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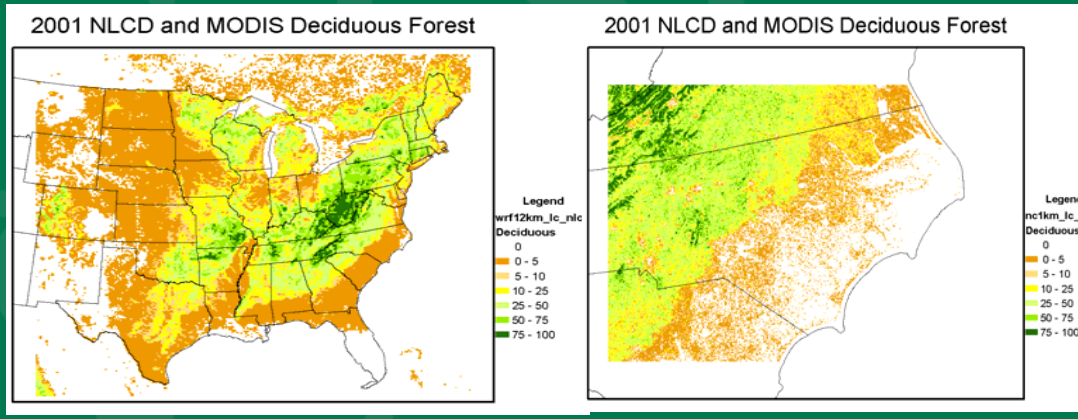
NEW HIGH RESOLUTION LAND-USE DATA IN WRF

Jonathan Pleim, NERL, USEPA
Limei Ran, Institute for the Environment, UNC-Chapel Hill
Robert Gilliam, NERL, USEPA



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Outline of the Presentation

- New Landuse Data
- Land Use Processing Tool in Spatial Allocator (SA)
- Preliminary Testing in WRF
  - 12 km CONUS WRF for 20 days
- Conclusions and Future Work

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Landuse Data in WRF

- Currently: USGS Global Land Cover Characteristics (GLCC) 30-second (around 1km) landuse data:
  - NOAA 1km AVHRR satellite images spanning 04/1992 through 03/1993
- Two new land cover data sets are available:
  - 2001 30m NLCD for US (Landsat 7 and 5 TM images) from 2 sources:
    - USGS for US
      - 21-classes USGS Land cover
      - Imperviousness
      - Tree canopy
    - NOAA Coastal Change Analysis Program (C-CAP)
      - 30-classes USGS Land cover
  - 2001 1km MODIS for the Globe (TERRA MODIS satellite images)
    - 20-classes IGBP land cover data

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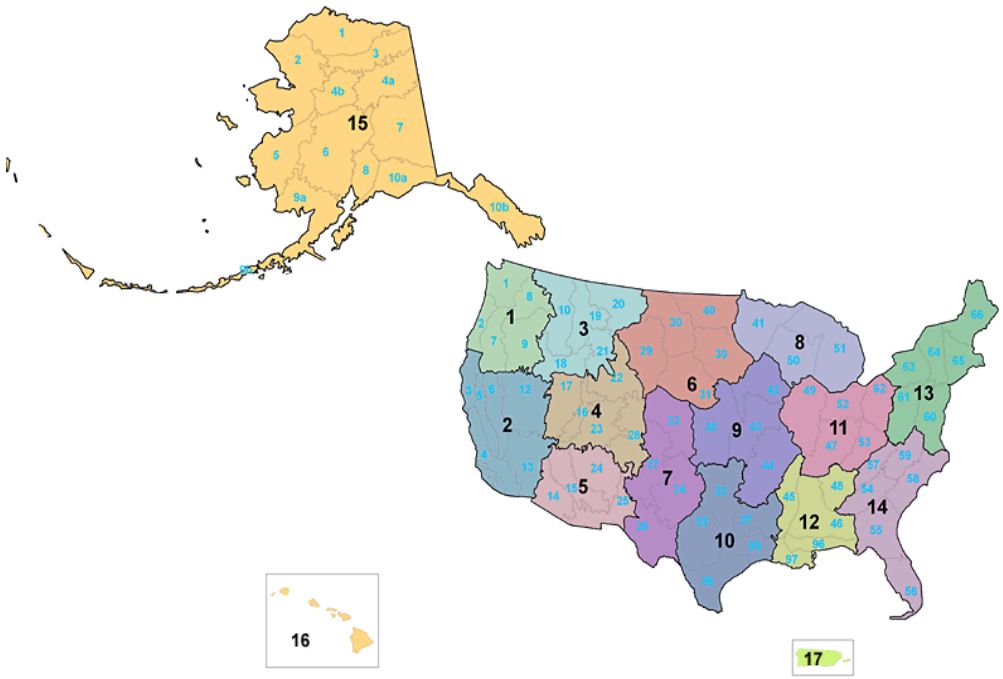
2001 NLCD Data

USGS



NOAA

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2001 NLCD Classification

11 - Open Water
12 - Perennial Ice/Snow
21 - Developed - Open Space
22 - Developed - Low Intensity
23 - Developed - Medium Intensity
24 - Developed - High Intensity
31 - Barren Land (Rock/Sand/Clay)
32 - Unconsolidated Shore
41 - Deciduous Forest
42 - Evergreen Forest
43 - Mixed Forest
51 - Dwarf Scrub
52 - Shrub/Scrub
71 - Grassland/Herbaceous
72 - Sedge/Herbaceous
73 - Lichens
74 – Moss
75 - Tundra
81 - Pasture/Hay
82 - Cultivated Crops
90 - Woody Wetlands
91 - Palustrine Forested Wetland
92 - Palustrine Scrub/Shrub Wetland
93 - Estuarine Forested Wetland
94 - Estuarine Scrub/Shrub Wetland
95 - Emergent Herbaceous Wetlands
96 - Palustrine Emergent Wetland
97 - Estuarine Emergent Wetland
98 - Palustrine Aquatic Bed
99 - Estuarine Aquatic Bed

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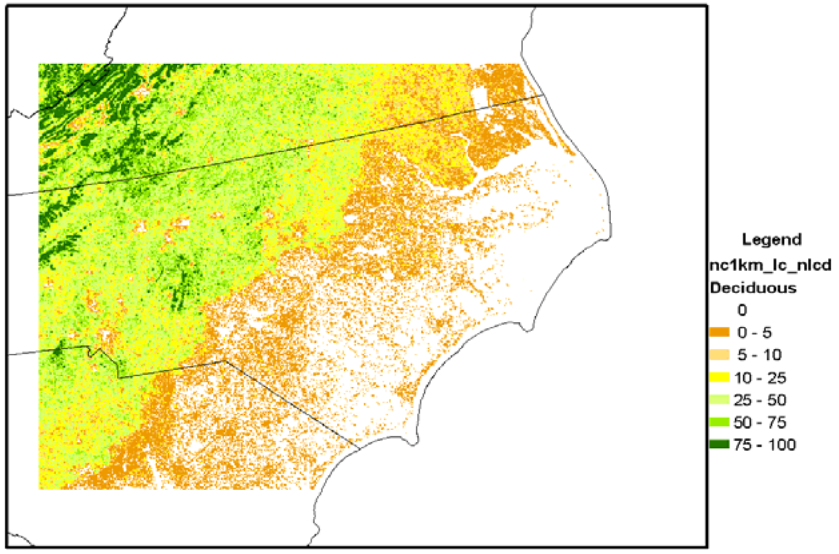
2001 NLCD and MODIS Data Processing Tools in Spatial Allocator

