

Update on UAHuntsville's Gridded Crop Model Program

GridSSAT

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Background

Through a NASA funded program, we are building a large scale spatial crop model based on satellite and other meteorological inputs to assist partners analyzing drought and crop health. We partnered with the following organizations to deliver Decision Support Tools (DST):

- The **National Drought Mitigation Center (NDMC)** and **State Climatologists**. Under this activity we proposed to deliver high resolution products to the NDMC and State Climatologists that described drought conditions in a common geographical format that could be used to better define and delineate the drought categories.
 - Map of the Atmosphere-Land Exchange Inversion imagery (ALEXI) Soil Moisture model: This ALEXI product developed jointly by NASA, NOAA and USDA provides a high resolution map of surface moisture which can be used to delineate drought.
 - Map of AMSR Soil Moisture: The AMSR Soil Moisture Product is a passive microwave retrieval of soil moisture.
 - Map of eMODIS percent of greenness product
 - Improved Lawn and Garden Index
- The **National Agricultural Statistics Service (NASS) Alabama Office** has agreed to serve as a partner with us on the activity. We will deliver the following products to NASS:
 - Gridded crop model (GridSSAT) water stress
 - Phenological state (e.g. emergence, sulking) from GridSSAT
 - High resolution surface weather information from NASA Land Data System used in GridSSAT
 - Projected crop yield from GridSSAT
 - Weekly estimates of irrigation demand
- The **Natural Resource and Conservation Service (NRCS) Alabama Office** has partnered with us on this activity. We will deliver the following products to the NRCS:
 - Estimates of seasonal irrigation water demand
 - Estimates of evaporation from the NASA Land Surface Data System.

Background

- We are utilizing the crop model called “Decision Support System for Agrotechnology Transfer” (DSSAT)
- DSSAT is run on a ~5-km grid for part of the Southeast (we call it “GridSSAT”)
- We have completed the 2011 season using:
 - One soil type
 - One corn cultivar
 - A latitude-dependent planting date

Input Meteorological Data for DSSAT

- **DSSAT requires the following daily meteorological data:**
 - **Min/Max temp (interpolated to 5km)**
 - **Average insolation (interpolated to 5km)**
 - **Precipitation (~ 5km resolution)**
- **For the 2012 growing season, we will also have the most common soil for each county incorporated into the model**

Data Distribution Website

- **The following slides provide examples how we plan to distribute GridSSAT data through a public website.**
- **In the first set are daily products that are available now and will continue in 2012**
- **In the second set are weekly products as well as GIS models available in 2012**

<http://realtimecrop.nsstc.uah.edu/>

GridSSAT Crop Model

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Daily Model Input and Output Graphics



