

The Global Flood Monitoring System (GFMS) on the recent flood events in southern United States

— Comparison with various flood information

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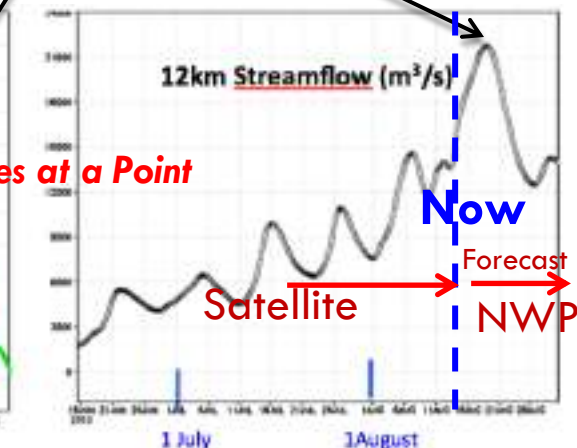
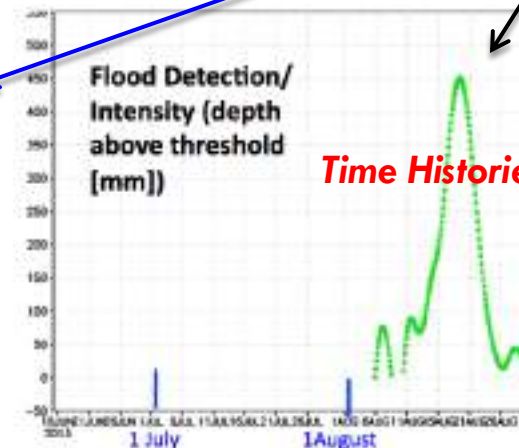
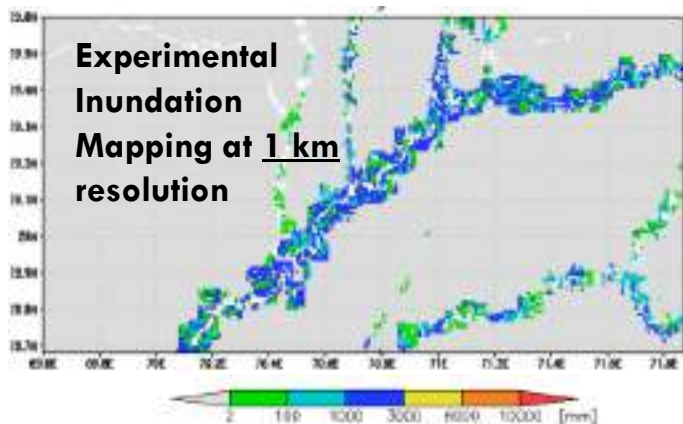
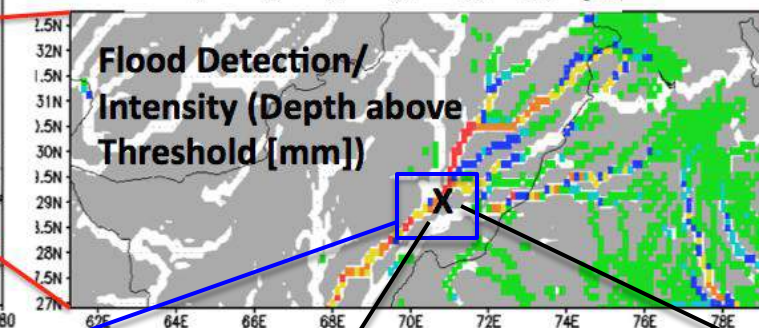
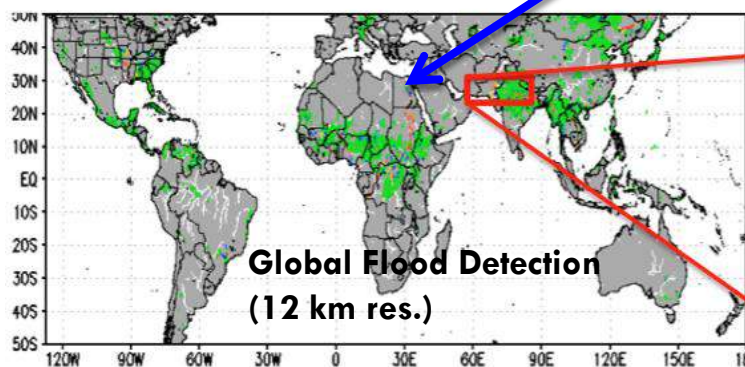
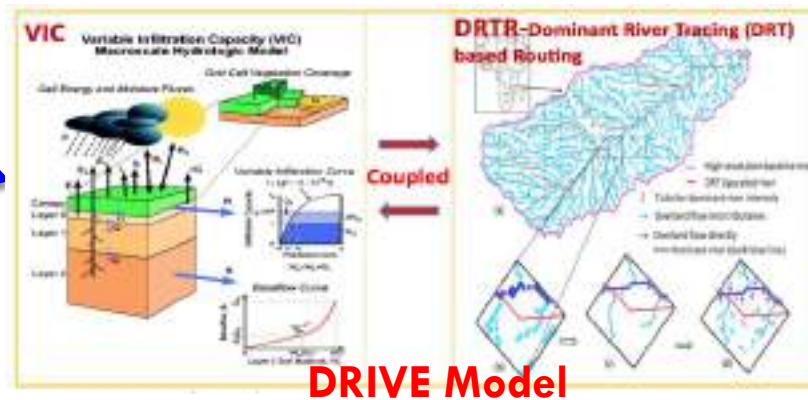
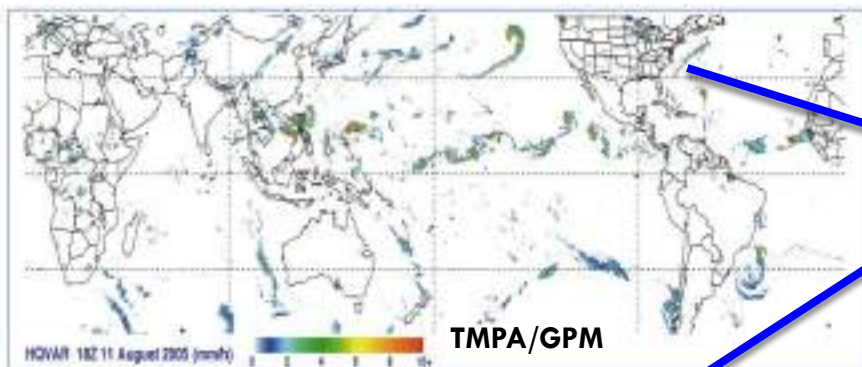
²NASA Goddard Space Flight Center, Greenbelt, MD 20771

Bob Adler (ESSIC/NASA GSFC)
Albert Kettner (NCAR)

