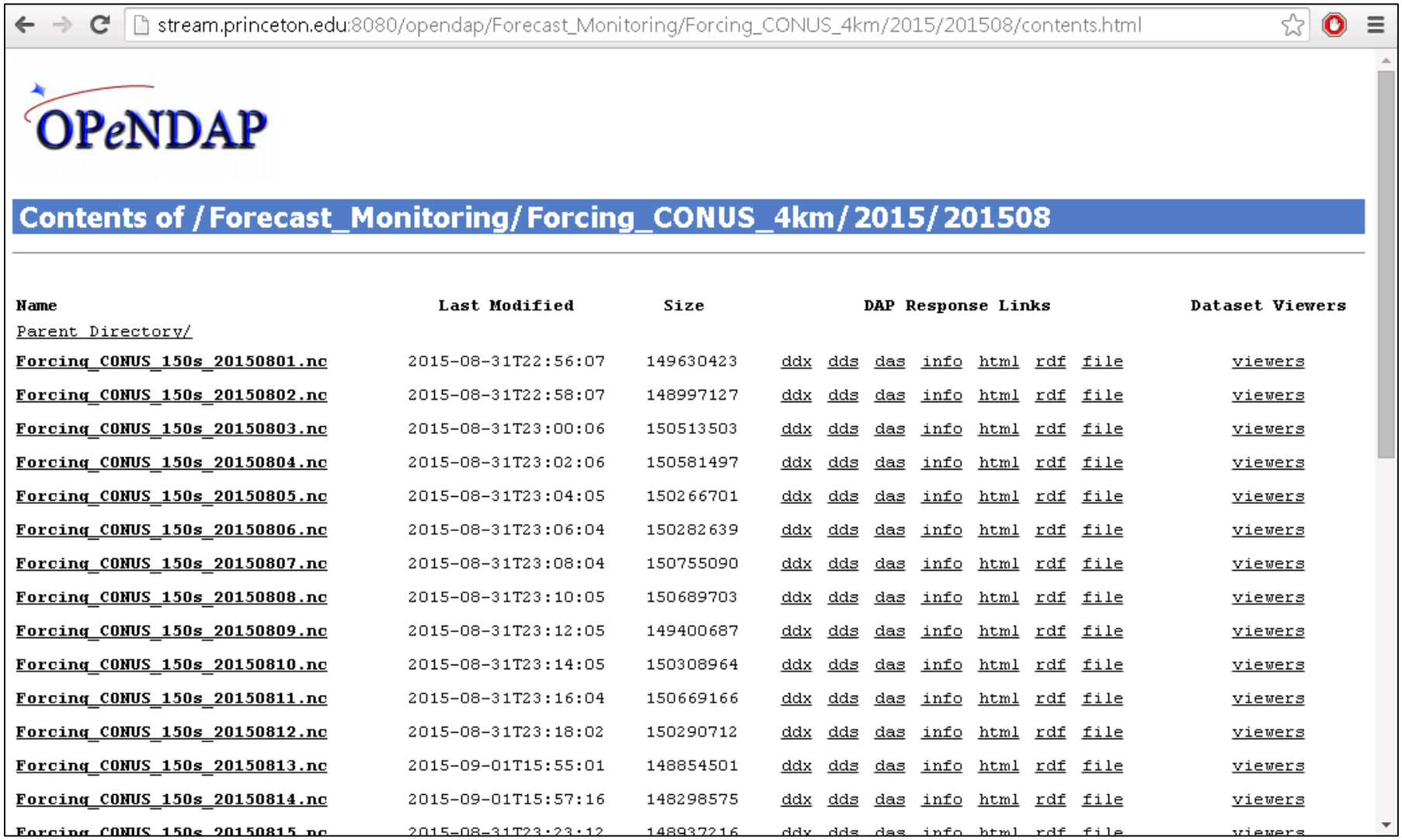
Trad
at 12km

Elevation Effect

Trad
at 4km

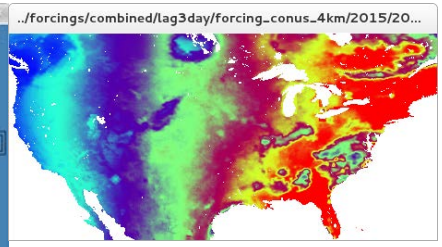
Data Portal @ Princeton and Archive @ JPL