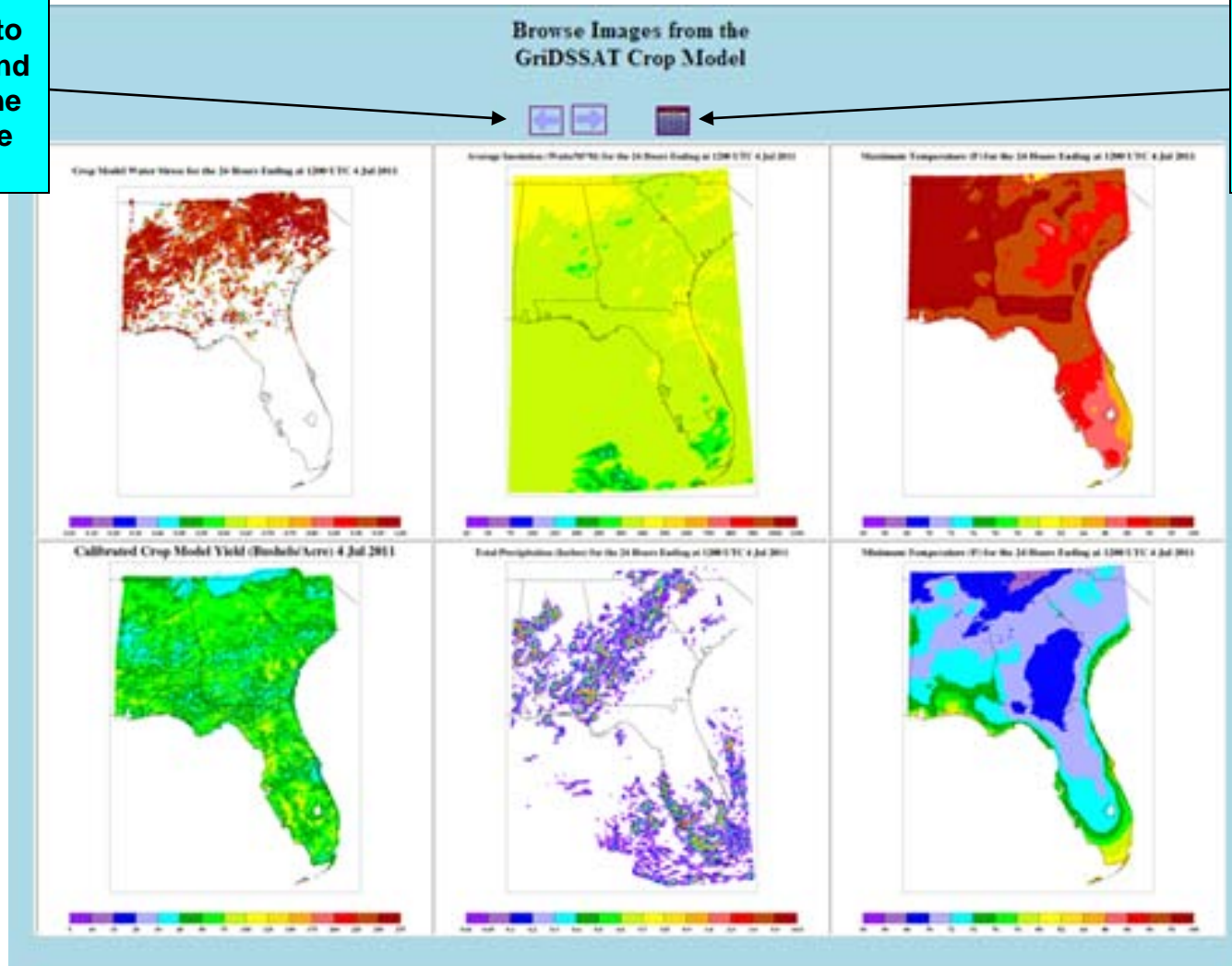
After Choosing a Day

Top Row (Left to Right): Stress, Insolation, Maximum Temperature

Bottom Row (Left to Right): Yield, Precipitation, Minimum Temperature

Use Arrows to go forward and backward one day at a time

Click on the Calendar to go to a different Year, Month, or Day



NOTE: For the 2012 Growing Season each page like this will also have the option of going into the future using 8-day model forecasts and eventually analog years