G. Robert Brakenridge (U. of Colorado)
Dan Slayback, Frederick S. Policelli (NASA GSFC)
Ming Feng (U. of Maryland)

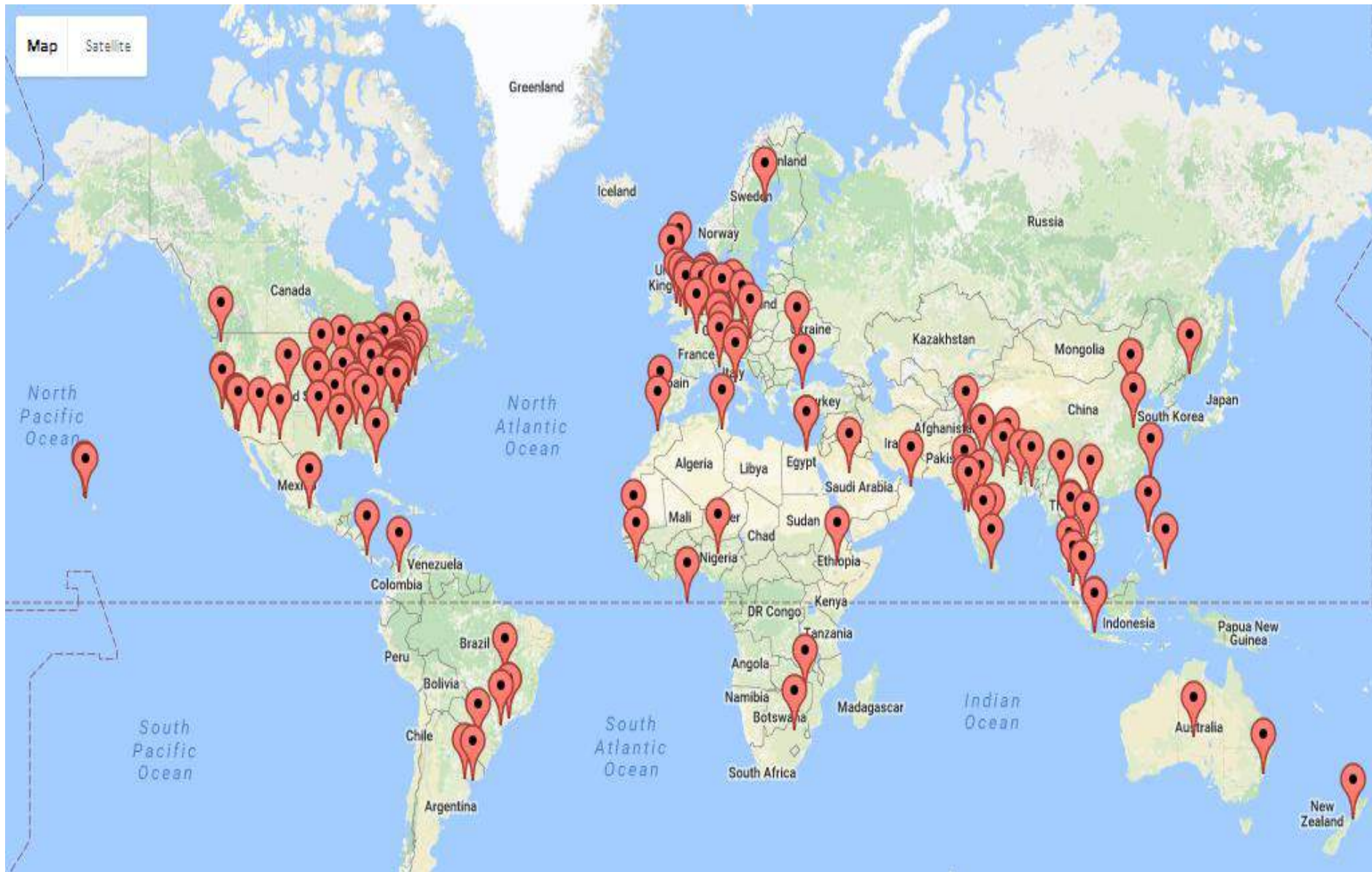
Global Flood Monitoring System (GFMS)

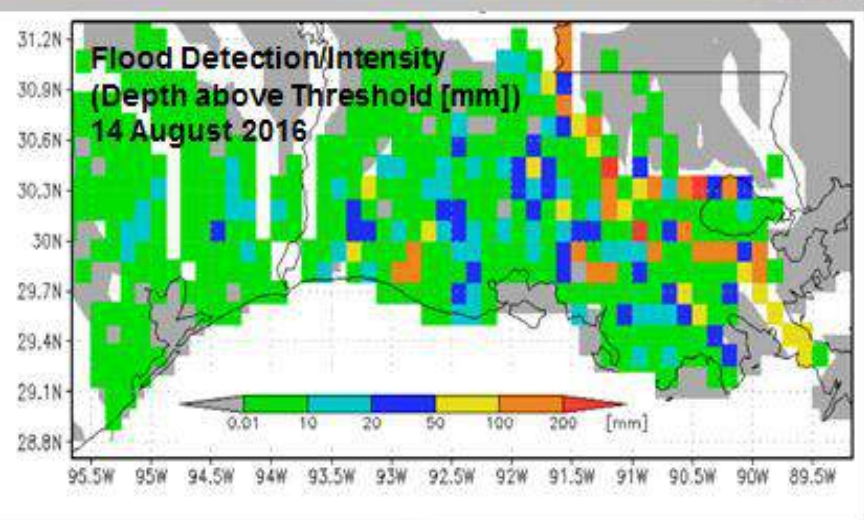
<http://flood.umd.edu>



GFMS visits of last week

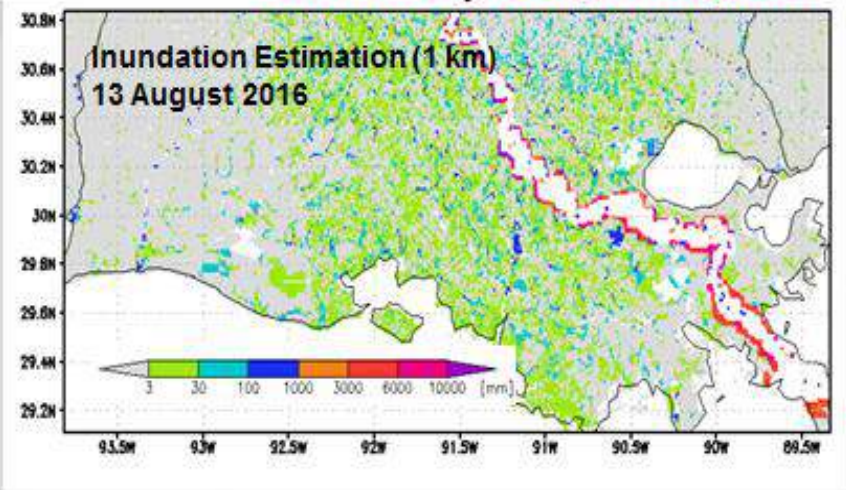
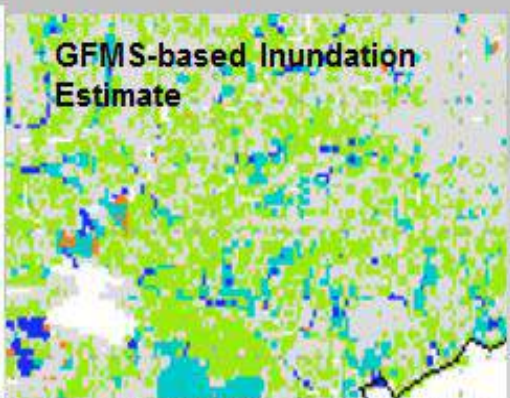
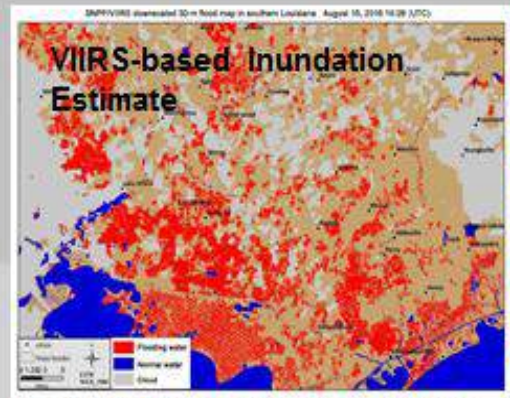
Snapshot taken on 09/19/2016





