

# 4 km ( $1/24^\circ$ ) Surface Meteorological Forcing Down-scaled from NLDAS-2 and Radar/Satellite Products

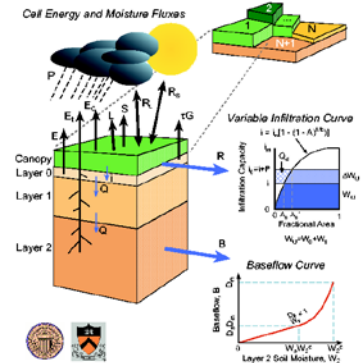
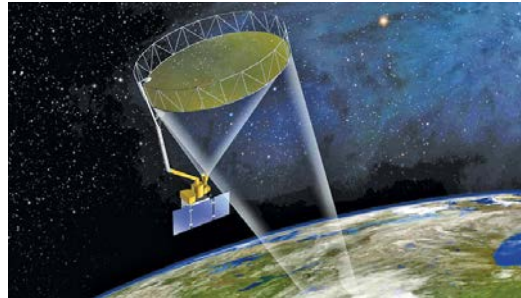
**Ming Pan**

**Princeton University**

Presented @ NLDAS Telecon 9/16/2015

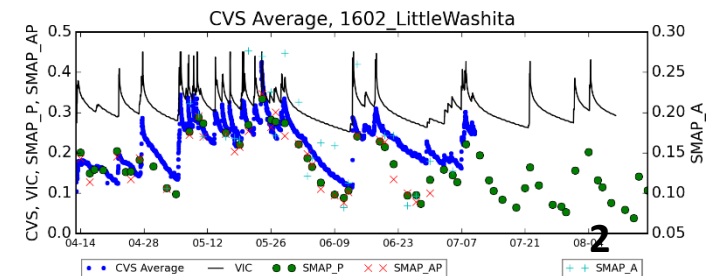
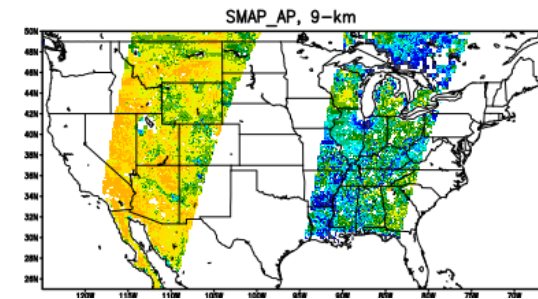
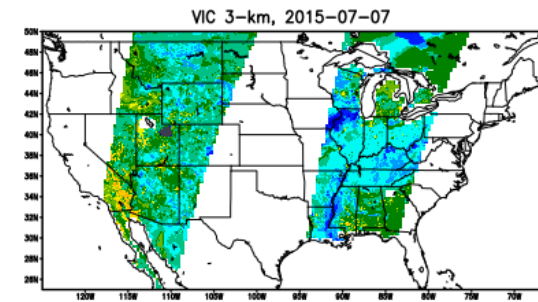
# Background