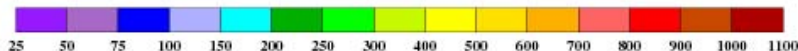
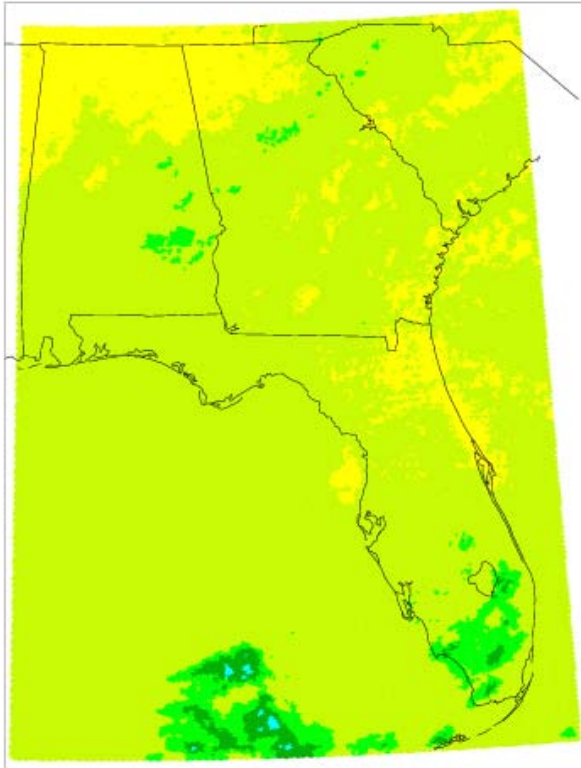
6-Panel Plot Details

- **The following 6 slides are the individual pictures from the previous 6-panel plot.**
- **Depending on user feedback we potentially could have fewer pictures on the 6-panel plot, or a different set of variables.**
- **For 2012 the plot page will have links to results obtained by going into the future 8-days using forecast data for temperature, precipitation, and insolation (as opposed to observed values).**
- **For 2012 we also should have the capability to run beyond the 8-day forecast period with one or more analog years.**

Example of **Daily** Average Insolation

This is derived from GOES satellite data (units are Watts/square meter)
Lower values represent clouds and precipitation

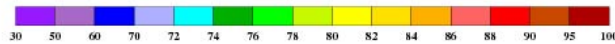
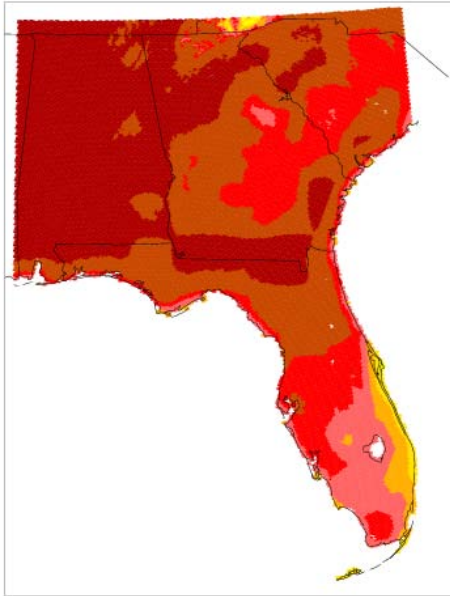
Average Insolation (Watts/M²M) for the 24 Hours Ending at 1200 UTC 4 Jul 2011



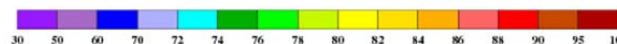
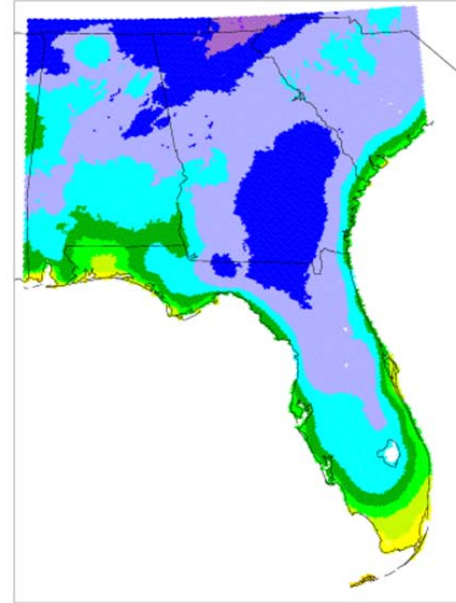
- **The NASA SPORT center also produces an estimated insolation product (for clear and cloudy skies) based on GOES satellite data.**
- **The hourly GOES insolation is averaged over 24hr to get a daily average.**
- **The insolation data is interpolated to 5km grid.**