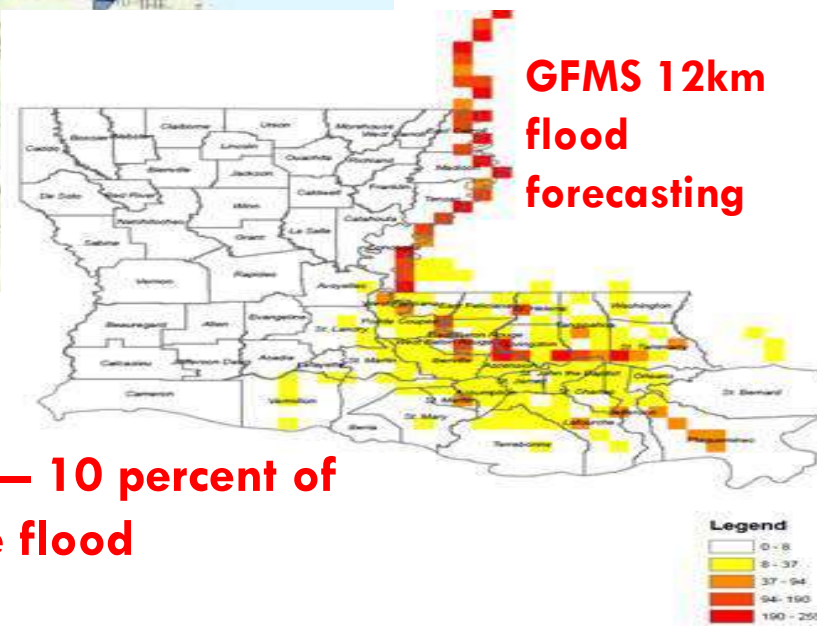
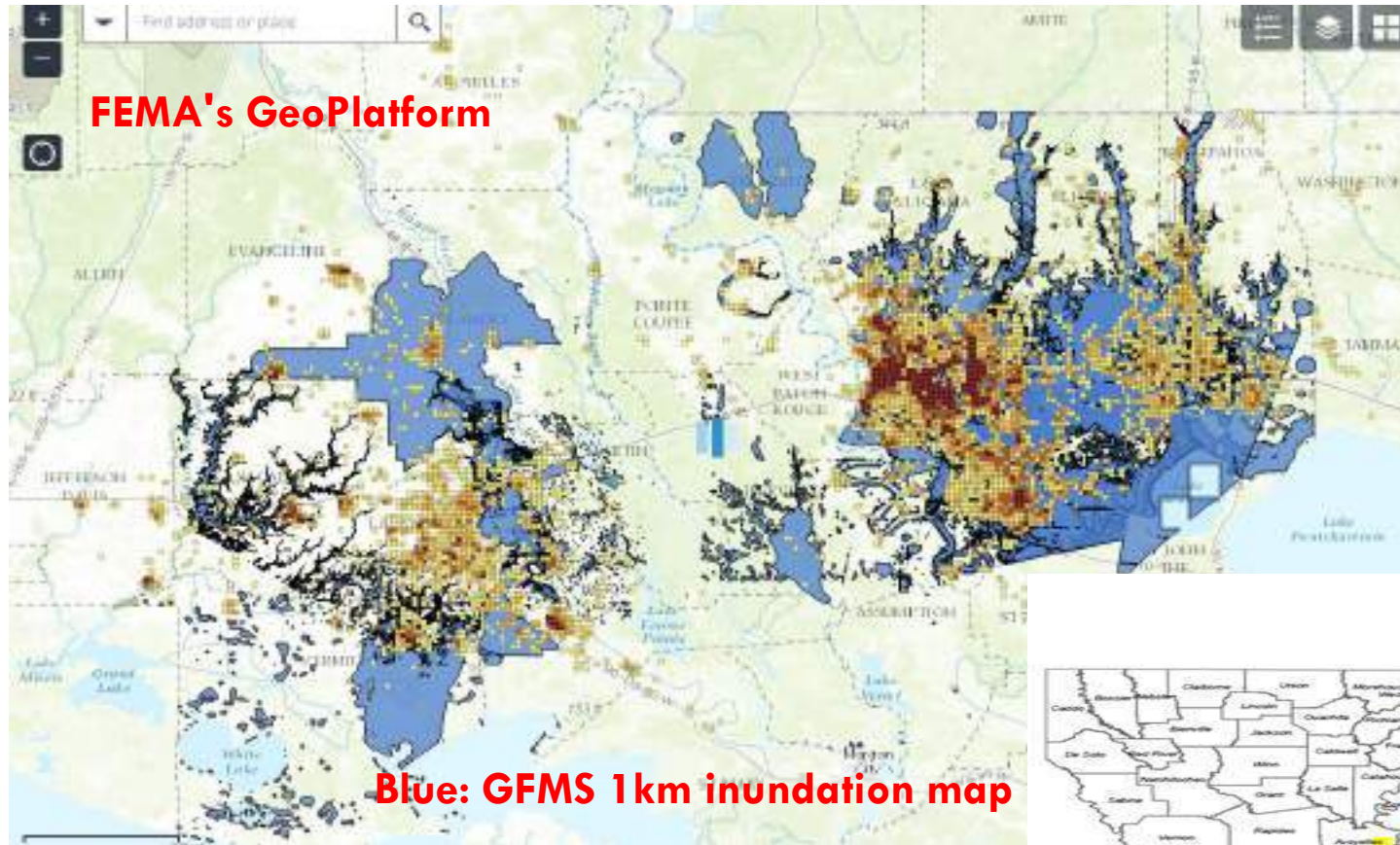
**Global Flood Monitoring System (GFMS)
Adler/Wu University of Maryland**

Satellite precipitation estimates merged via the GPM product are utilized as a key input into the Global Flood Monitoring System (GFMS) utilizing land surface and routing models at 12 and 1 km resolution to estimate the occurrence and intensity of floods. The hydrological calculations are extended into the future (out to five days) using GEOS-5 rainfall predictions.