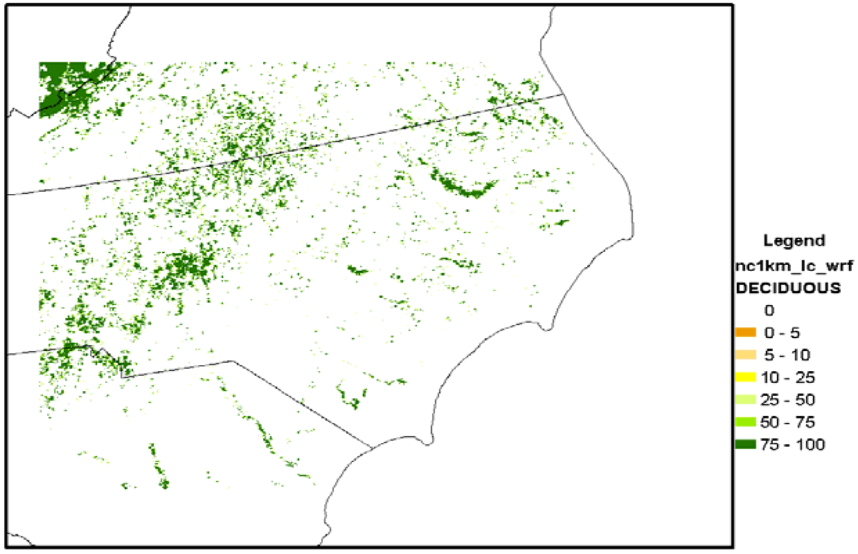
- SA Web site: http://www.ie.unc.edu/cempd/projects/mims/spatial/
- Two scripts in raster_scripts directory:
  1. Pre-process original NLCD data sets to get rid of overlaps.
  2. Generate land cover for model grid from NLCD and MODIS:
     - » *NOAA coastal NLCD land cover*
     - » *USGS US NLCD land cover*
     - » *NASA MODIS Global land cover data*
     - » *2001 NLCD imperviousness*
     - » *2001 NLCD canopy density*
- Two output files produced:
  - Gridded WRF-ready NetCDF landuse
  - CSV text file