**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



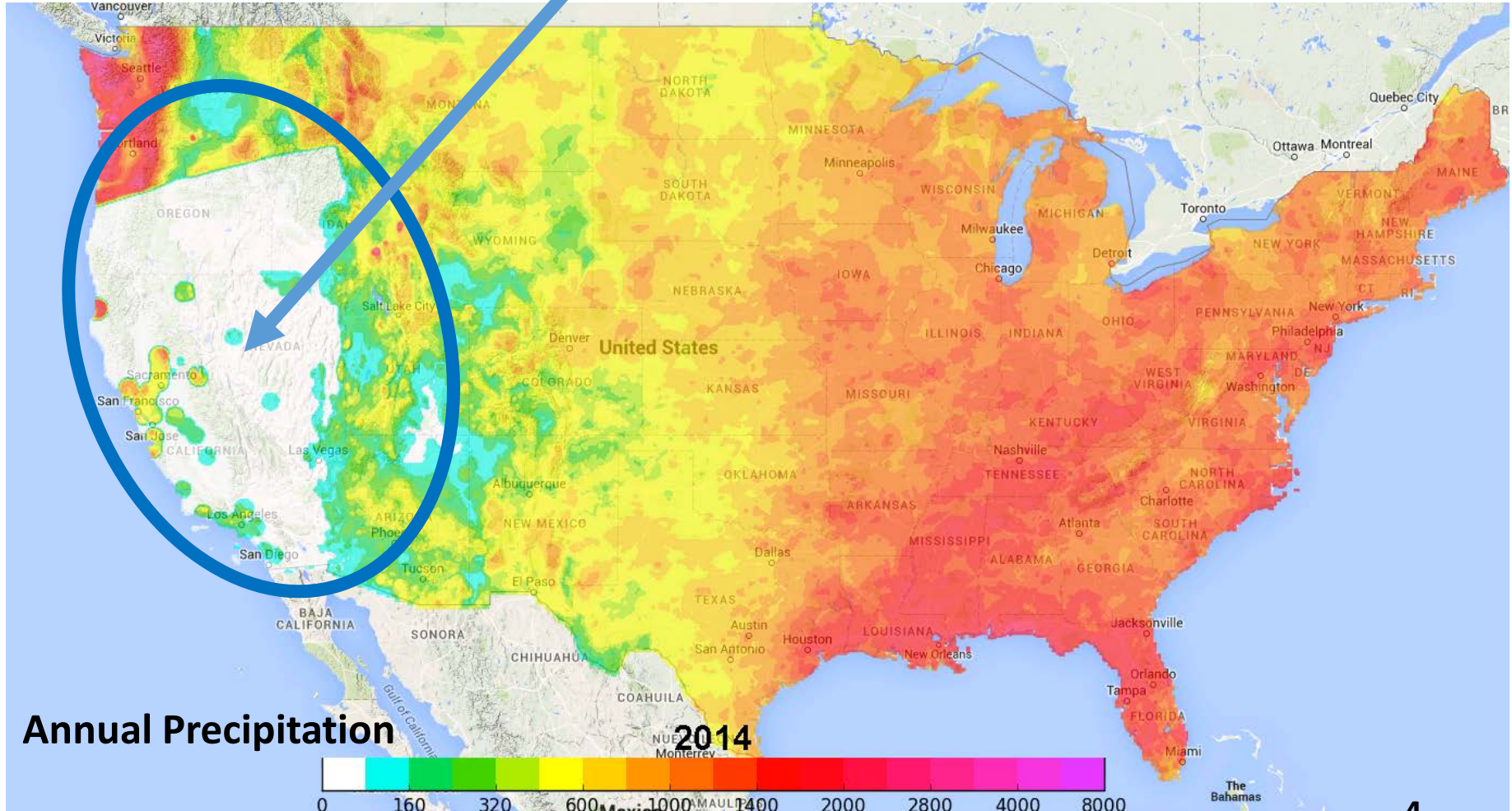
# Major Source Datasets

## 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

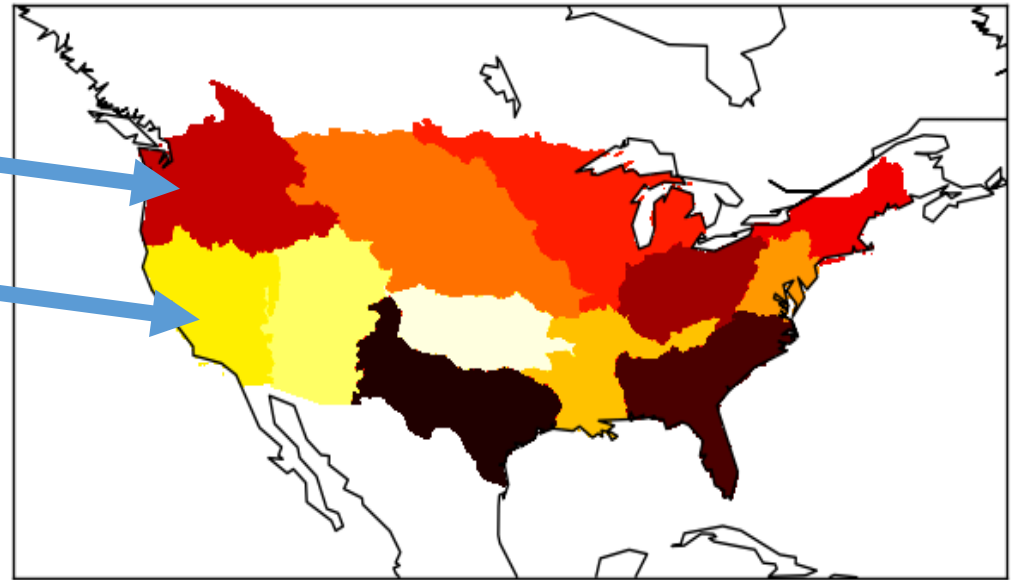


# Stage IV and Stage II

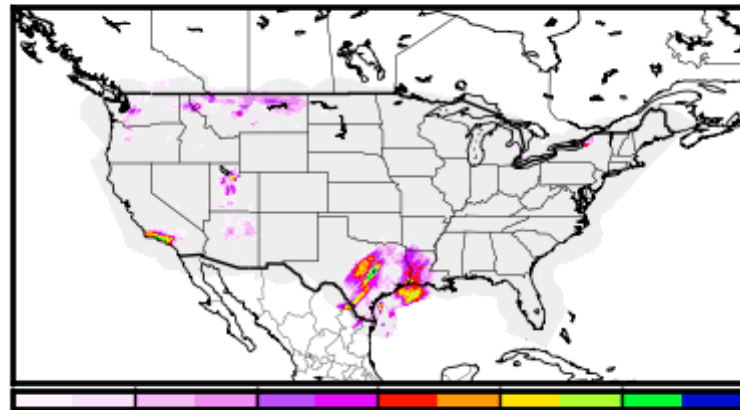
RFCS

Northwest RFC (NWRFC)

California Nevada RFC (CNRFC)

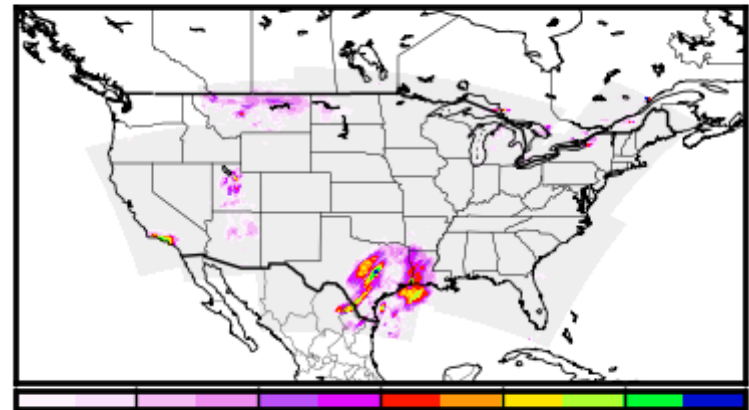


Hrly Stage II



0.2 1.0 3.0 6.0 10.0 15.0 25.0

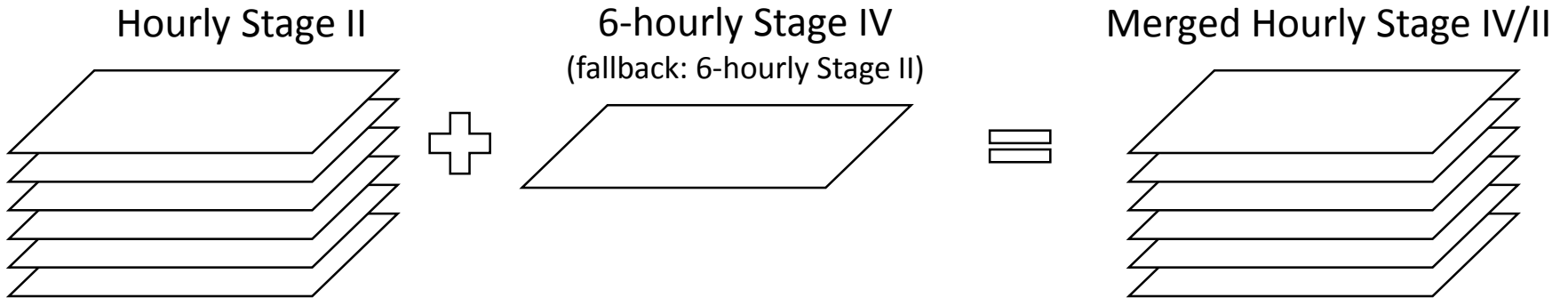
Hrly Stage IV



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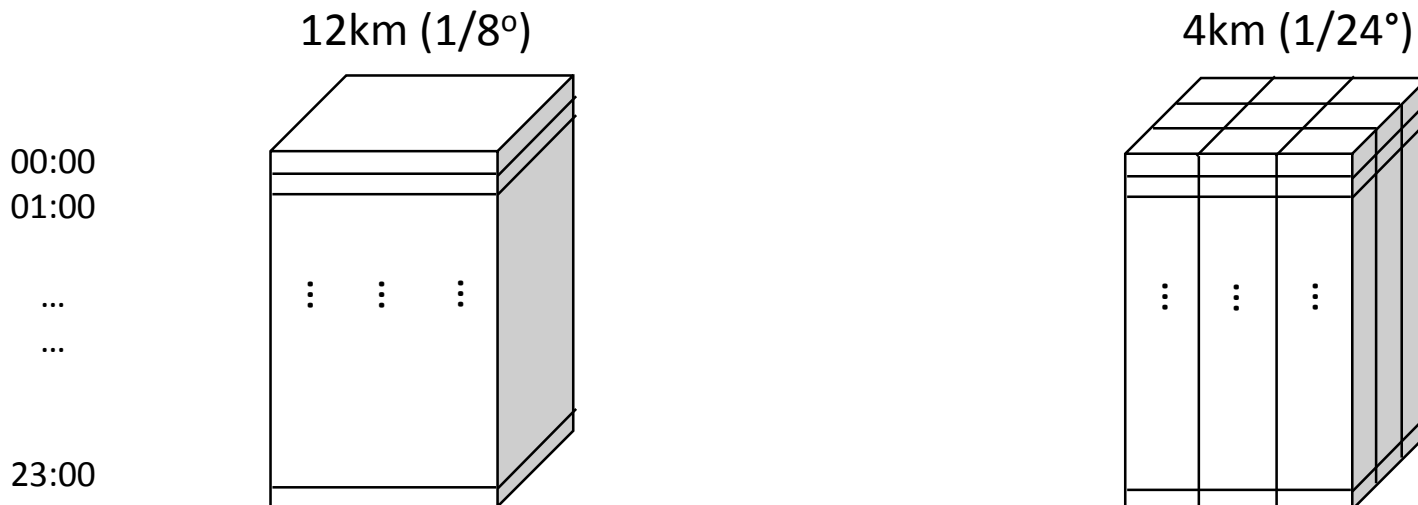
# Stage IV and Stage II