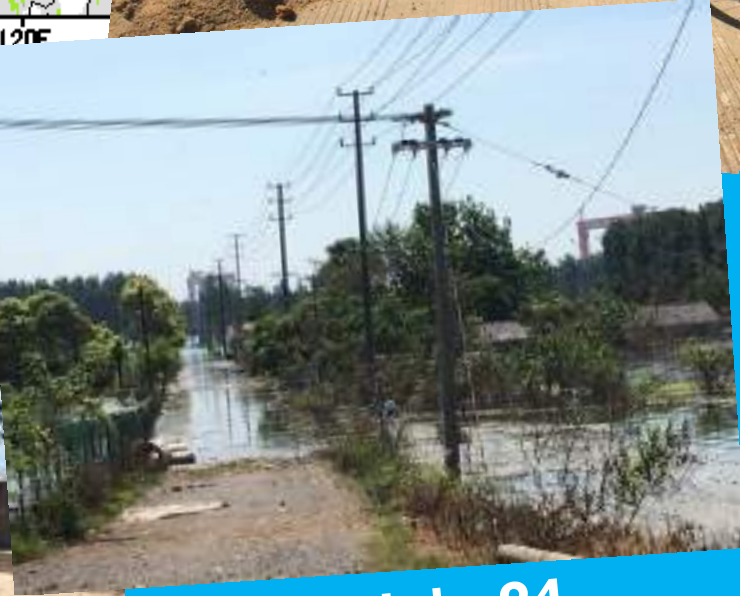
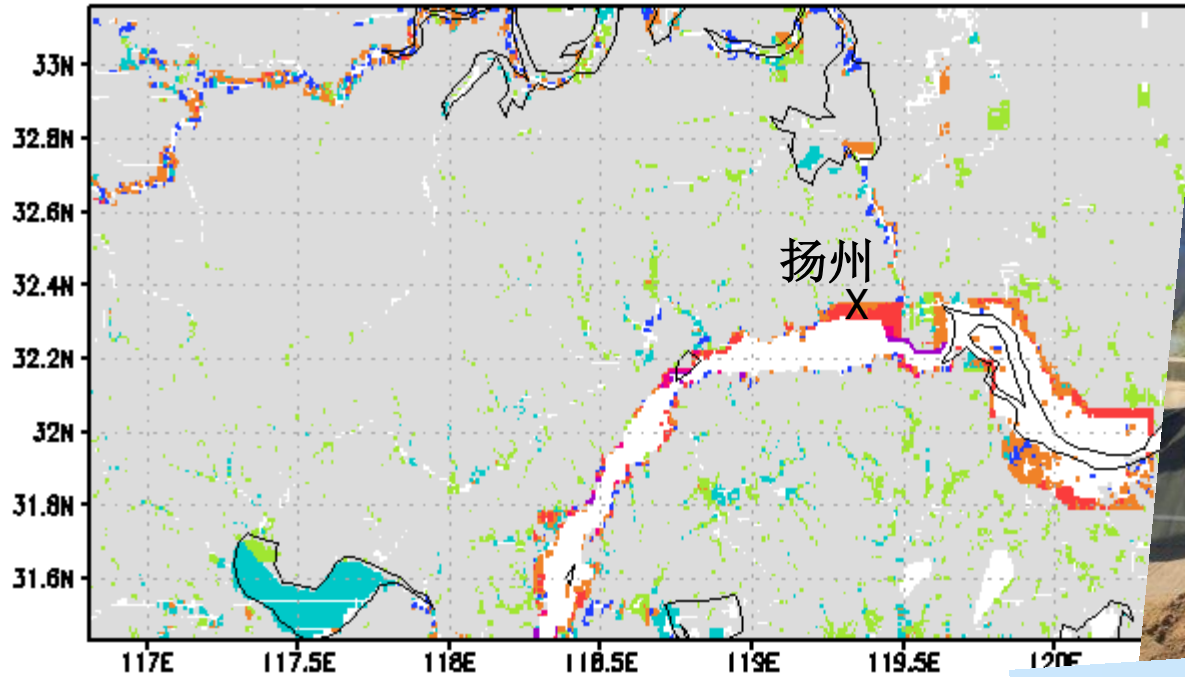
During the Louisiana floods in August GFMS images and data were provided showing large-scale current conditions and forecasts as in upper left image (3-hr resolution). The forecasts were used by FEMA to help plan their response. The 1-km resolution inundation estimates from GFMS (example in lower left) were downloaded by FEMA and used to estimate number of structures and homes impacted. The GFMS inundation estimates were also used to compare with those from optical and SAR data, when

FEMA : How many houses, people flooded in Louisiana?



158,629 occupied houses and 507,495 people – 10 percent of the state's population -- were "affected" by the flood

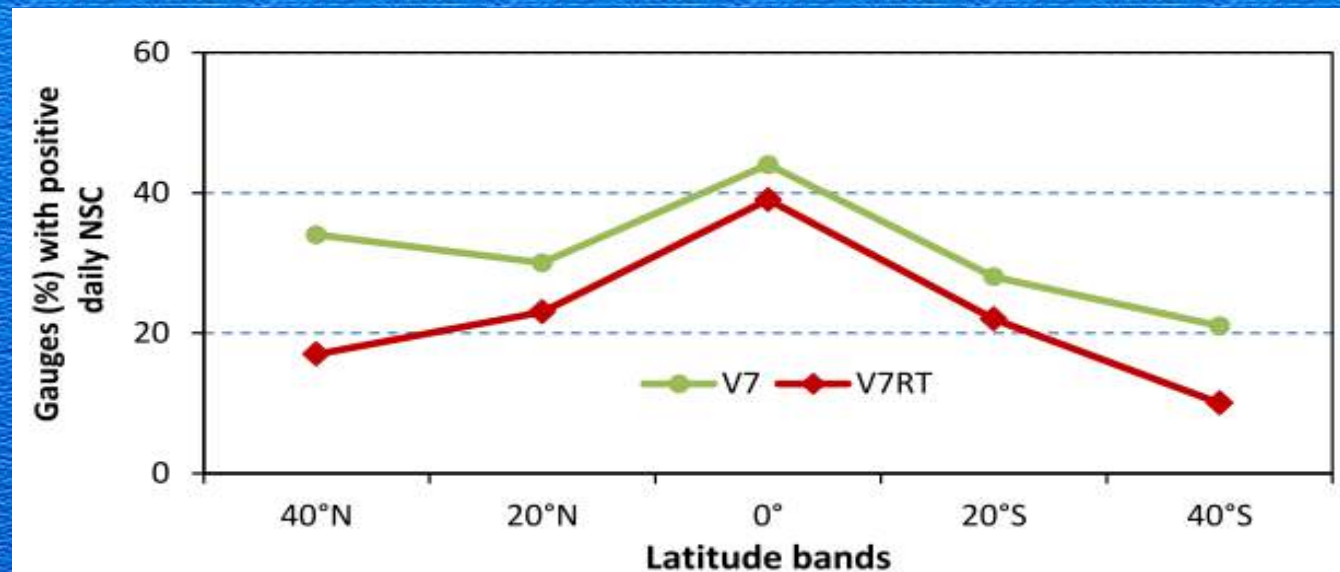
July 24, 2016 Inundation map 1km res. [mm]
12Z24Jul2016



Photos for July 24

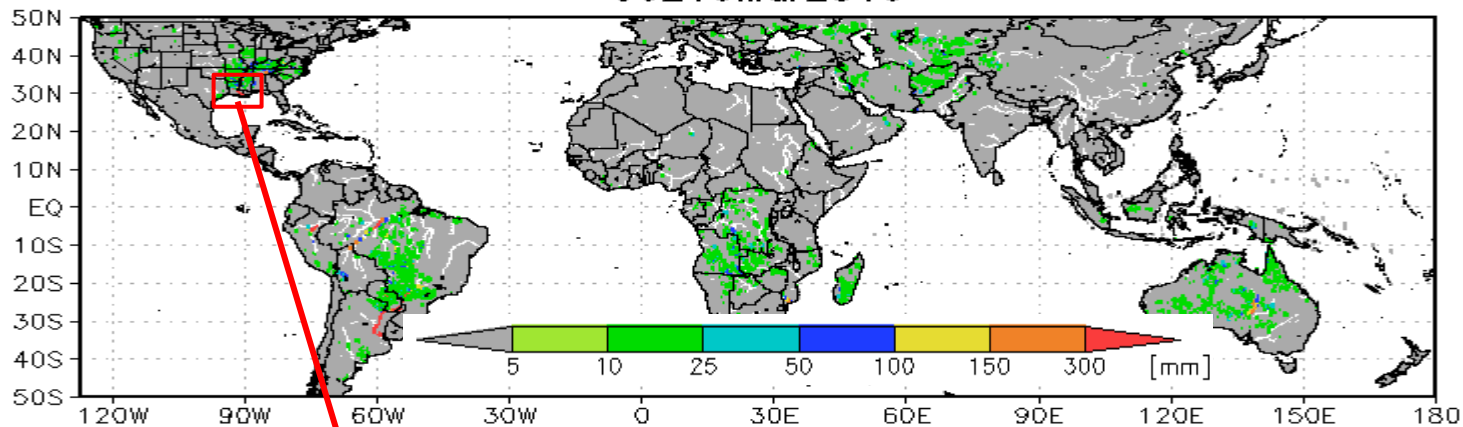
Global evaluation TMPA real-time (**DRIVE-RT**) and research (rain gauge adjusted, **DRIVE-V7**) [15yrs (1998~), 3-hrly, $1/8^\circ$ res.]