Example of Daily Min/Max Temperature Derived from SPoRT Data Assimilation Product

Maximum Temperature (F) for the 24 Hours Ending at 1200 UTC 4 Jul 2011



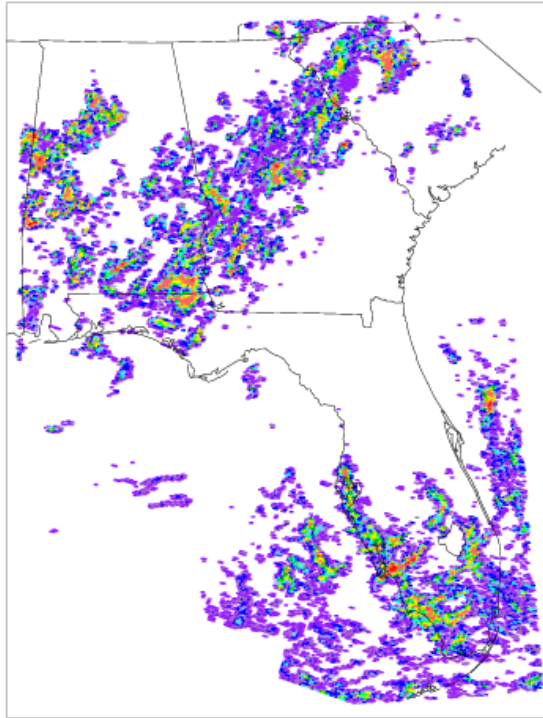
Minimum Temperature (F) for the 24 Hours Ending at 1200 UTC 4 Jul 2011



- Jonathan Case of the NASA Short-term Prediction Research and Transition (SPoRT) runs an assimilation system locally, which is a blend of observed and model data.
- Hourly temperature fields on a 3-km grid are the basis for Min/Max Temps
- The 3-km values are interpolated to the 5-km grid.

Example of **Daily** Precipitation
Derived from NCEP Stage-IV Data
Areas which have no 24hr precipitation are in white

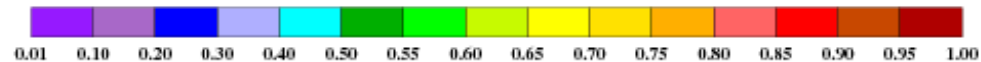
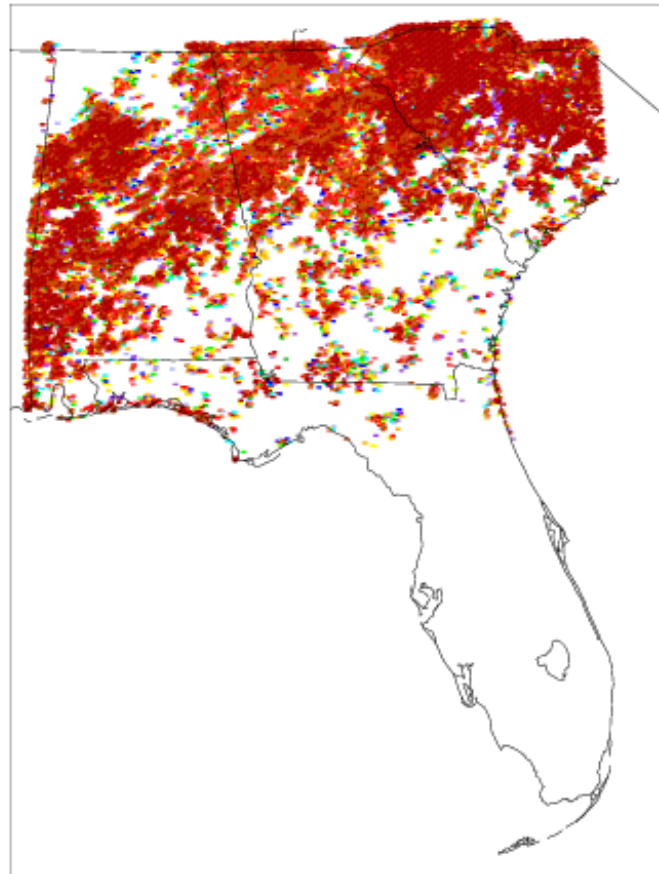
Total Precipitation (Inches) for the 24 Hours Ending at 1200 UTC 4 Jul 2011