NC 1km Grid Domain

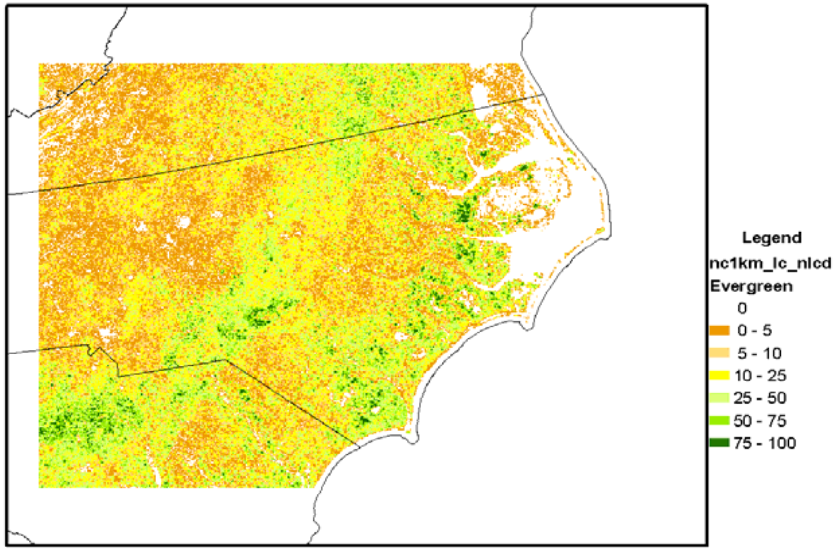
2001 NLCD and MODIS Deciduous Forest



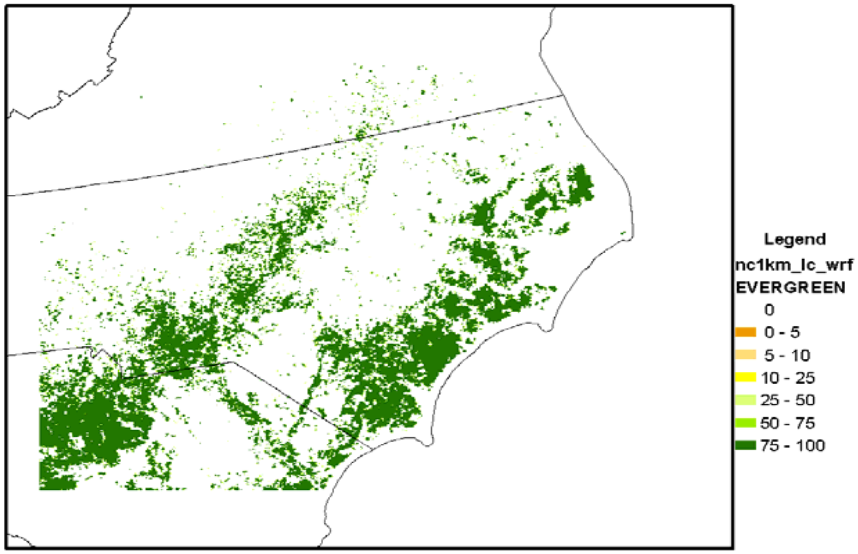
GLCC Deciduous Forest



2001 NLCD and MODIS Evergreen Forest

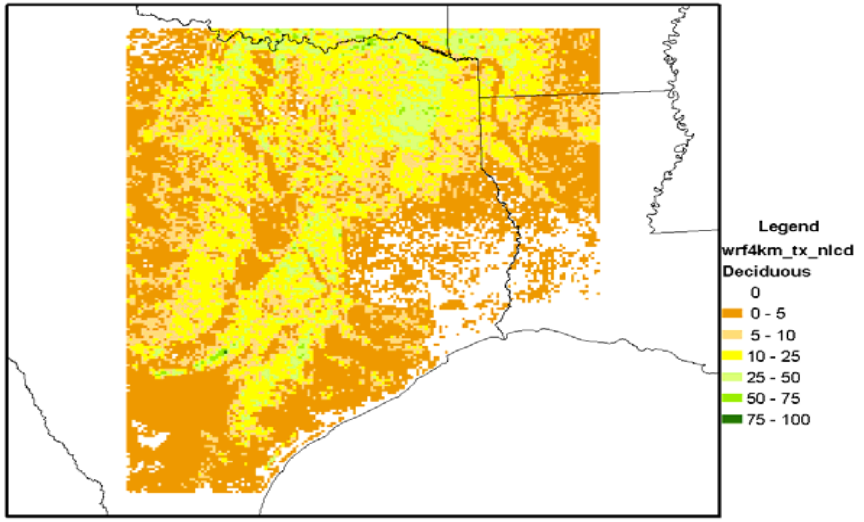


GLCC Evergreen Forest

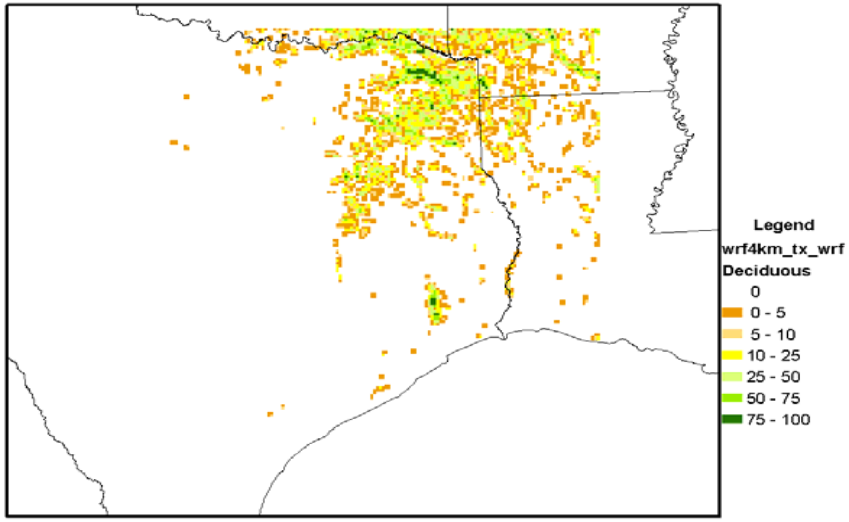


Texas 4km Grid Domain

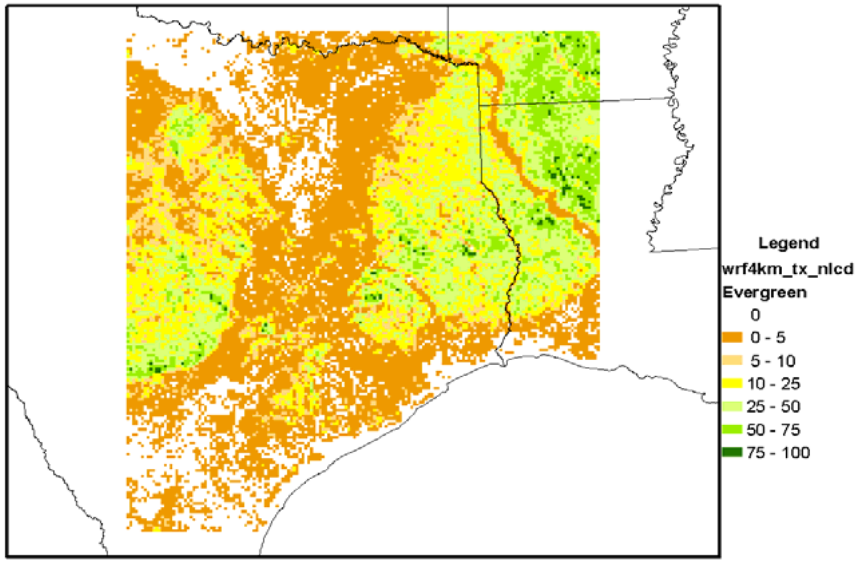
2001 NLCD and MODIS Deciduous Forest



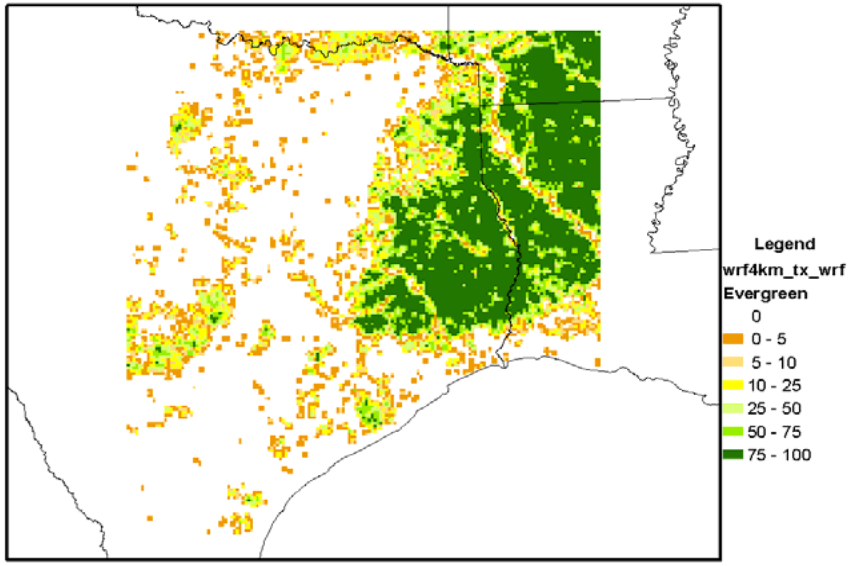
GLCC Deciduous Forest



2001 NLCD and MODIS Evergreen Forest