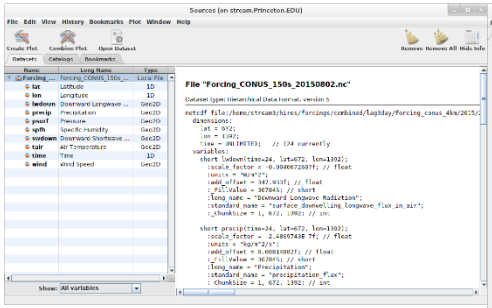
http://stream.princeton.edu:8080/opendap/Forecast_Monitoring/Forcing_CONUS_4km/

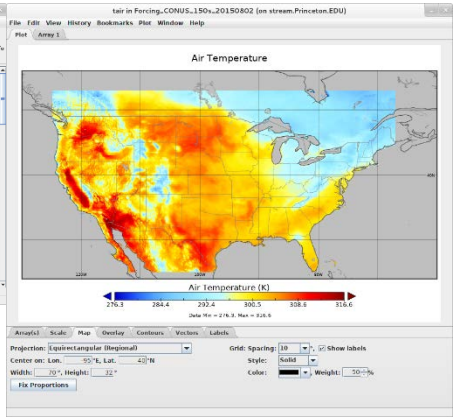


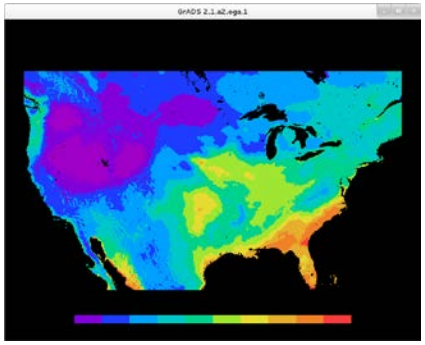
Data Portal @ Princeton and Archive @ JPL

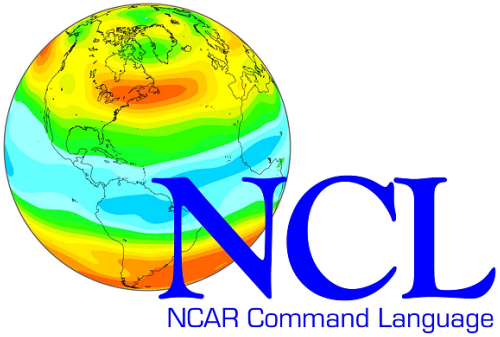
Access manipulate data from any NetCDF or OPeNDAP compatible software