- The precipitation data is the **NCEP Stage IV** product described online at <http://www.emc.ncep.noaa.gov/mmb/ylin/pcpanl/stage4/>
- It is an optimal blend of radar-derived and gauge precipitation
- Hourly files are summed to obtain 24hr total precipitation

Example of **Daily** DSSAT Stress
Zero stress (wet) is 0.0 (white)
Maximum stress (dry) is 1.0 (brown)

Crop Model Water Stress for the 24 Hours Ending at 1200 UTC 4 Jul 2011

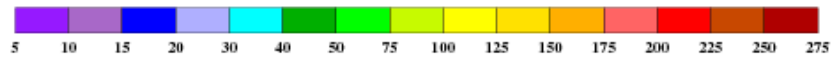
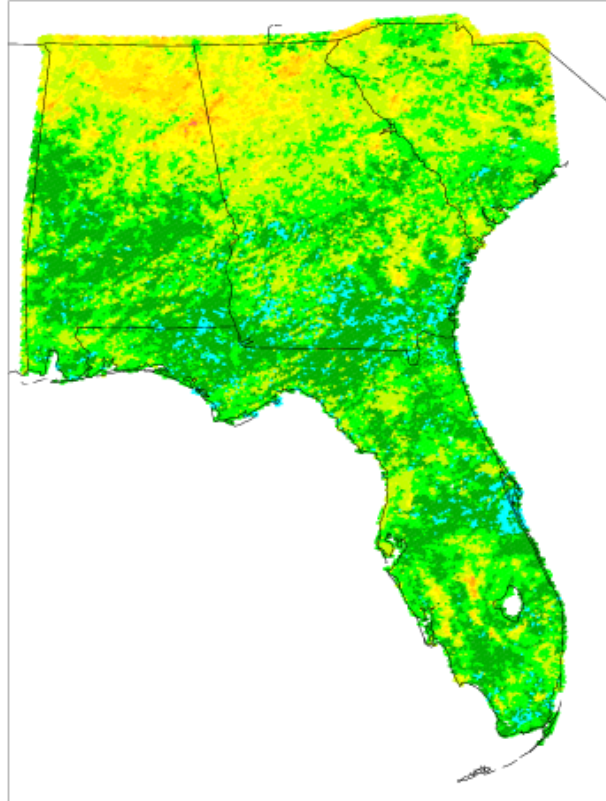


Example of DSSAT Daily Yield ending August 29th, 2011

Calibrated Crop Model Yield (Bushels/Acre) 29 Aug 2011

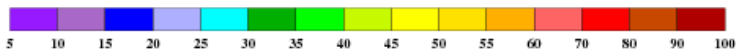
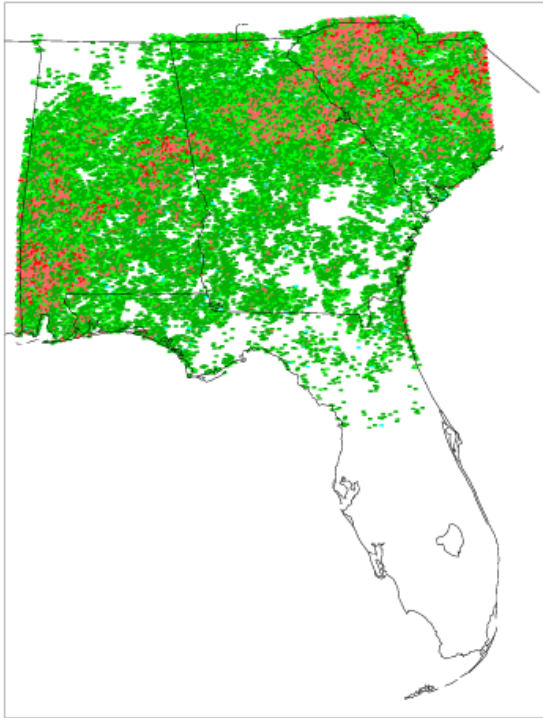
Near final corn yield from
GridSSAT.