- (1) **Flood event** based evaluation using 2,086 archived flood events by Dartmouth Flood Observatory [*Wu, et al., JHM, 2012*]
- (2) **Streamflow** based evaluation at 1,121 river gauges by GRDC, across the globe.

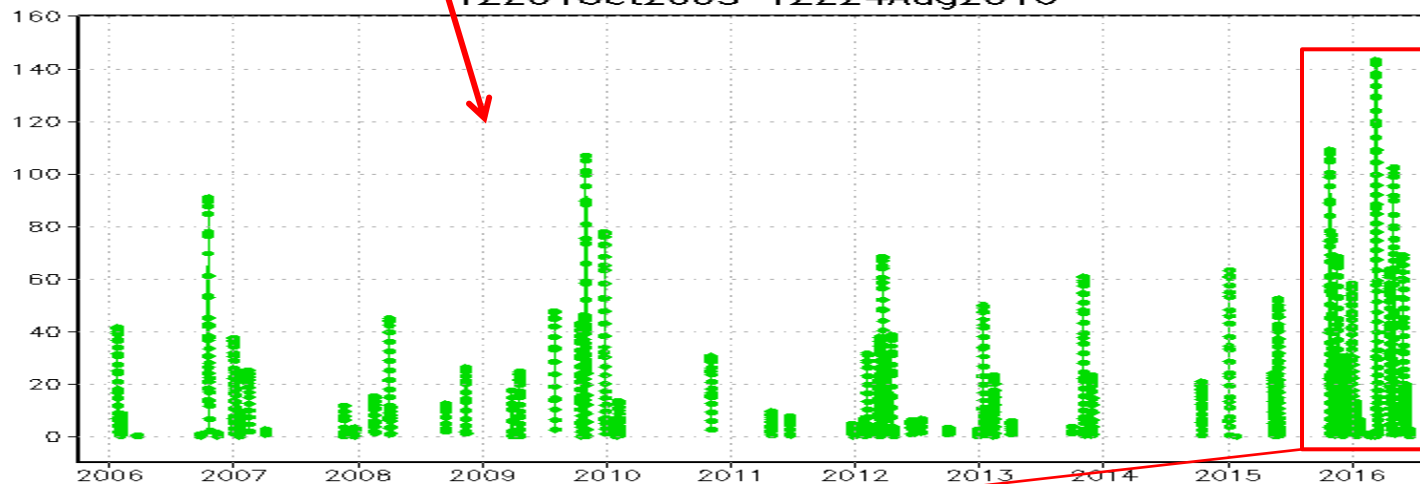


Wu, et al., WRR , 2014;

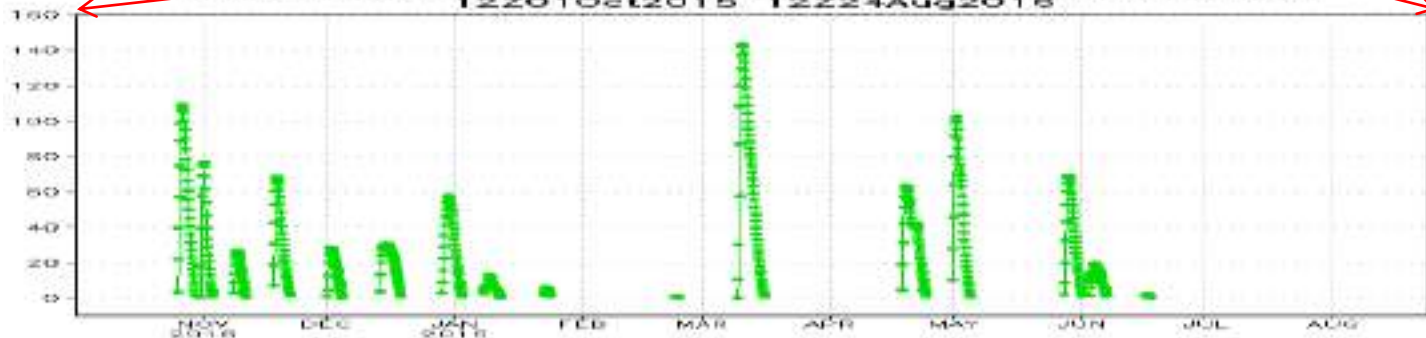
Flood Detection/Intensity (depth above threshold [mm]) 06Z16Mar2016



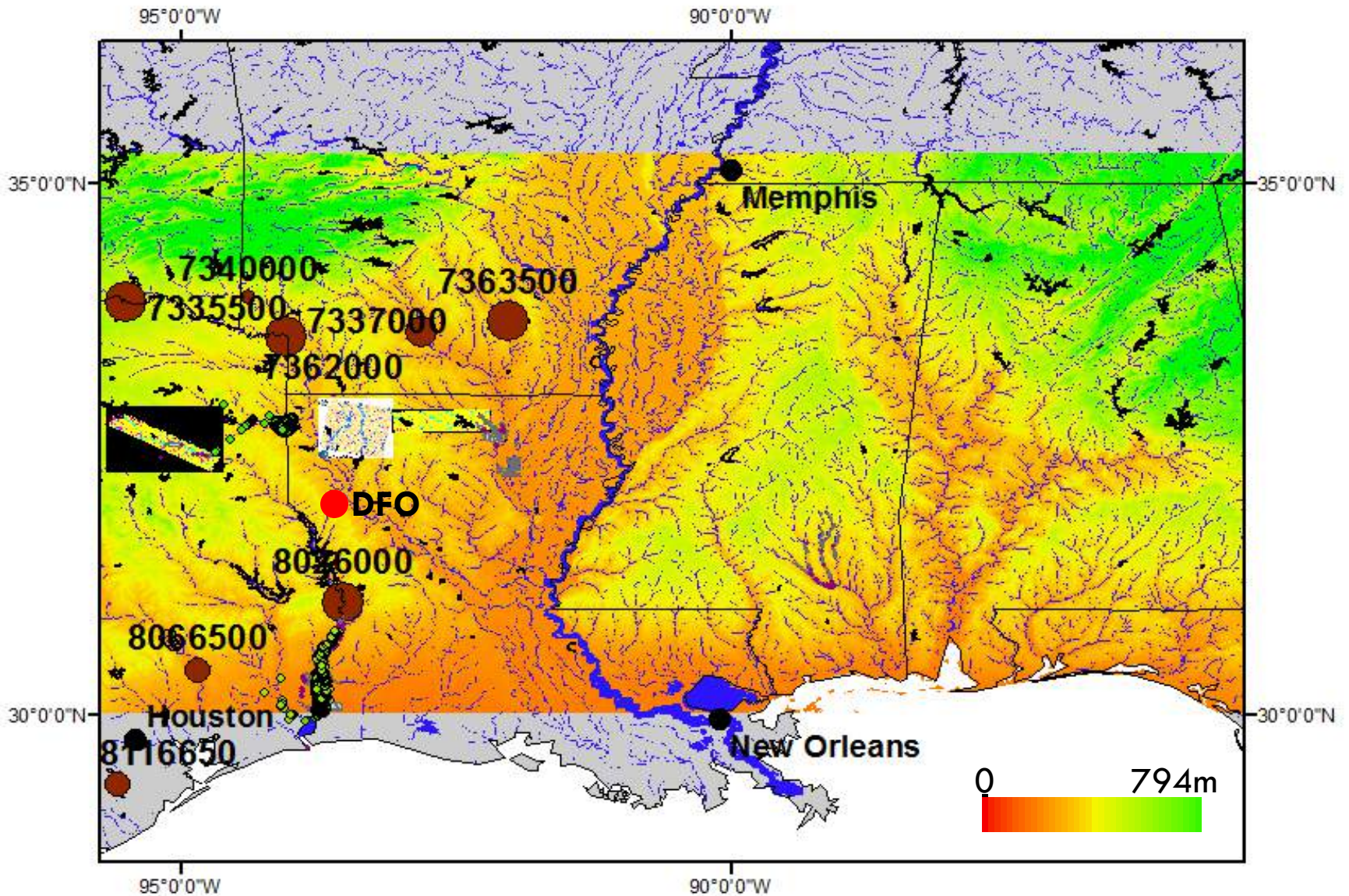
Flood Detection/Intensity (depth above threshold [mm]) 12Z01Oct2005 12Z24Aug2016