## 1. For CNRFC and NWRFC:



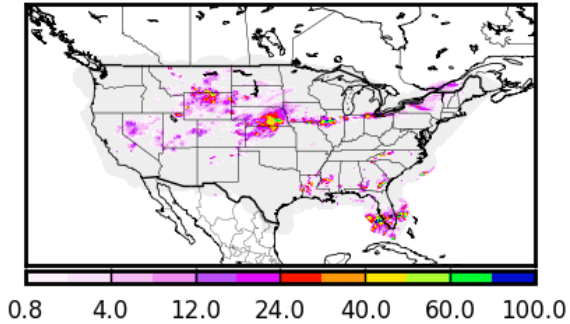
## 2. Other RFCs: rescale to match 6-hourly Stage IV total

## 3. Match NLDAS-2 daily total at $1/8^\circ$ scale (only if daily total exceeds 0.4mm)

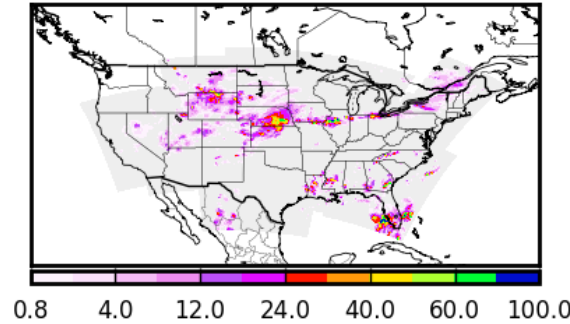


# Stage IV and Stage II

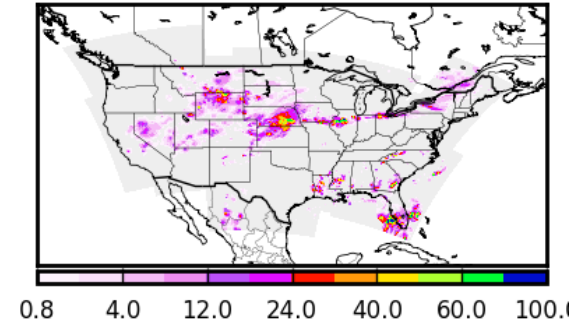
6-hr Sum Stage II



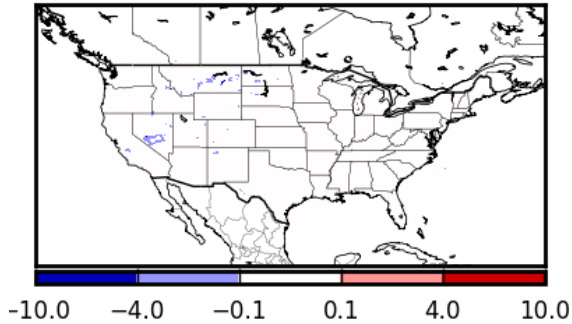
6-hr Sum Stage IV



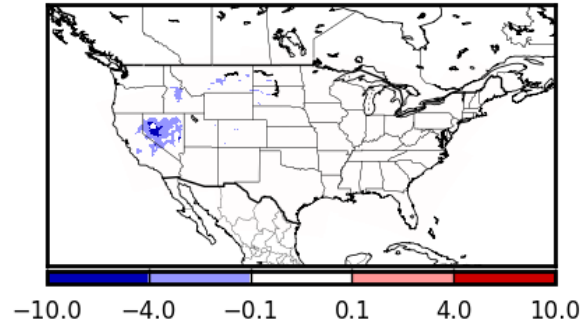
6-hrly Stage IV



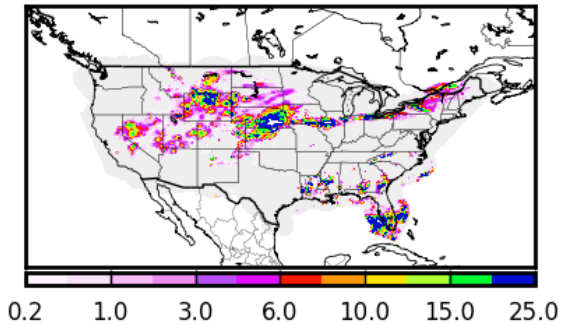
6-hr Stage II Sum - 6-hrly Stage IV



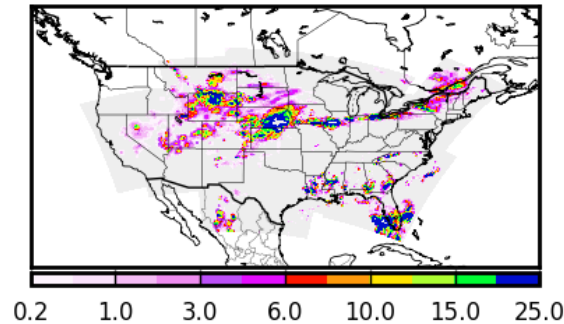
6-hr Stage IV Sum - 6-hrly Stage IV



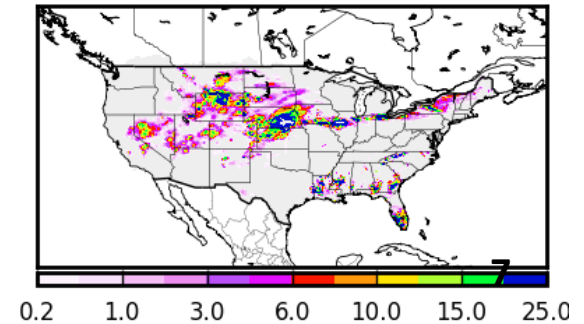
Hrly Stage II



Hrly Stage IV

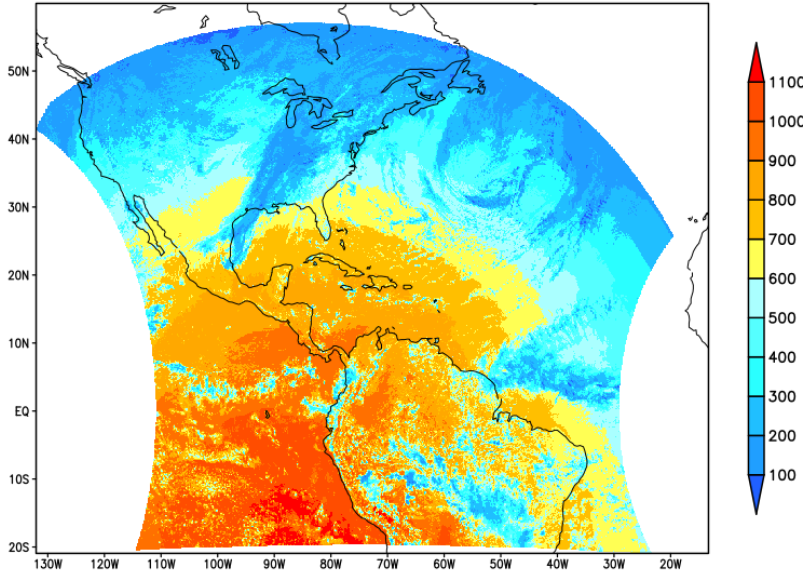