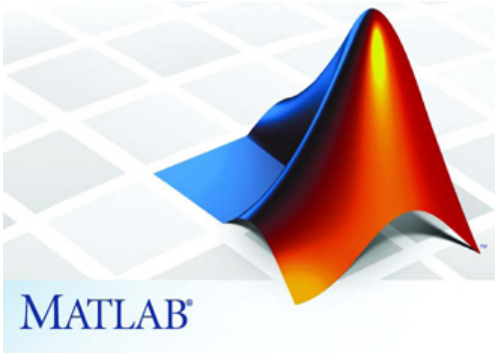






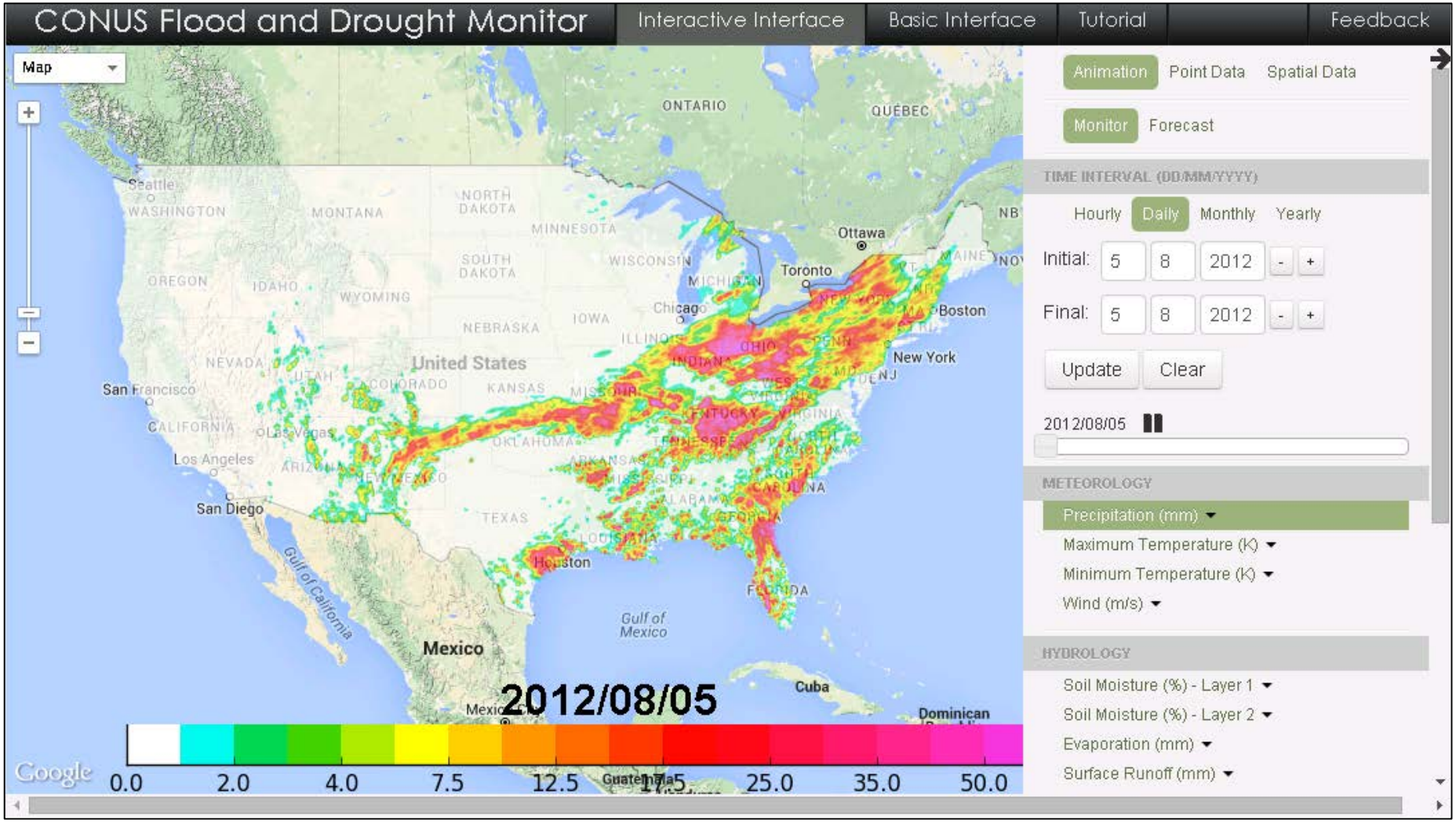






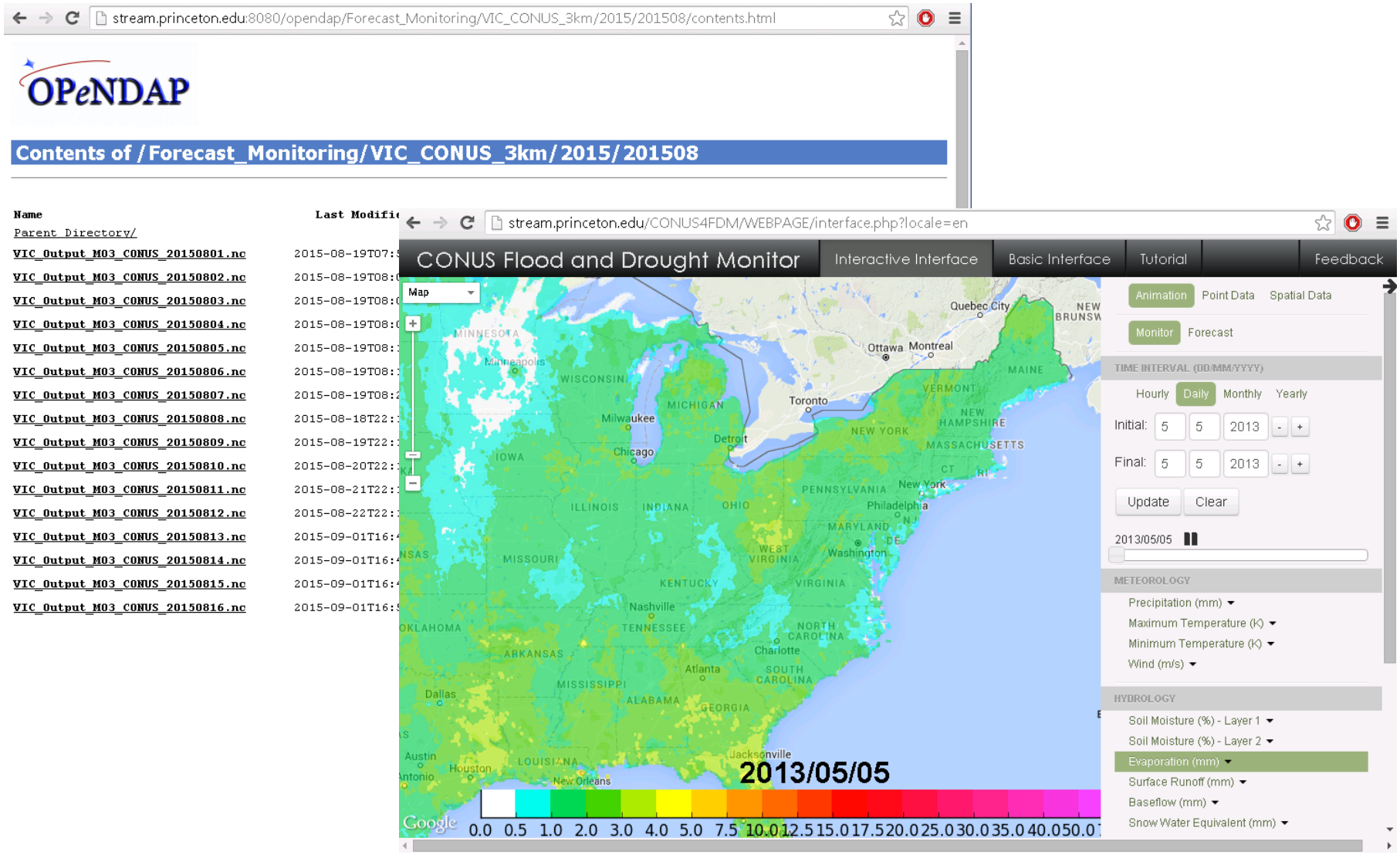
Caution: data packed into 2-byte short integers. GrADS:sdfopen/xdfopen, ncview, Panoply, etc, will apply scale_factor/add_offset automatically, others may need it done manually.

Data Portal @ Princeton and Archive @ JPL



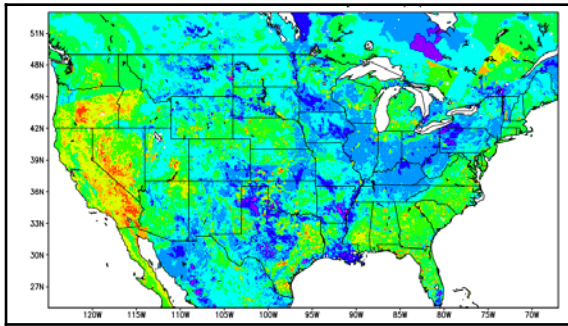
Data Portal @ Princeton and Archive @ JPL