Flood Detection/Intensity (depth above threshold [mm]) 12Z01Oct2015 12Z24Aug2016



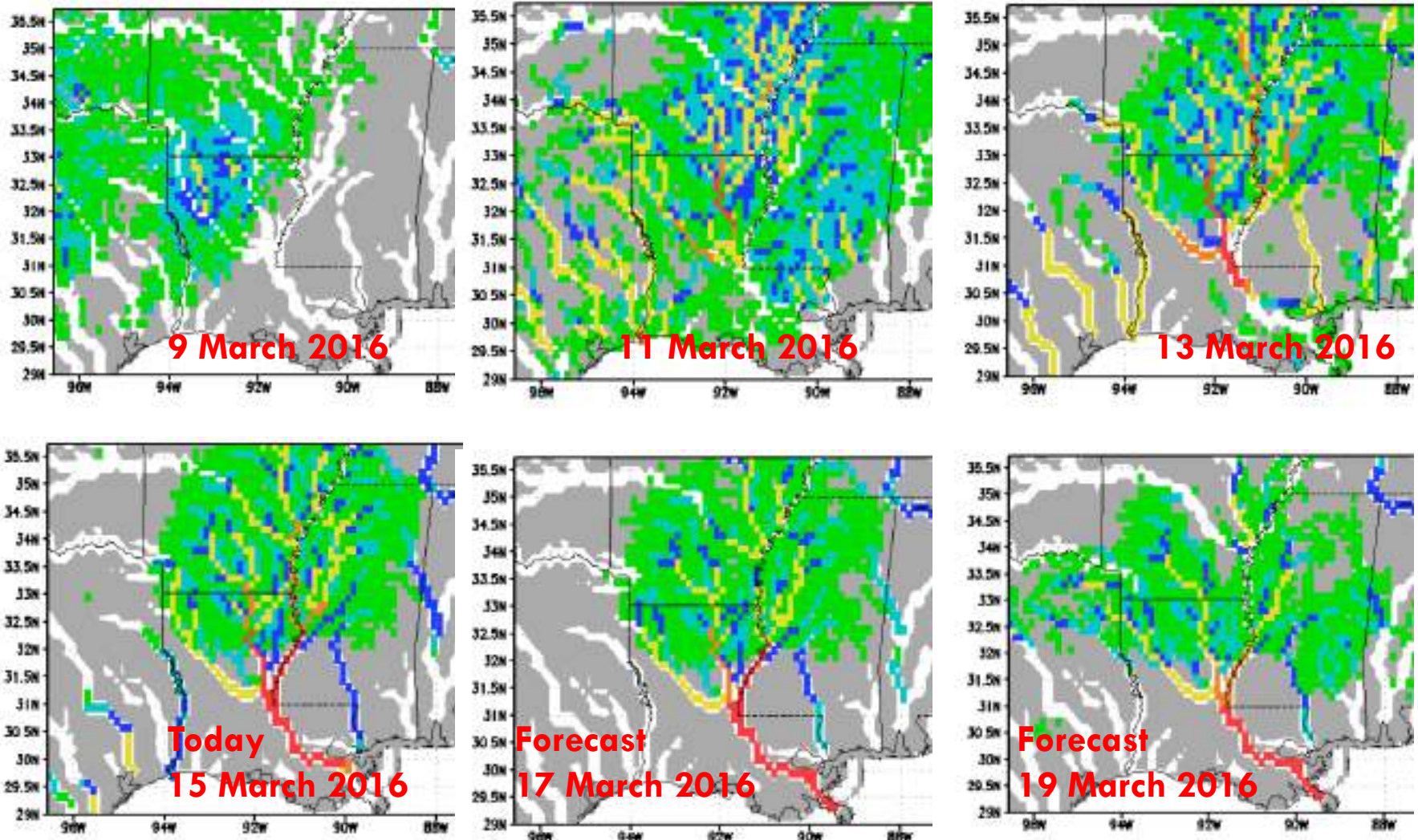
Data collection



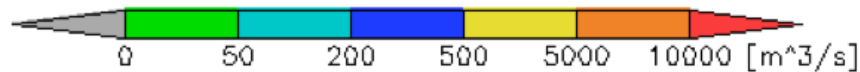
Hazards Data Distribution System (HDDS)

<http://hddsexplorer.usgs.gov/>

Overview and Forecast for Southern Floods

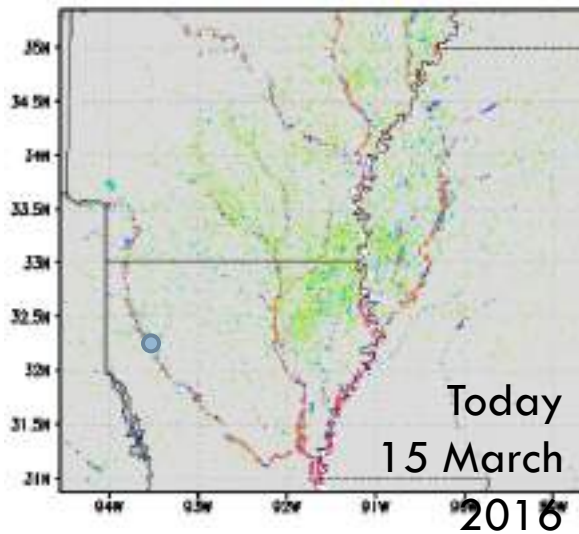
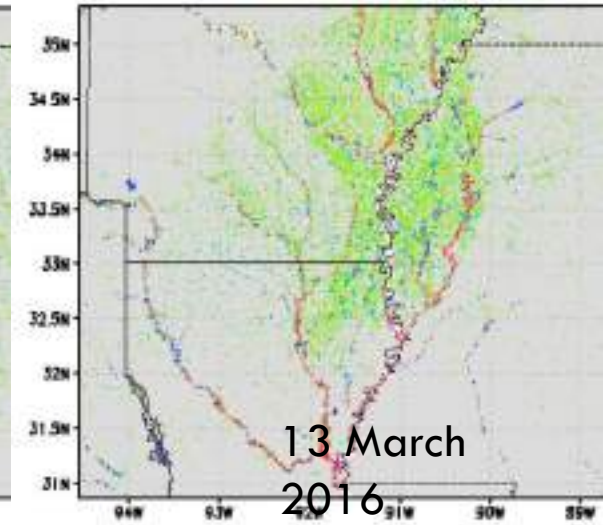
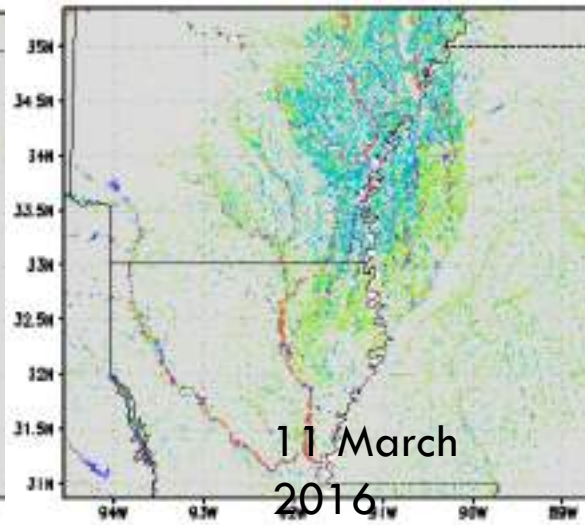
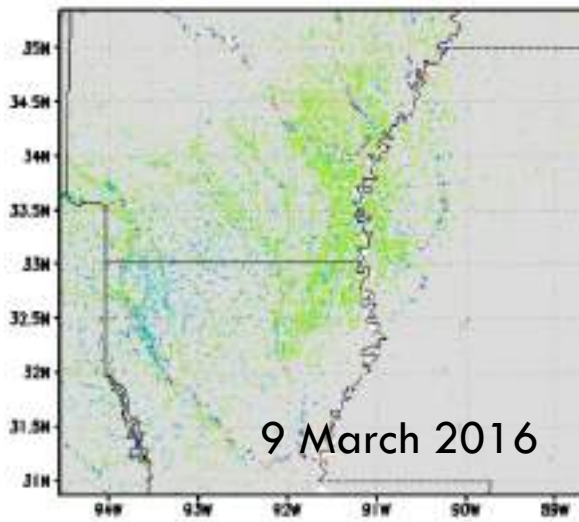