Hrly Merged, 2015-06-11T01

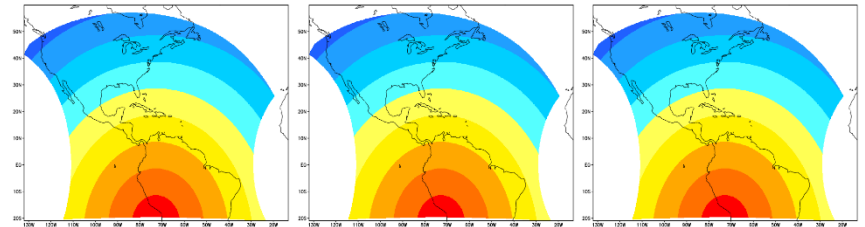


# GOES Solar Insolation Product (GSIP)

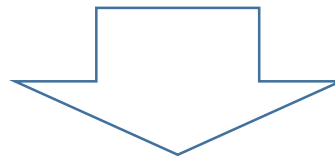
GSIP Downward Shortwave Radiation  
1/8°, validated at 00:45



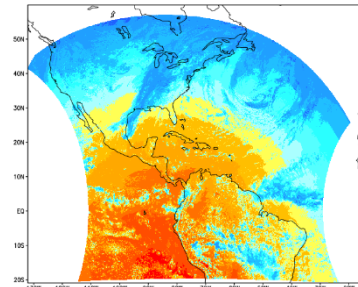
Solar Zenith Angles at  
00:00, 00:45, 01:00



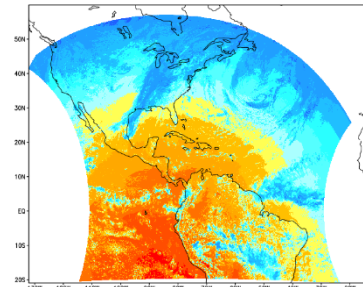
Solar Angle Based Correction



Mean Flux  
00:00 – 01:00



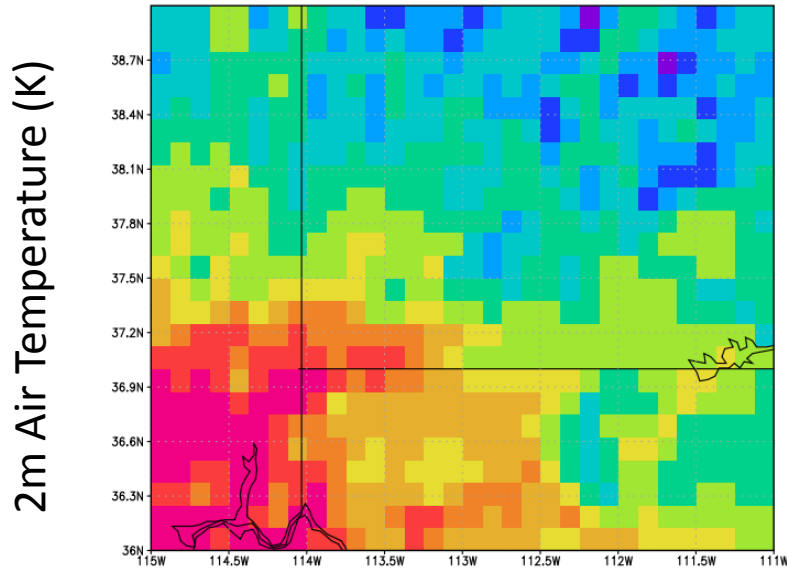
Interpolation



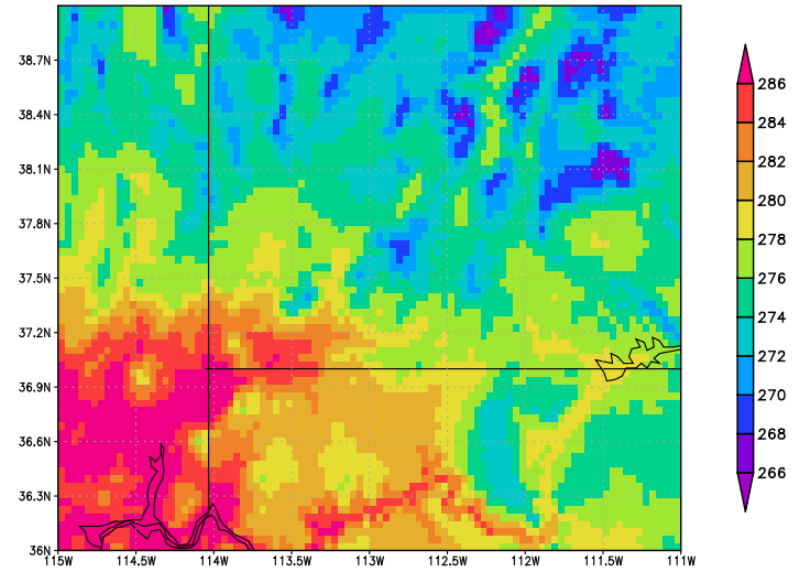


# Downscaling

12km (1/8°)



4km (1/24°)



– Elevation Effect



Interpolation

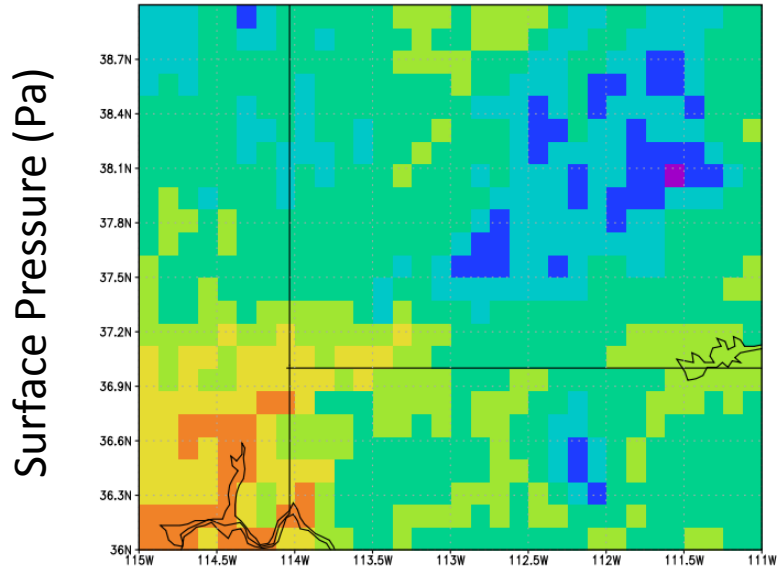


+ Elevation Effect

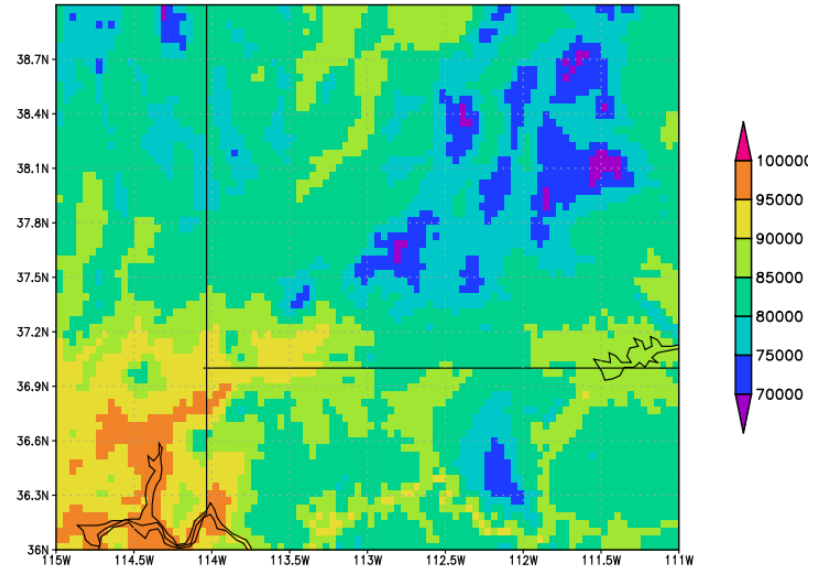


# Downscaling

12km (1/8°)