Note very good yields in North
Alabama but poor yields in
South
Alabama.

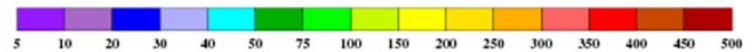
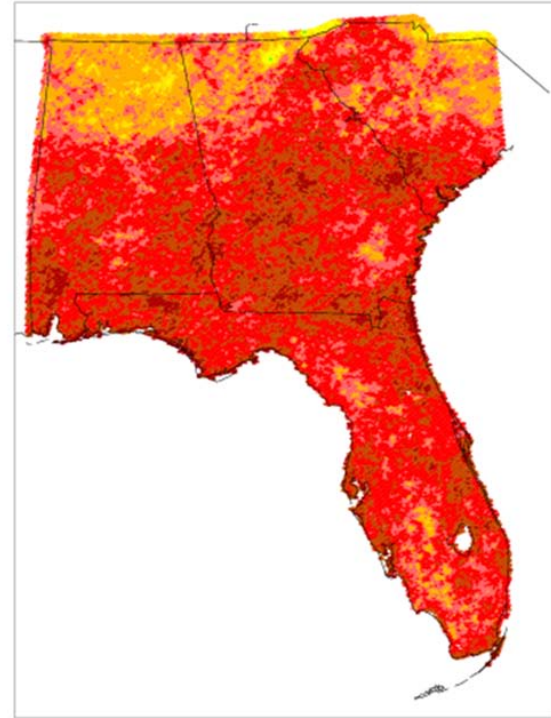


Example of Weekly & Cumulative DSSAT Irrigation (White areas need no irrigation)

Weekly Irrigation (mm) Ending at 1200 UTC 4 Jul 2011

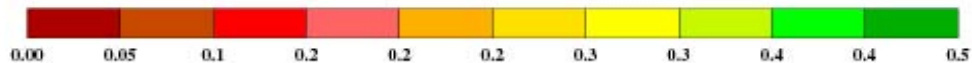
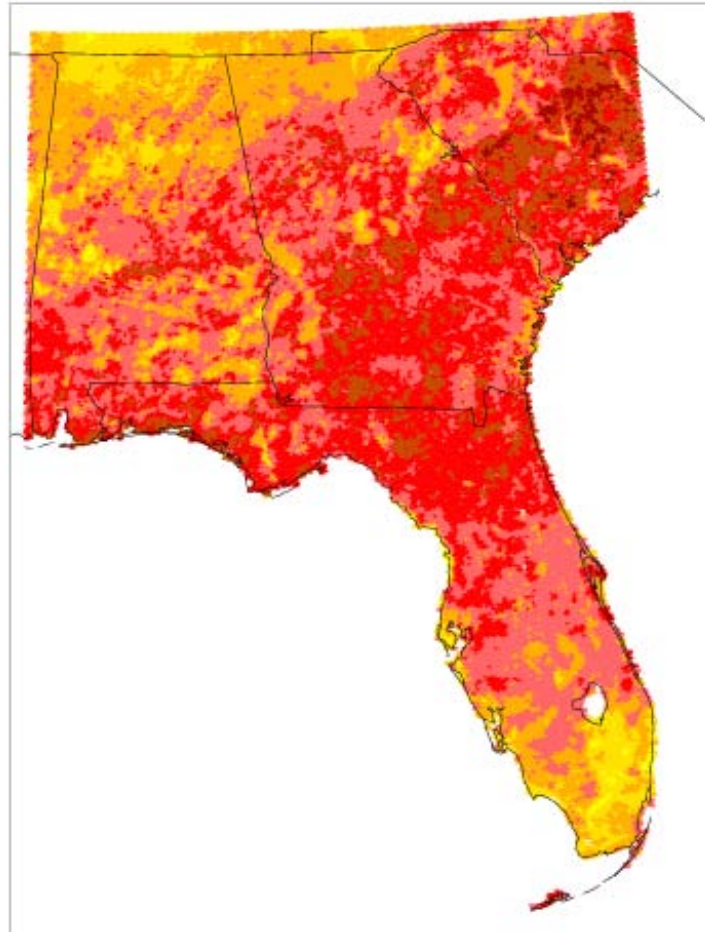