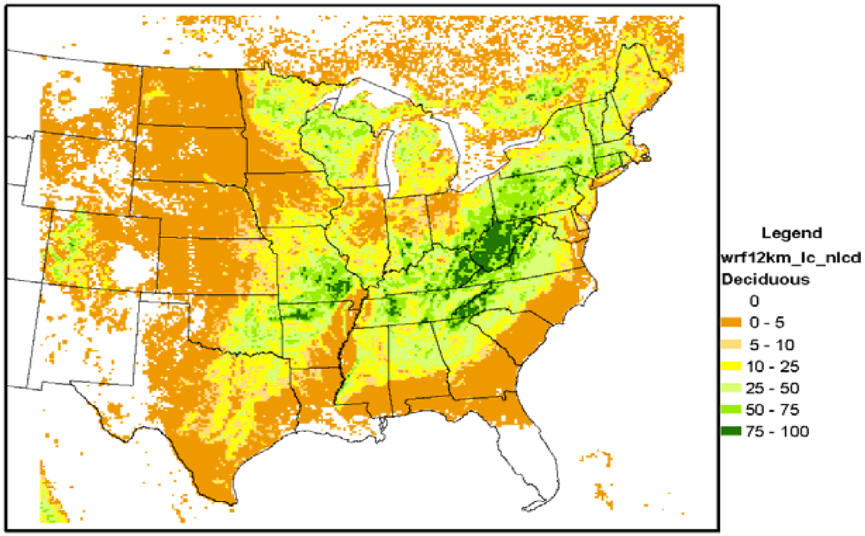


GLCC Evergreen Forest

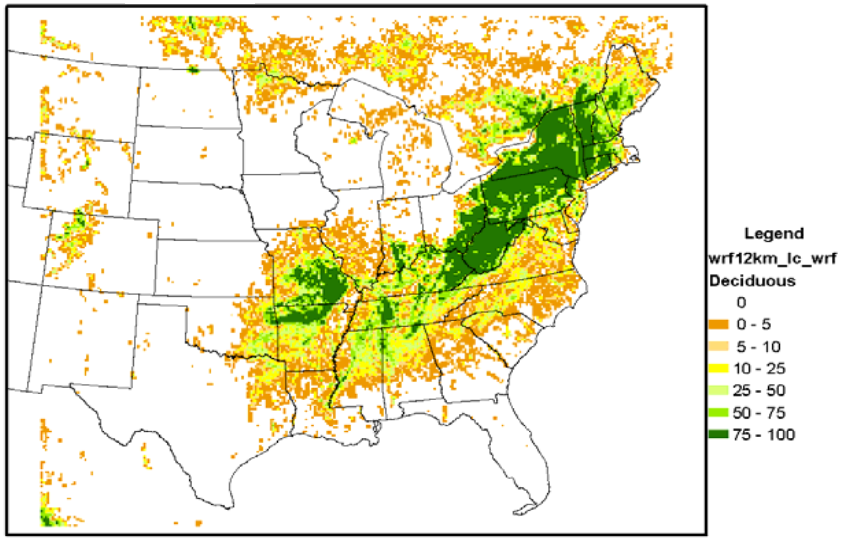


East US 12km Grid Domain

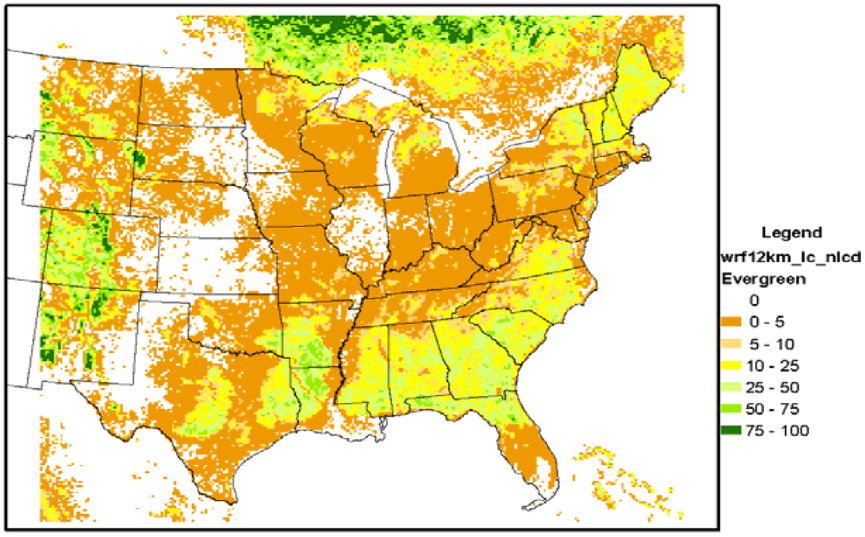
2001 NLCD and MODIS Deciduous Forest



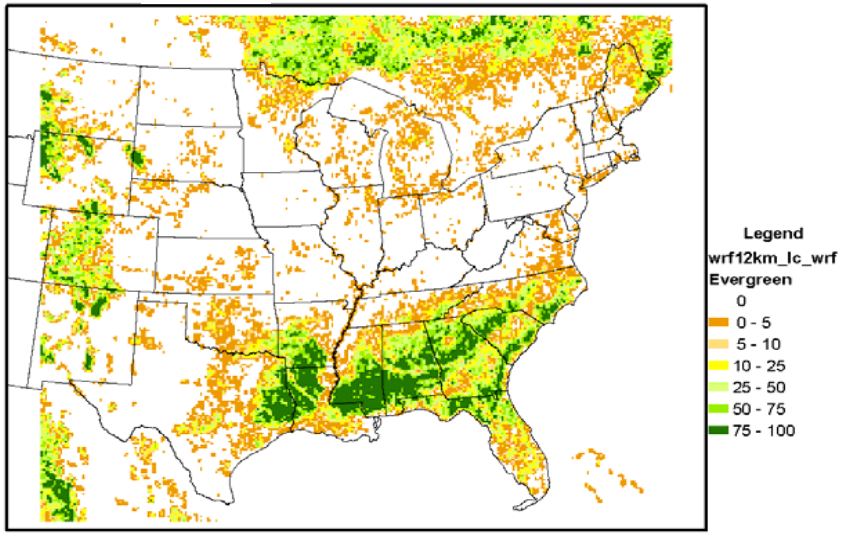
GLCC Deciduous Forest



2001 NLCD and MODIS Evergreen Forest



GLCC Evergreen Forest



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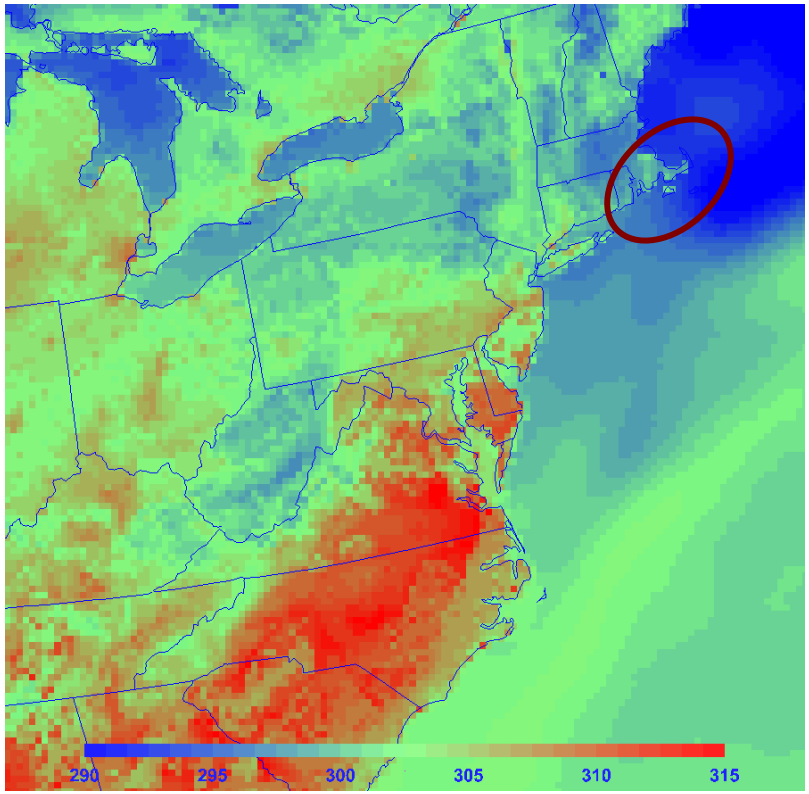
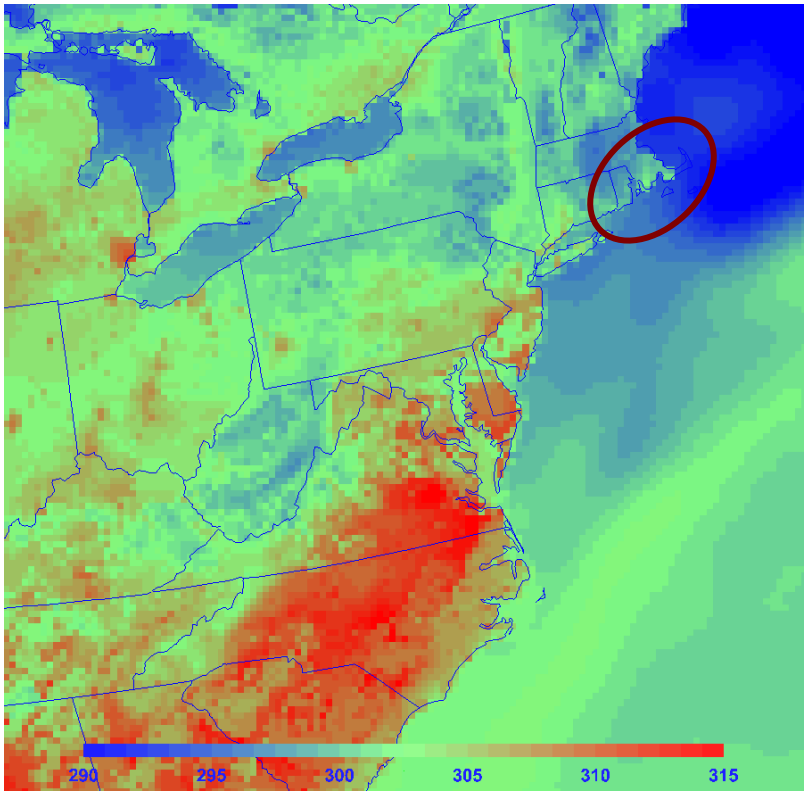
Surface Temperature at 19Z, August 4, 2006