4km (1/24°)



– Elevation Effect

Seal Level Pa  
at 12km



Interpolation

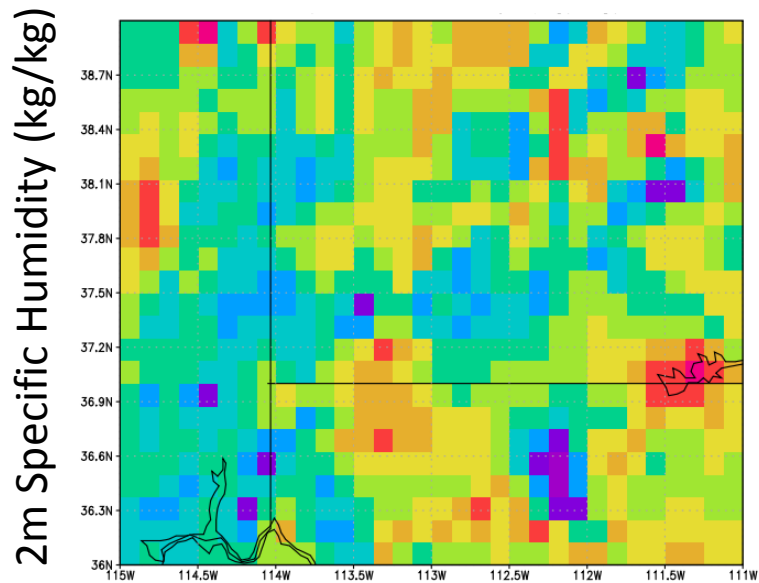


+ Elevation Effect

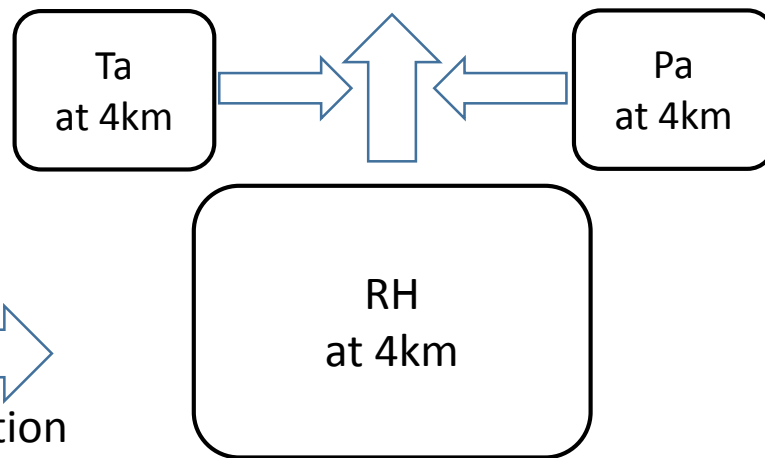
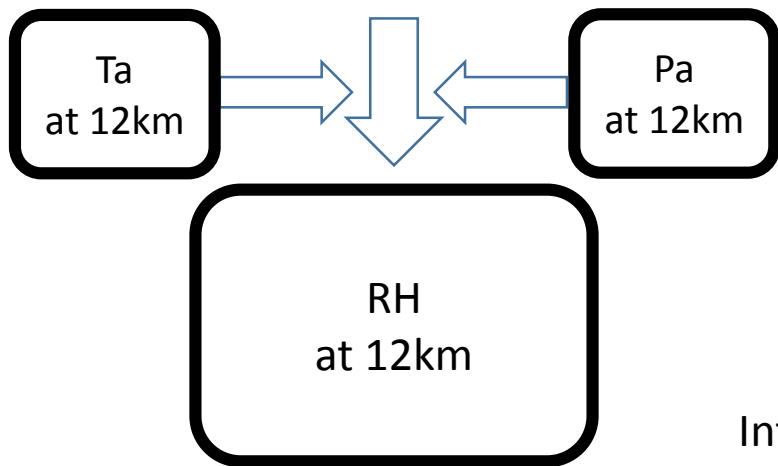
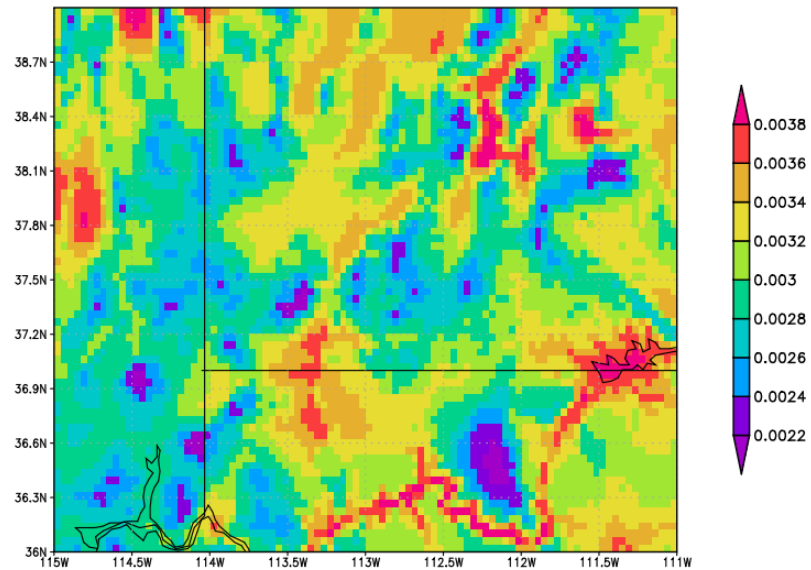
Seal Level Pa  
at 4km

# Downscaling

12km (1/8°)