Streamflow above Flood Threshold [m^3/s]



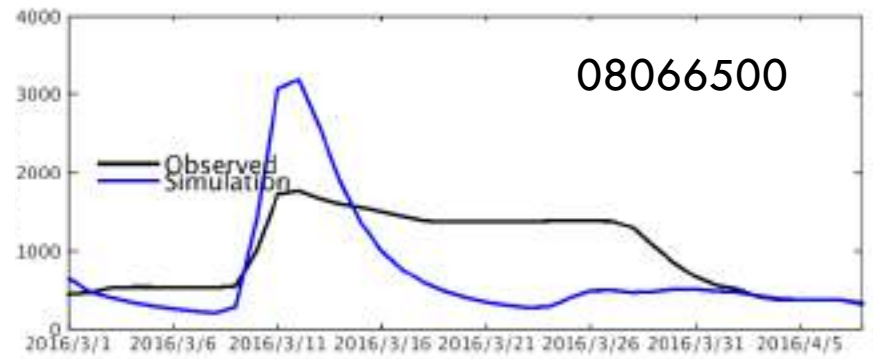
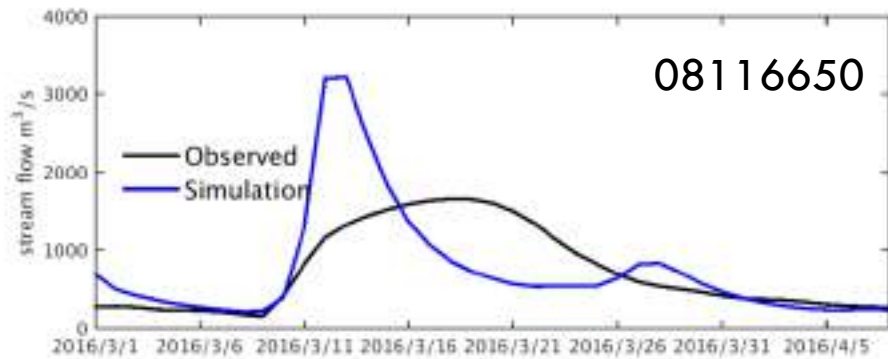
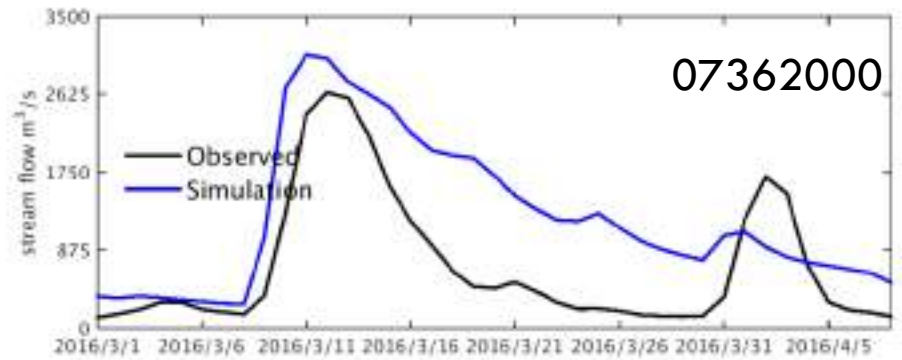
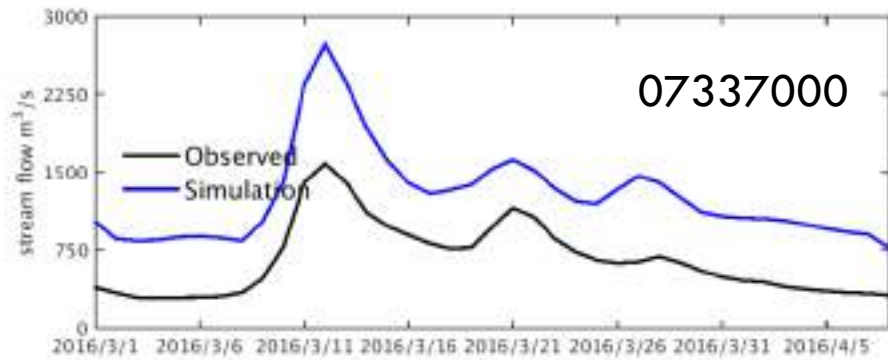
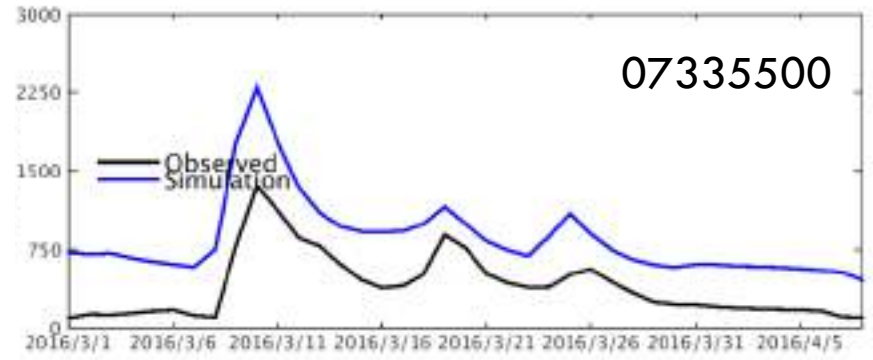
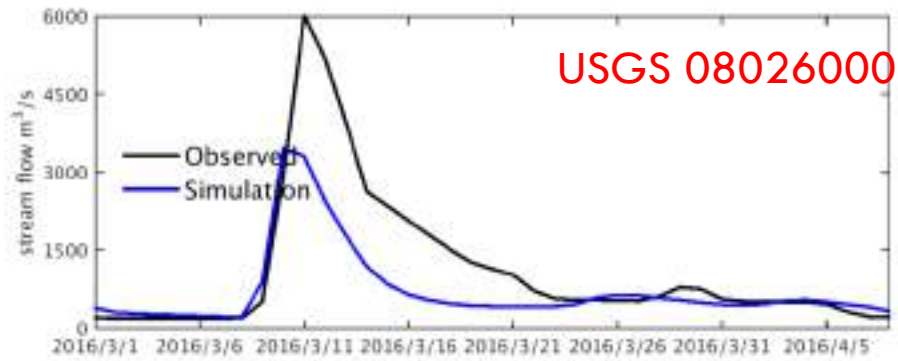
GFMS/UMD