Cumulative Irrigation (mm) to Date Ending at 1200 UTC 29 Aug 2011



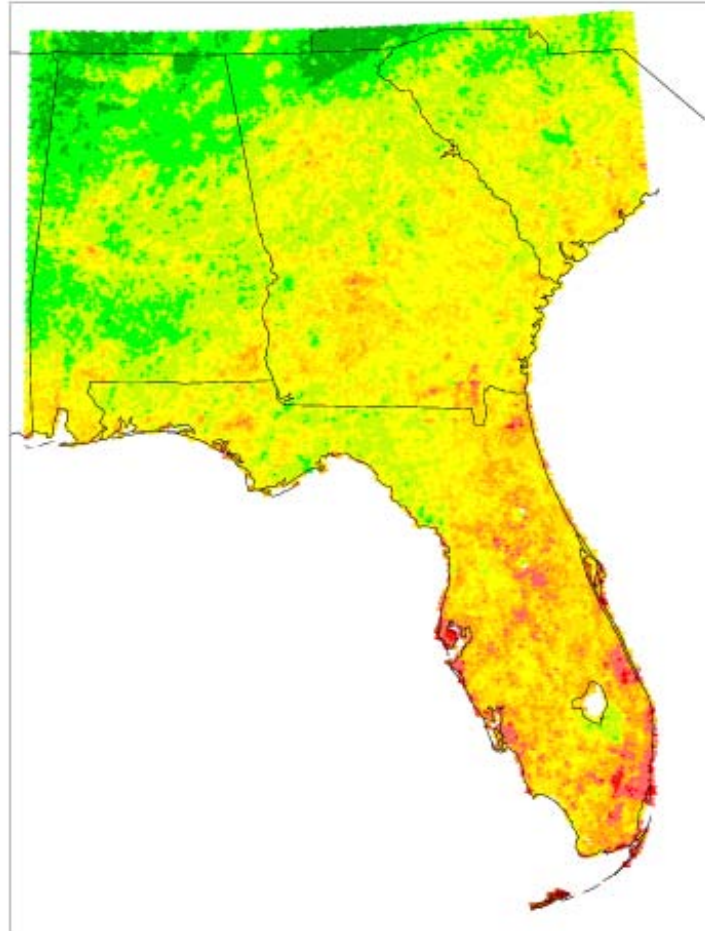
Example of 0-10 cm Soil Moisture
Units are cubic meters H₂O per cubic meters of soil
Derived from NASA SPO₂RT Data Assimilation Product

LDAS Volumetric Soil Moisture 0-10 cm Ending at 1200 UTC 4 Jul 2011



Example of Green Vegetative Percentage Derived from NASA SPoRT Data Assimilation Product

LDAS Vegetation Percentage Ending at 1200 UTC 4 Jul 2011



GIS Models

- Additional options available for the 2012 season will include GIS downloads
- Years 2008-2011 will be available through the website.