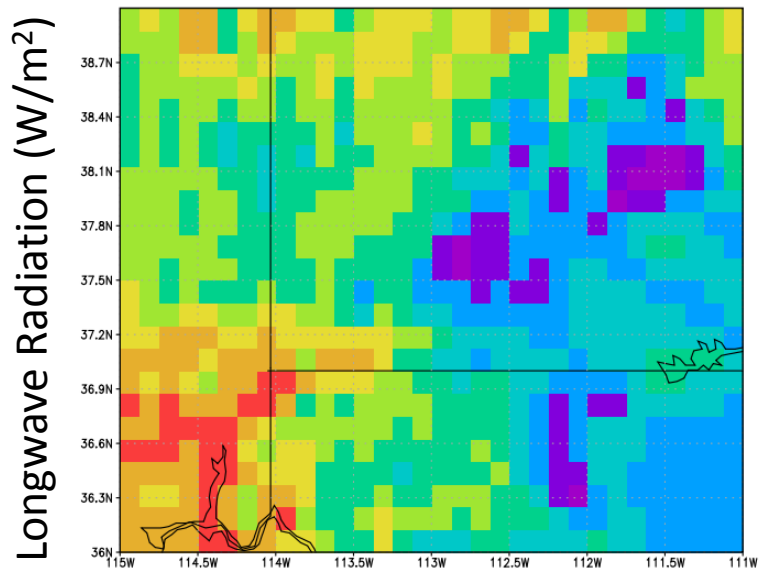
4km (1/24°)



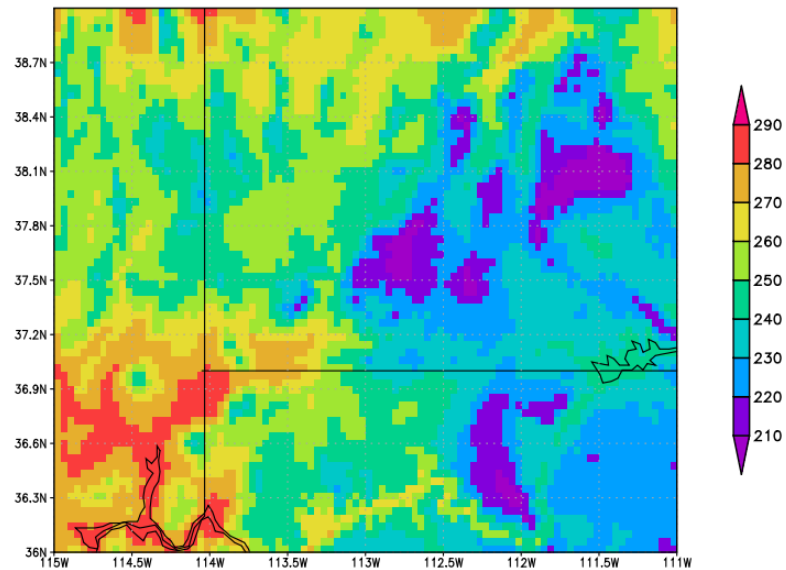
Interpolation

# Downscaling

12km (1/8°)



4km (1/24°)