http://stream.princeton.edu:8080/opendap/Forecast_Monitoring/VIC_CONUS_3km/

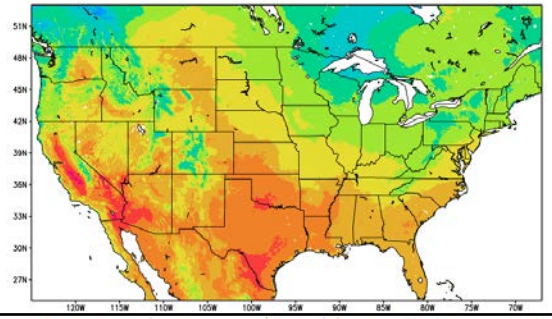


Data Portal @ Princeton and Archive @ JPL

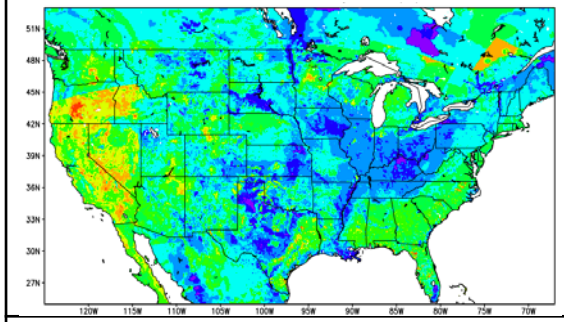
Variables Archived @ JPL



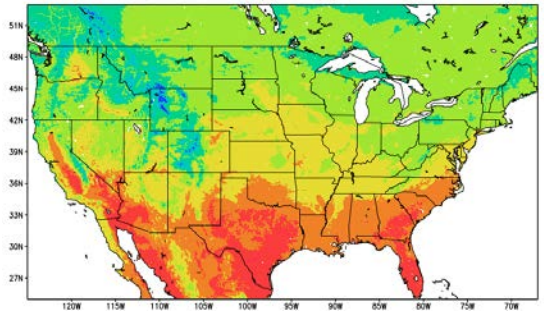
Soil Moisture in Layer 1



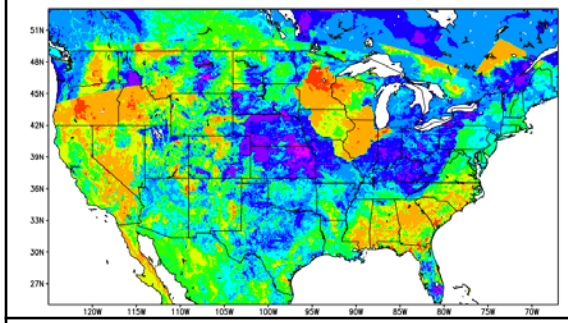
Soil Temperature in Layer 1



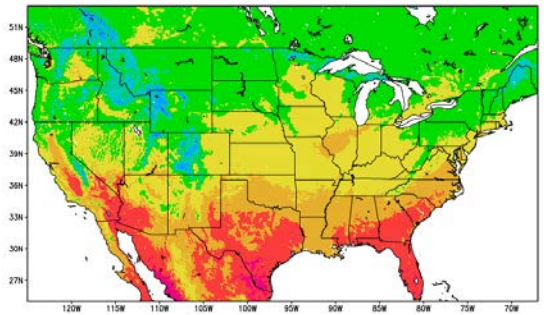
Soil Moisture in Layer 2



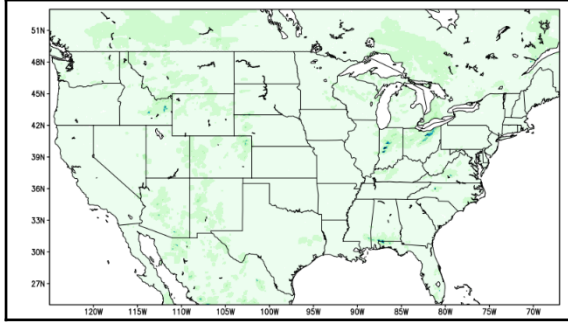
Soil Temperature in Layer 2



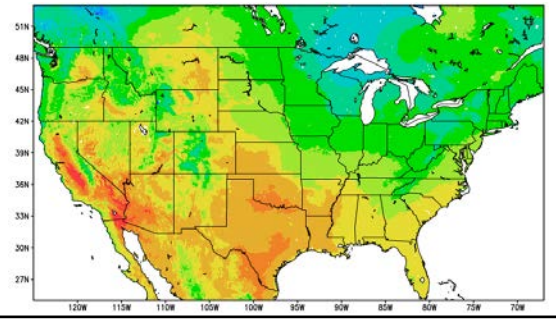
Soil Moisture in Layer 3



Soil Temperature in Layer 3



Precipitation



Land Surface Temperature

Backup Slides