NLCD



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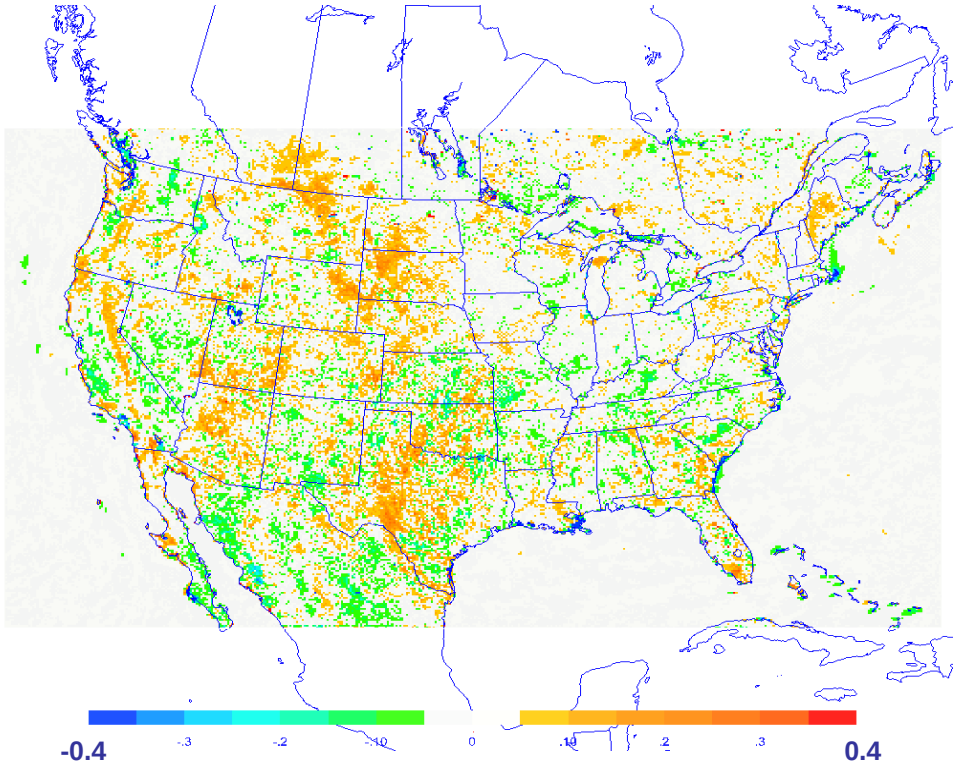
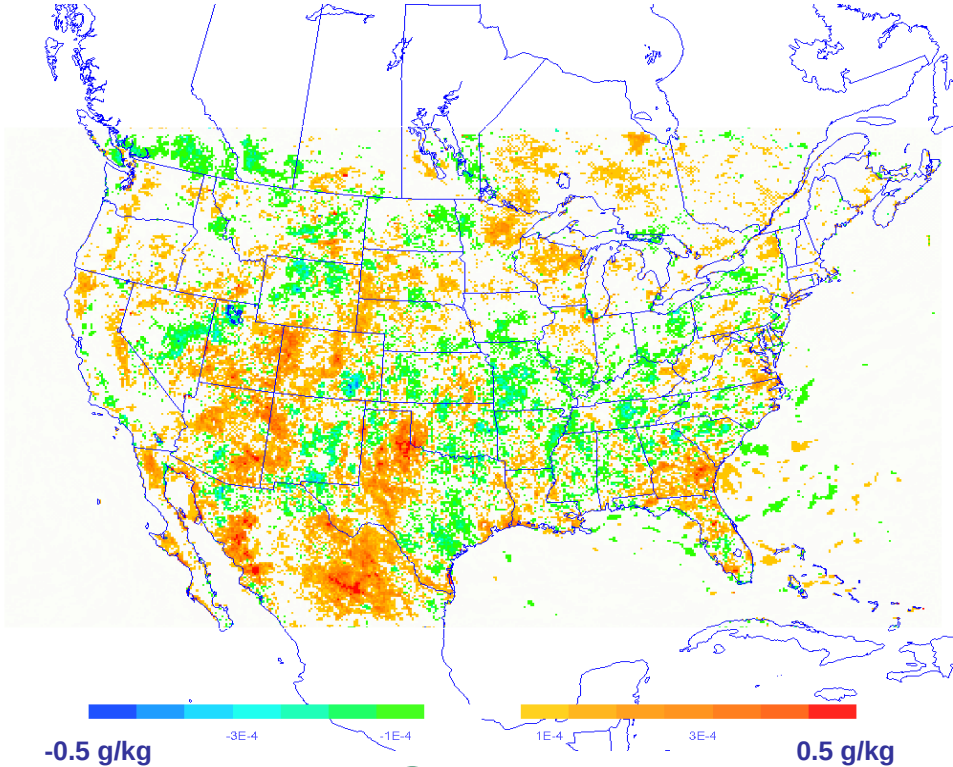
MAE difference : NLCD-GLCC
15-day average (August 2006)



T 2m



q_v 2m

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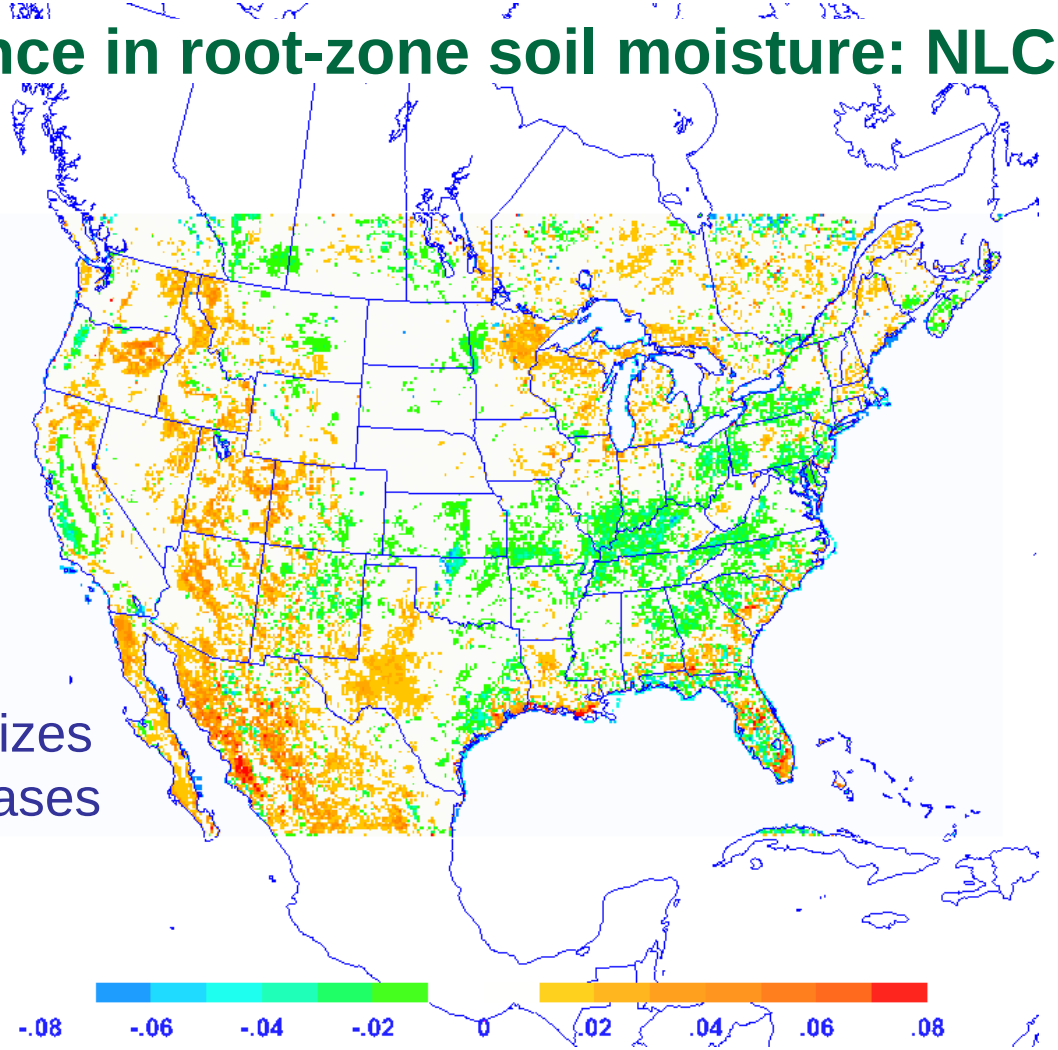
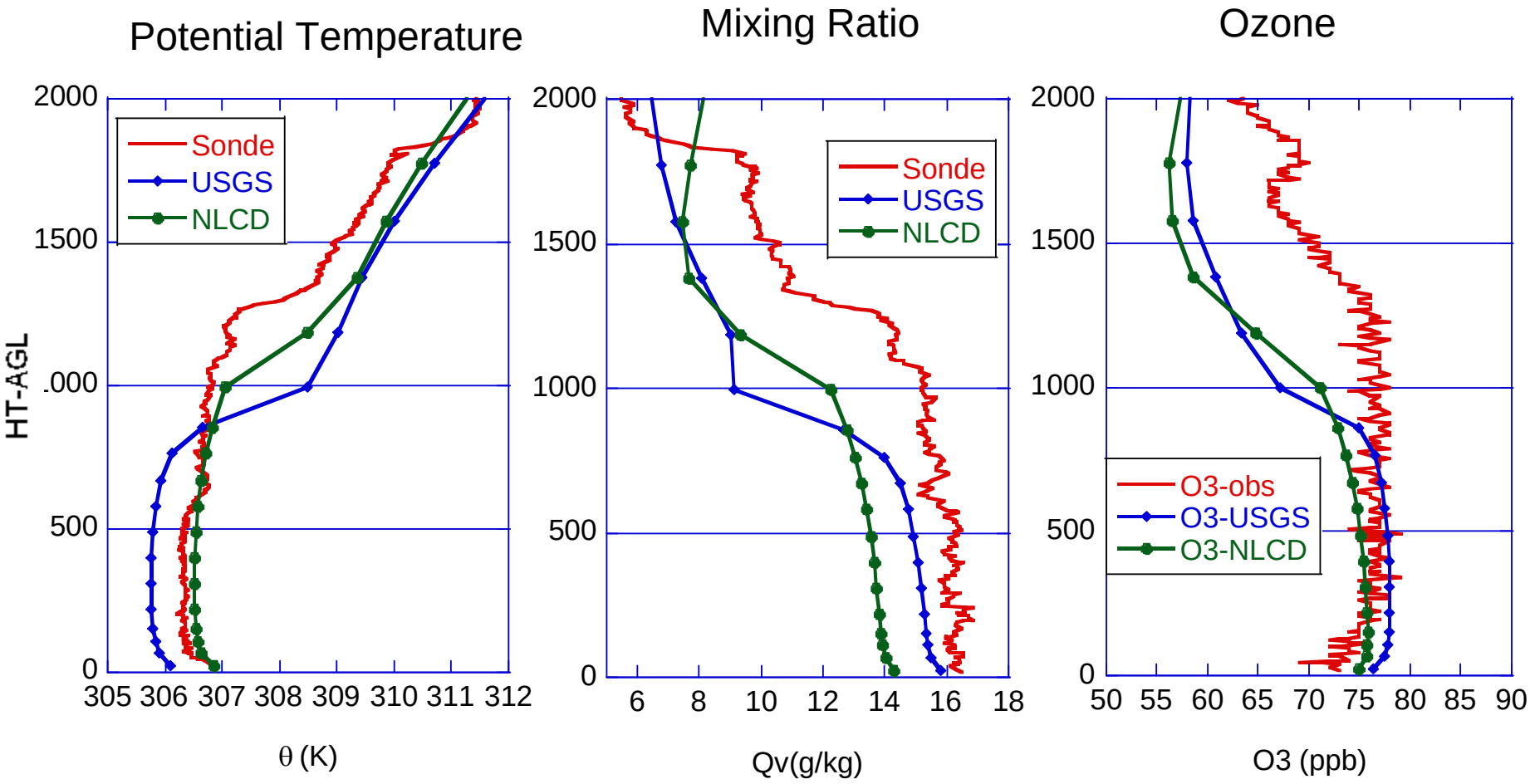
Difference in root-zone soil moisture: NLCD-GLCC