Stefan-Boltzmann



Stefan-Boltzmann

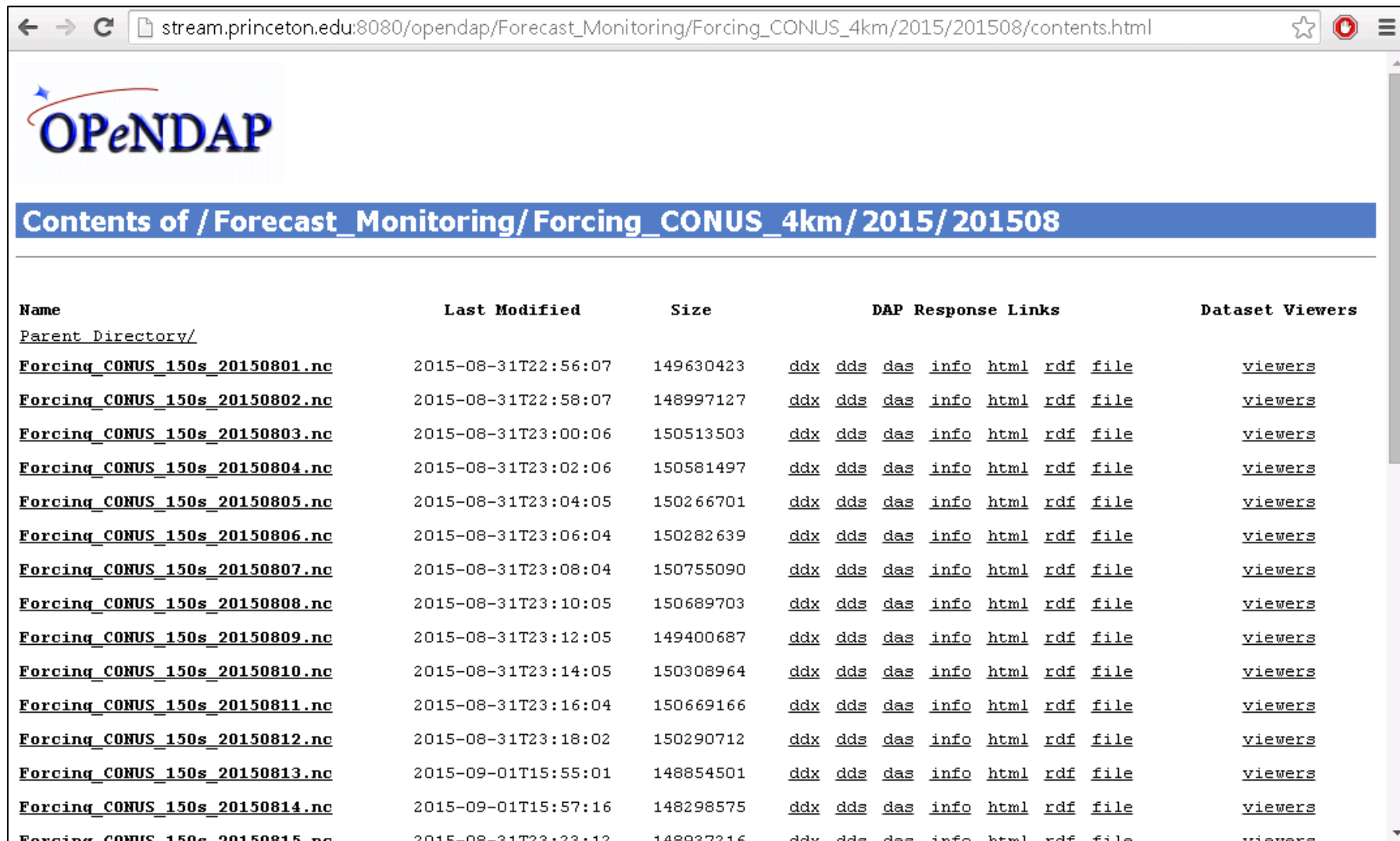


Elevation Effect



# Data Portal @ Princeton and Archive @ JPL

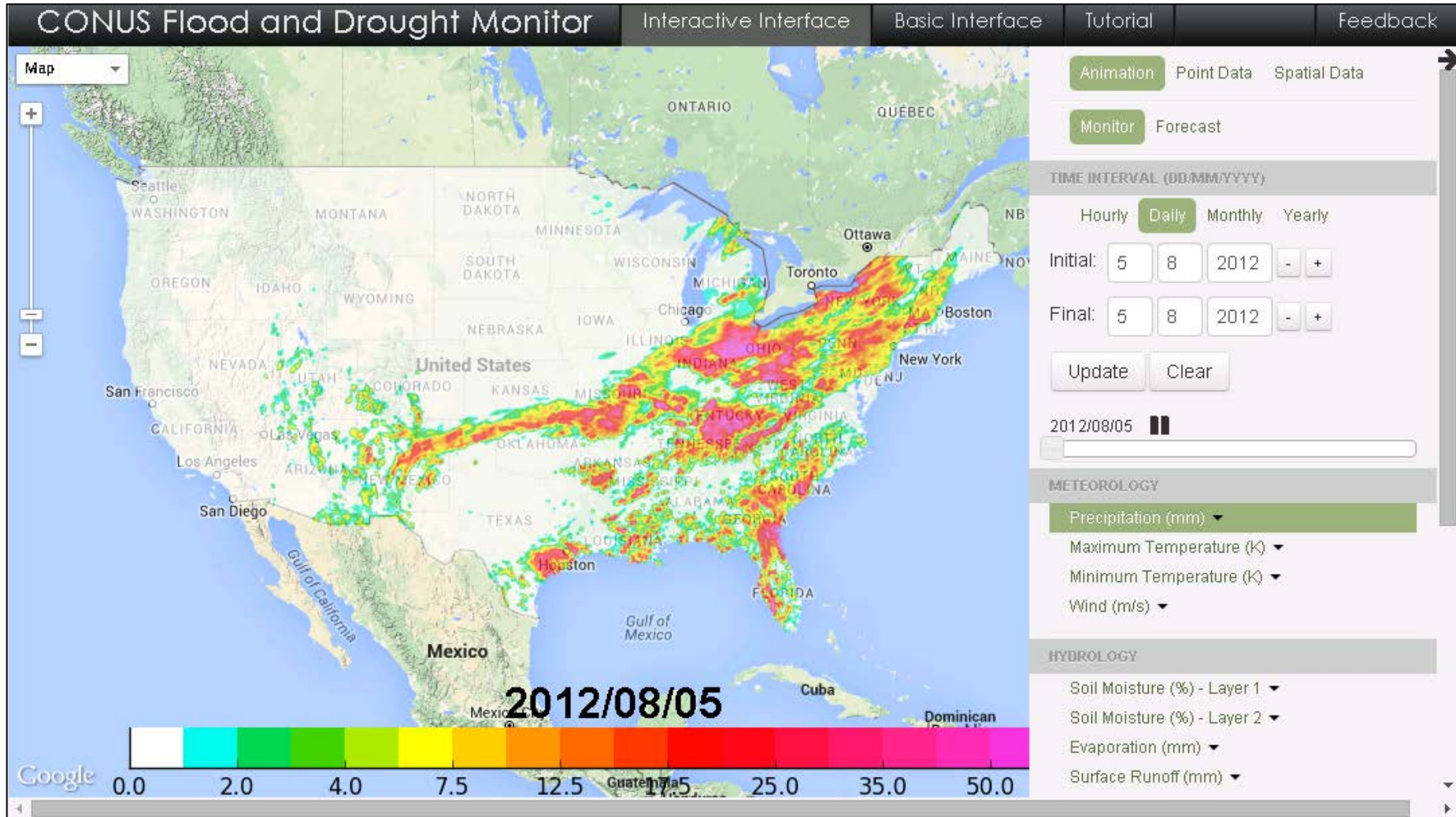
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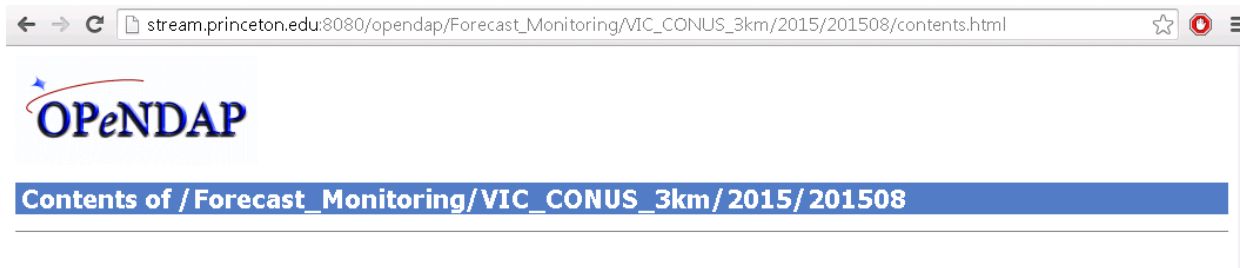


# Data Portal @ Princeton and Archive @ JPL



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[http://stream.princeton.edu:8080/opendap/Forecast\\_Monitoring/VIC\\_CONUS\\_3km/](http://stream.princeton.edu:8080/opendap/Forecast_Monitoring/VIC_CONUS_3km/)

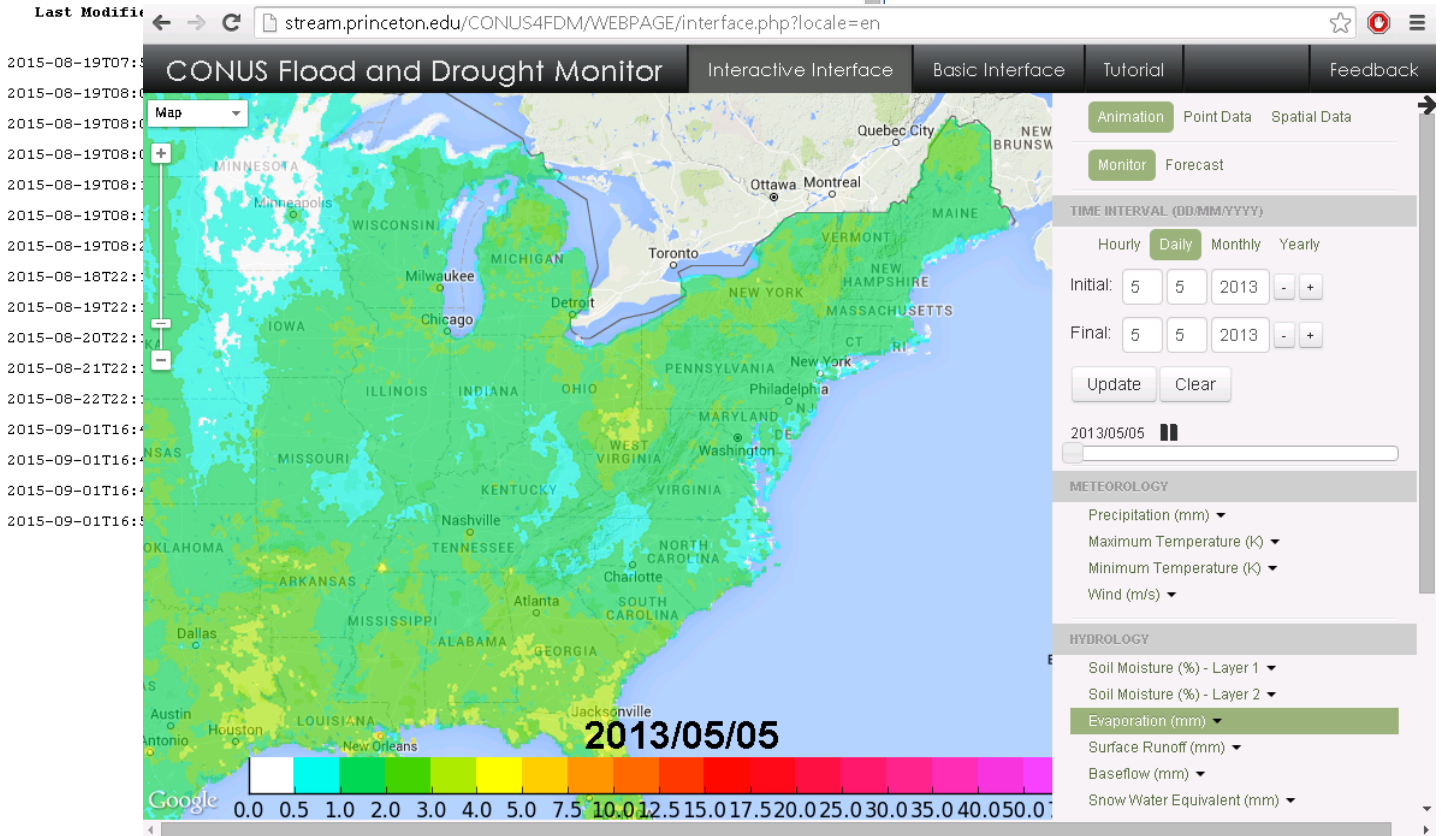


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**OPeNDAP**

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← → ↻ stream.princeton.edu/CONUS4FDM/WEBPAGE/interface.php?locale=en ☆ 🔴 ☰

**CONUS Flood and Drought Monitor** Interactive Interface Basic Interface Tutorial Feedback

Map

Animation Point Data Spatial Data

Monitor Forecast

TIME INTERVAL (DD/MM/YYYY)

Hourly **Daily** Monthly Yearly

Initial: 5 5 2013 - +

Final: 5 5 2013 - +

Update Clear

2013/05/05

METEOROLOGY

- Precipitation (mm) ▾
- Maximum Temperature (K) ▾
- Minimum Temperature (K) ▾
- Wind (m/s) ▾

HYDROLOGY

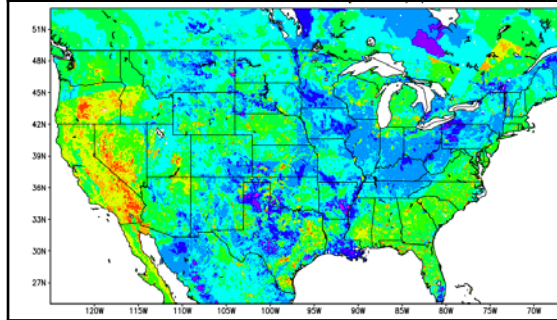
- Soil Moisture (%) - Layer 1 ▾
- Soil Moisture (%) - Layer 2 ▾
- Evaporation (mm) ▾**
- Surface Runoff (mm) ▾
- Baseflow (mm) ▾
- Snow Water Equivalent (mm) ▾

0.0 0.5 1.0 2.0 3.0 4.0 5.0 7.5 10.0 12.5 15.0 17.5 20.0 25.0 30.0 35.0 40.0 50.0

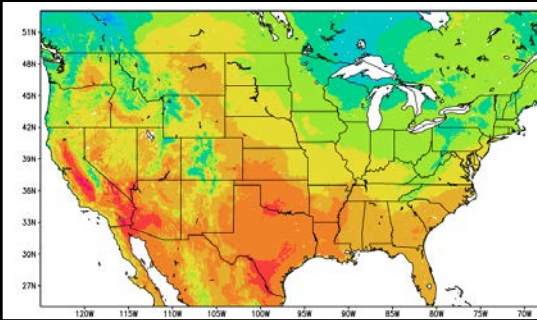


# Data Portal @ Princeton and Archive @ JPL

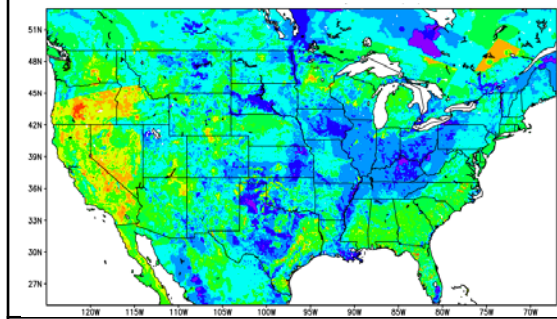
## Variables Archived @ JPL



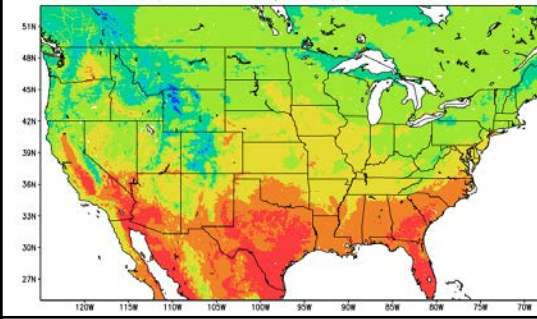
Soil Moisture  
in Layer 1



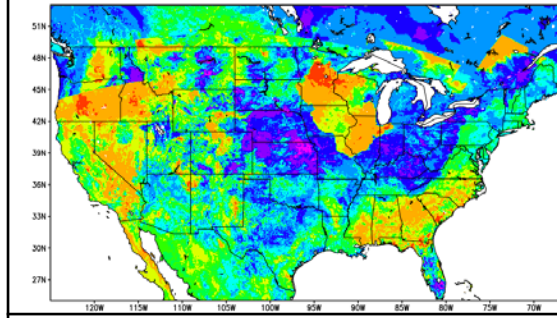
Soil Temperature  
in Layer 1



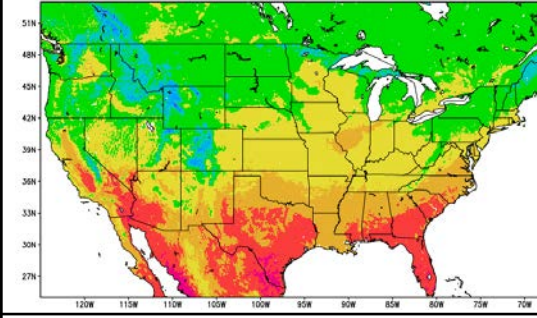
Soil Moisture  
in Layer 2



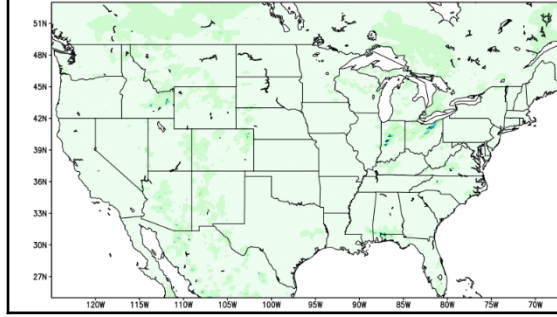
Soil Temperature  
in Layer 2



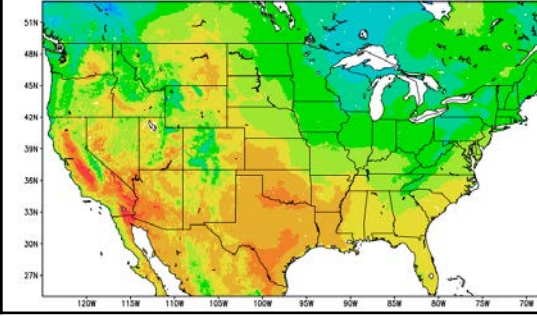
Soil Moisture  
in Layer 3



Soil Temperature  
in Layer 3



Precipitation



Land Surface  
Temperature

# Backup Slides