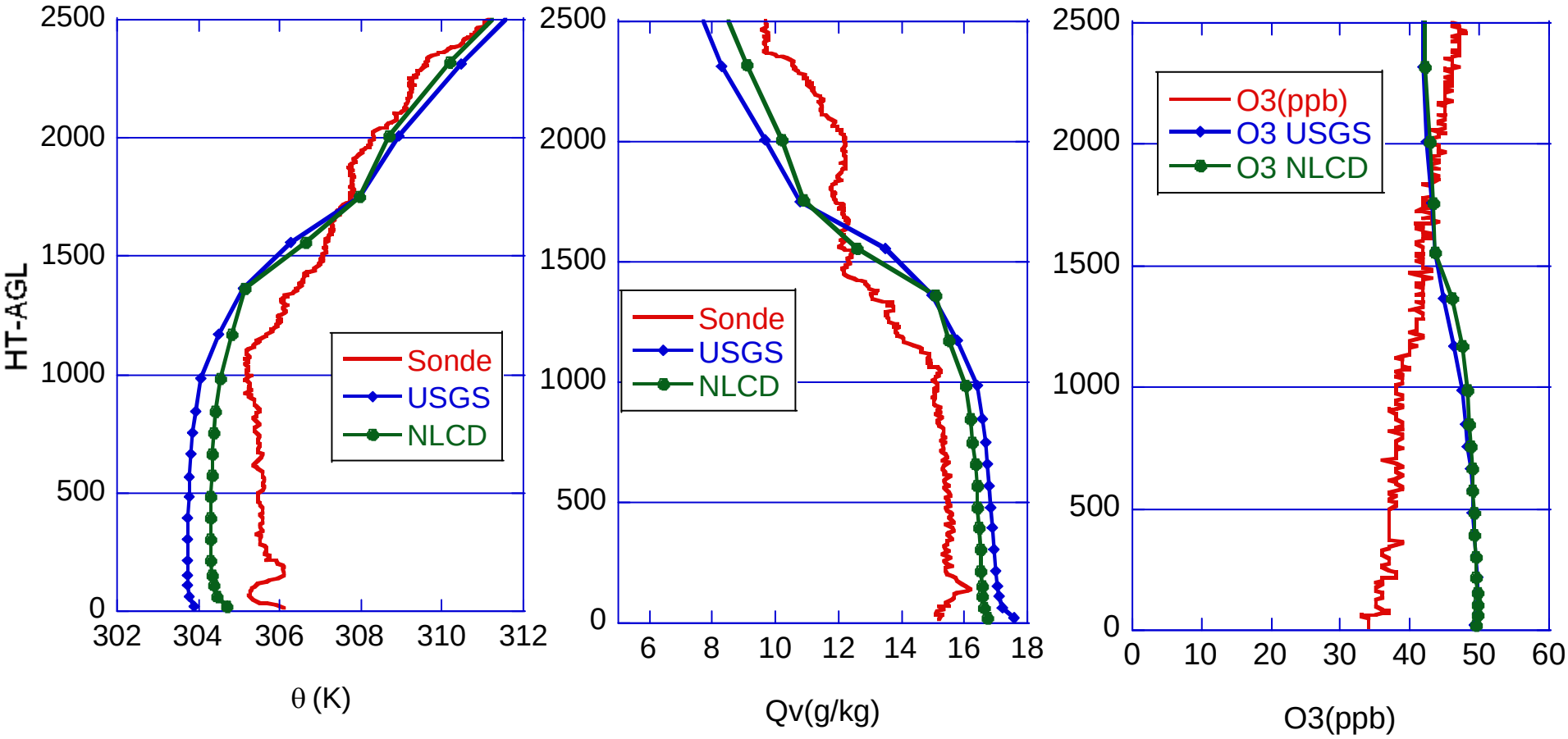
Soil moisture Nudging in the PX LSM minimizes 2m T and q_v biases

August 4, 2006

Narragansett, RI
August 2, 2006 – 17 UTC



Huntsville, August 28, 2006 – 18 UTC



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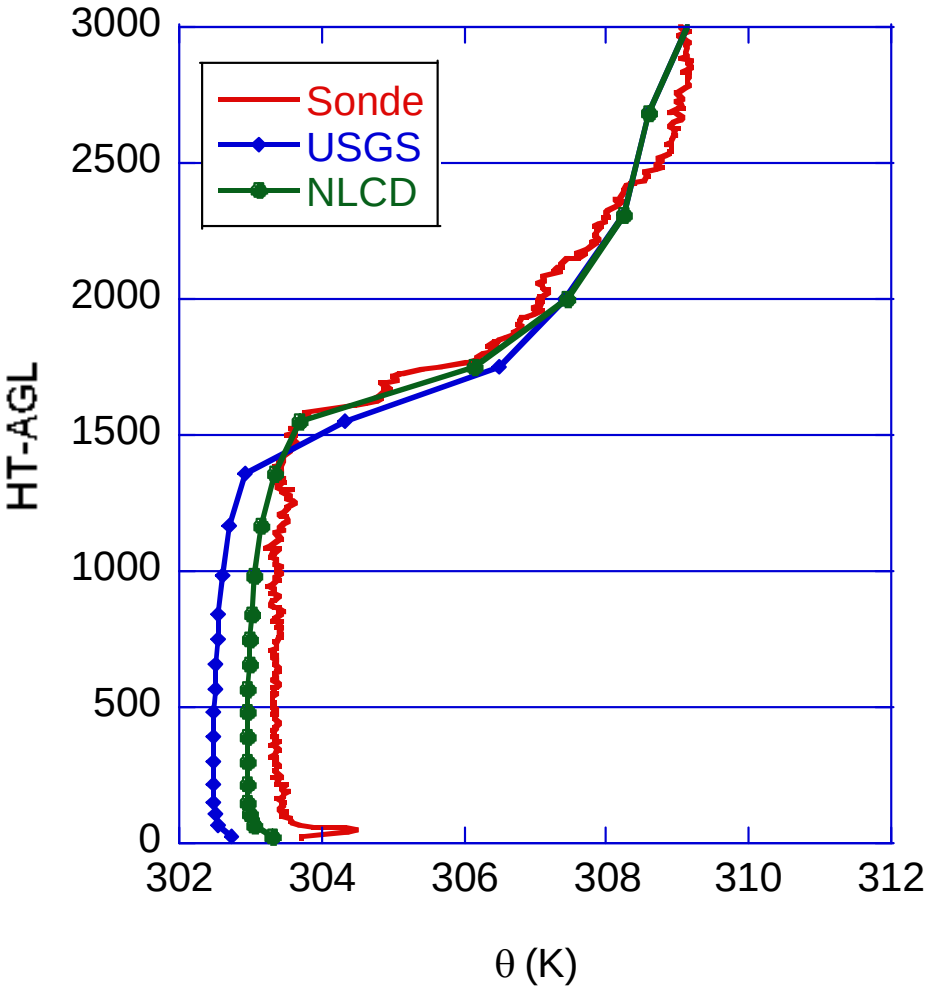
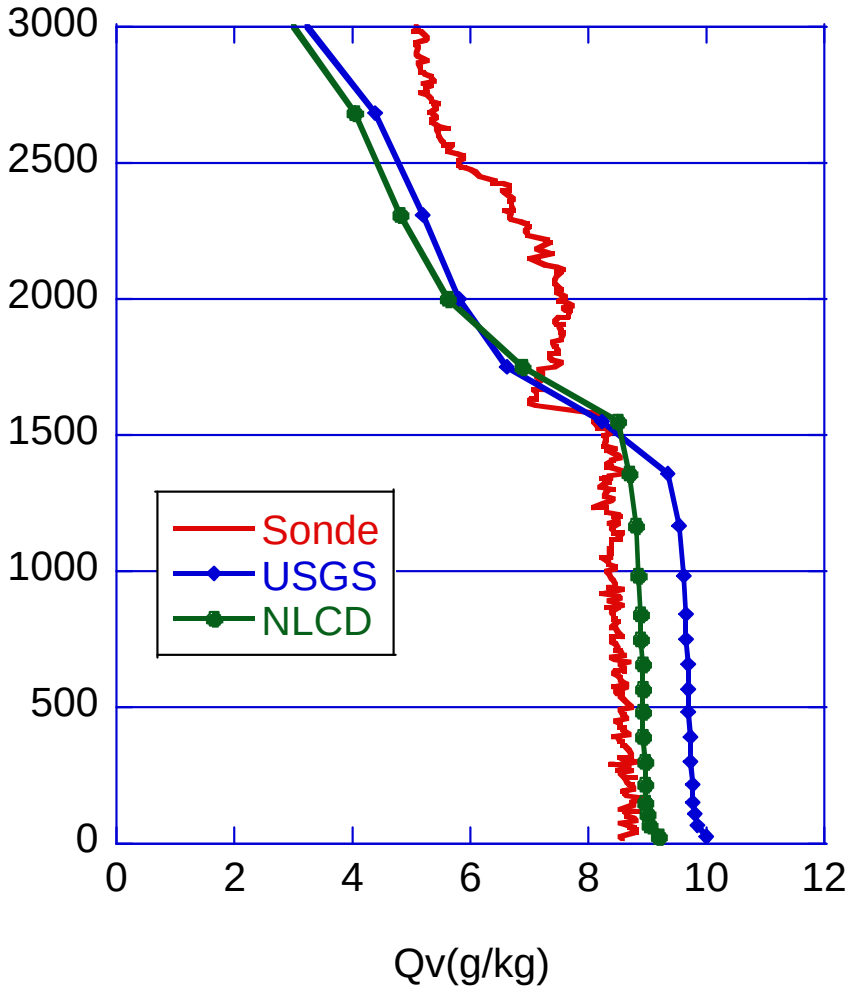
Houston 8/31 19 UTC





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Conclusions

- The new NLCD land cover data provides much higher resolution and more accurate land use information for Meteorology and AQ modeling
- New data processing tools have been developed to hierarchically combine NLCD-CCAP, NLCD-USGS, and MODIS LU data onto model grids
- Preliminary WRF testing at 12 km grid resolution show better representation of coastlines and smoother fields of vegetation parameters
- Evaluation of T-2m and q_v-2m shows very little difference at 12 km resolution due (in part) to soil moisture adjustment scheme

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Next Steps

- More WRF testing
  - 12 km CONUS Annual runs (2006, 2002)
  - 4 km & 1 km TexAQSII (August-October 2006)
  - 1 km NC
- Augmented database (BELD4) being created from 2001 NLCD and MODIS land cover, FIA, and NASS for biogenic emission.
  - Tree species groups
  - Crop types
- Adjust parameters for new land cover classes to improve model performance

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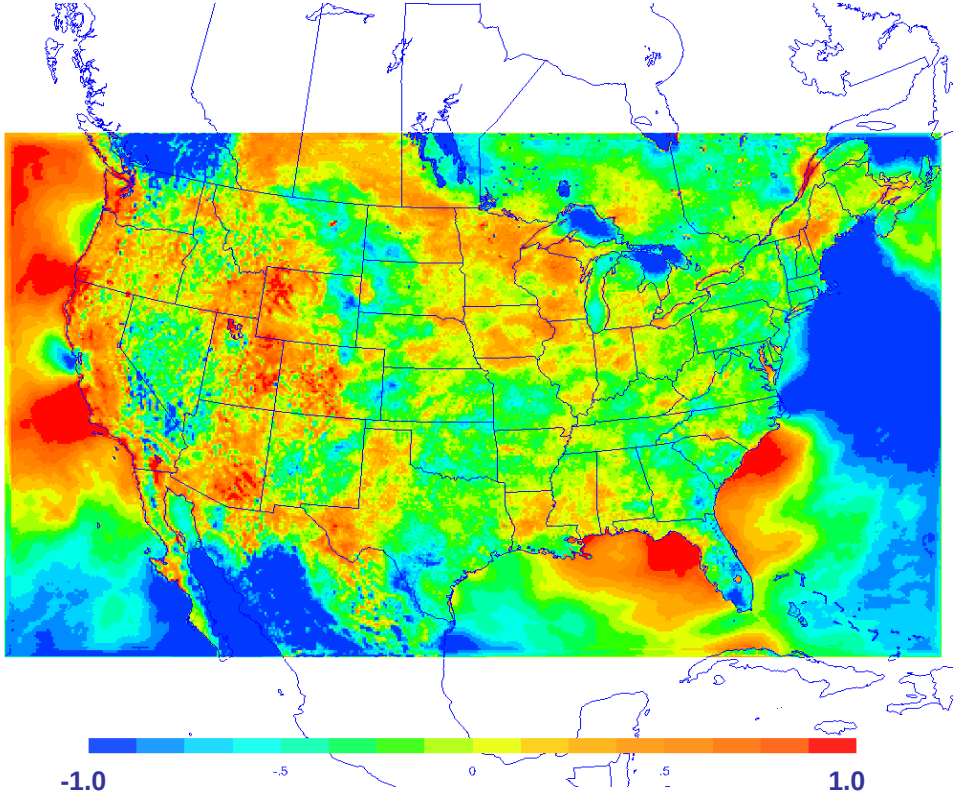
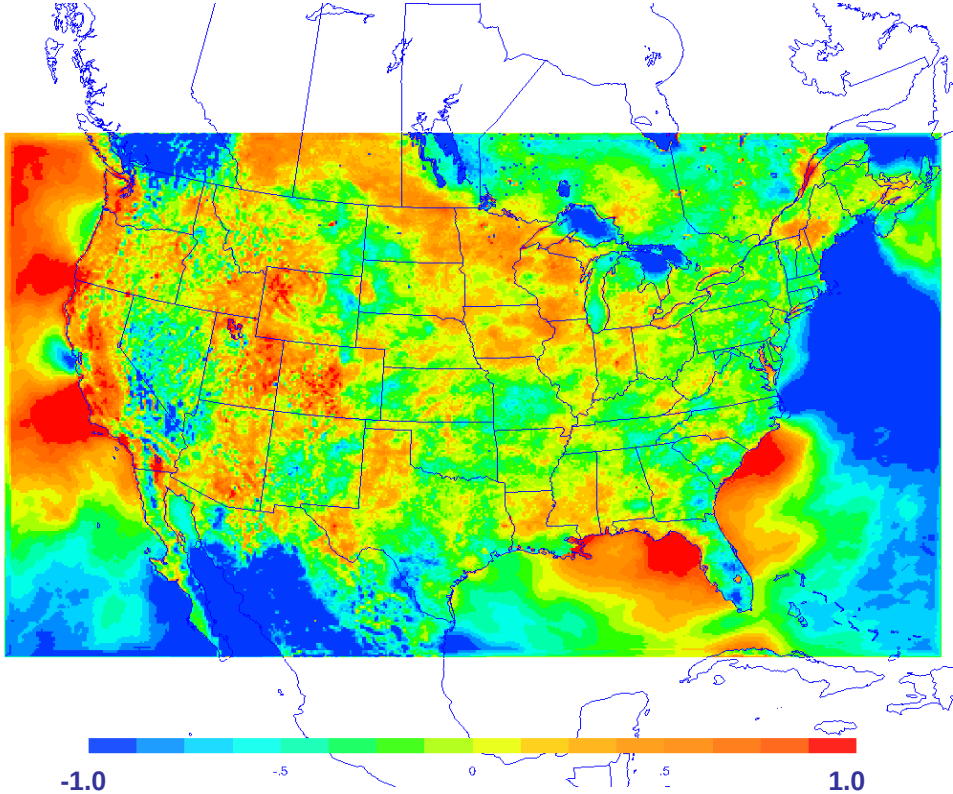
T-2m Bias – 15 day average



NLCD



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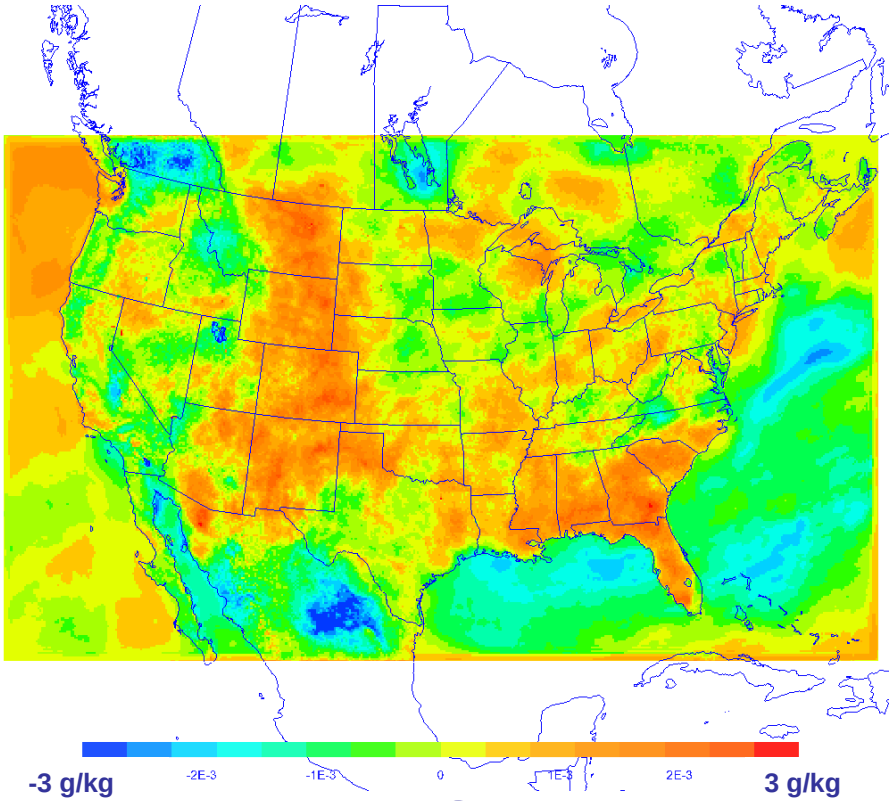
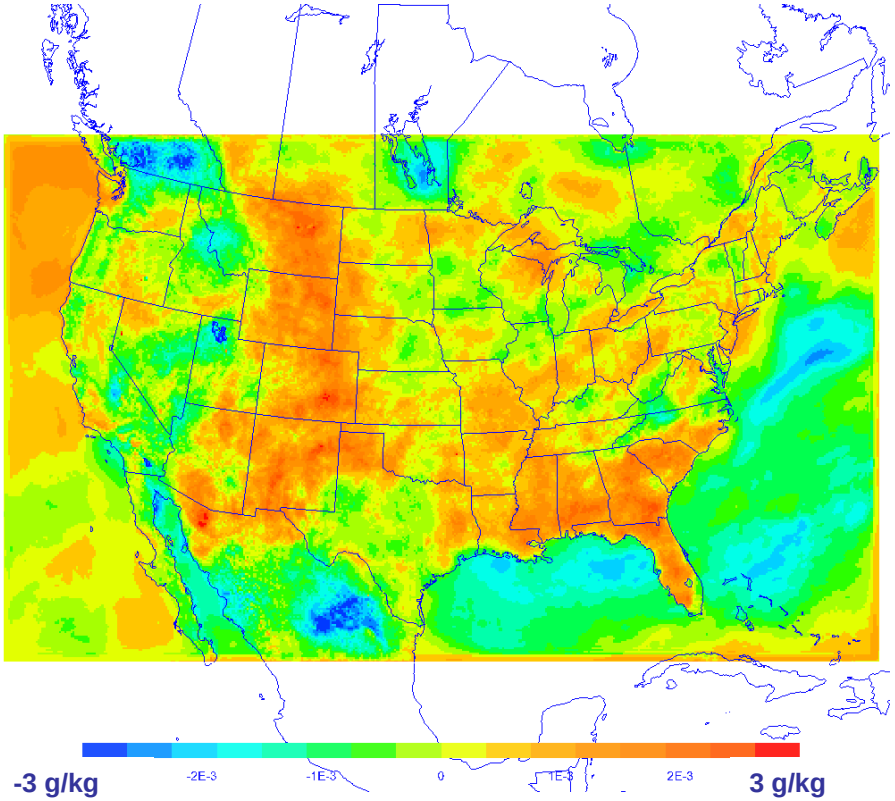
q_v-2m Bias – 15 day average



NLCD



GLCC