Estimated Inundation Evolution

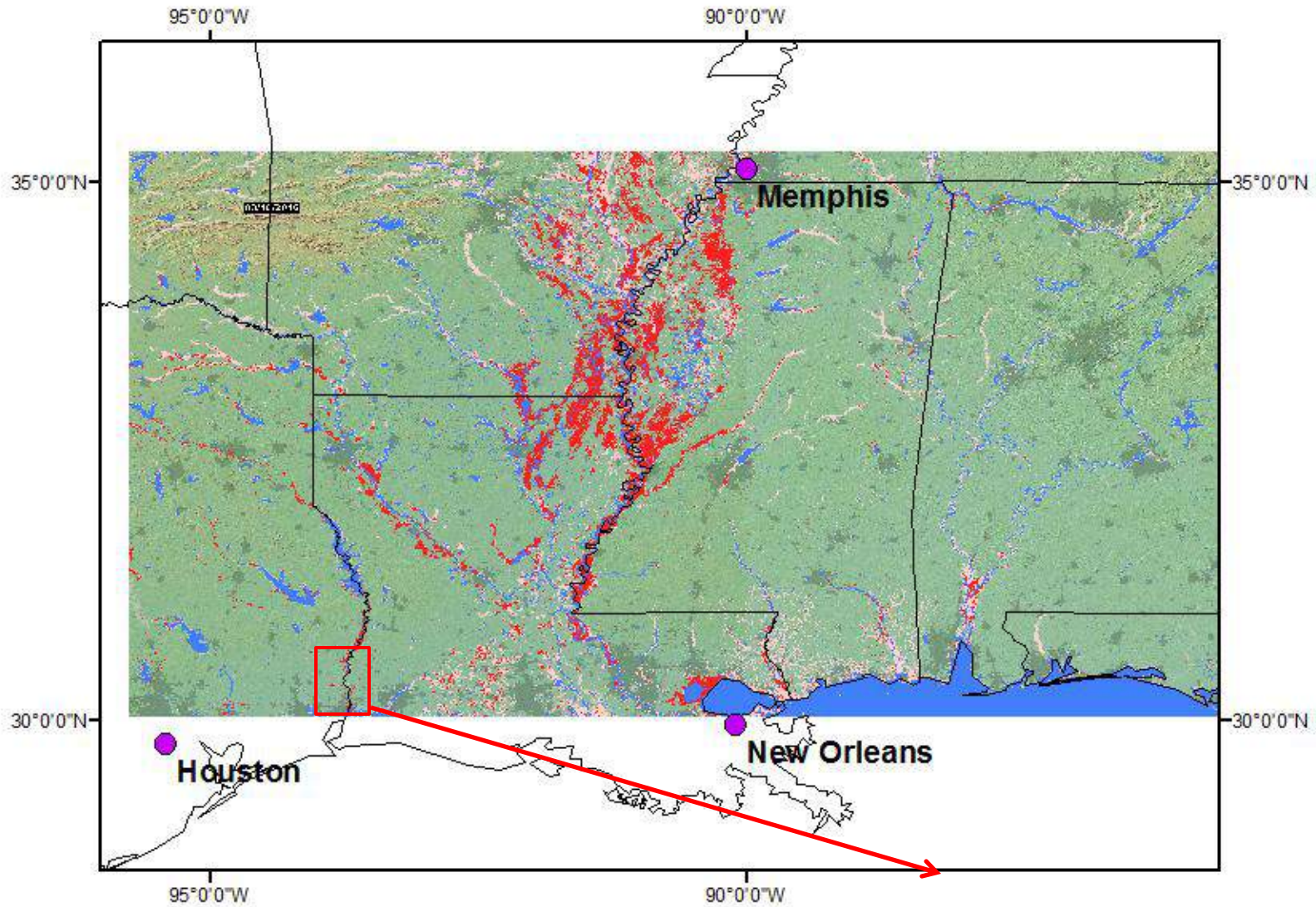


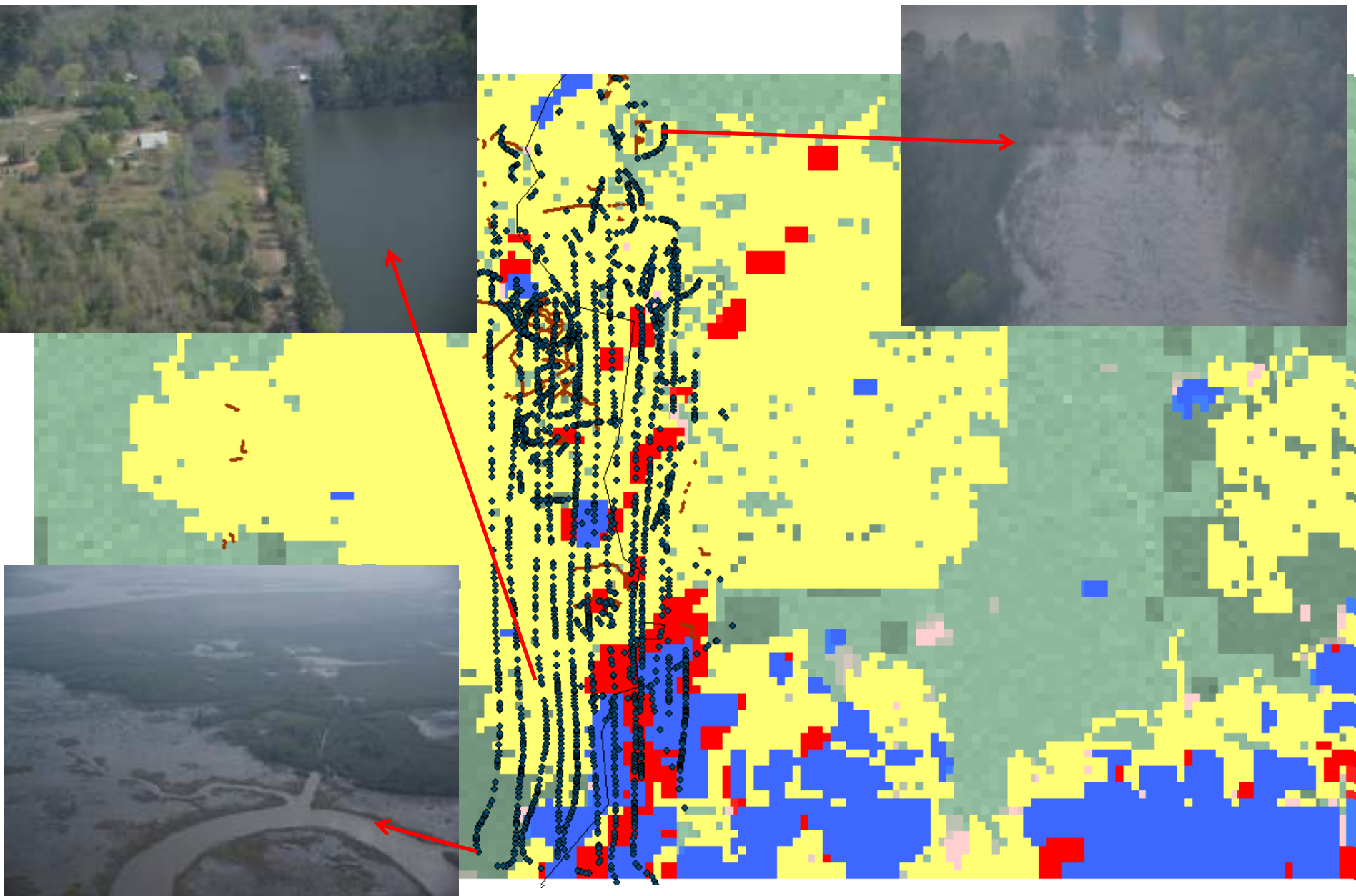
Inundation map 1km res. [mm]





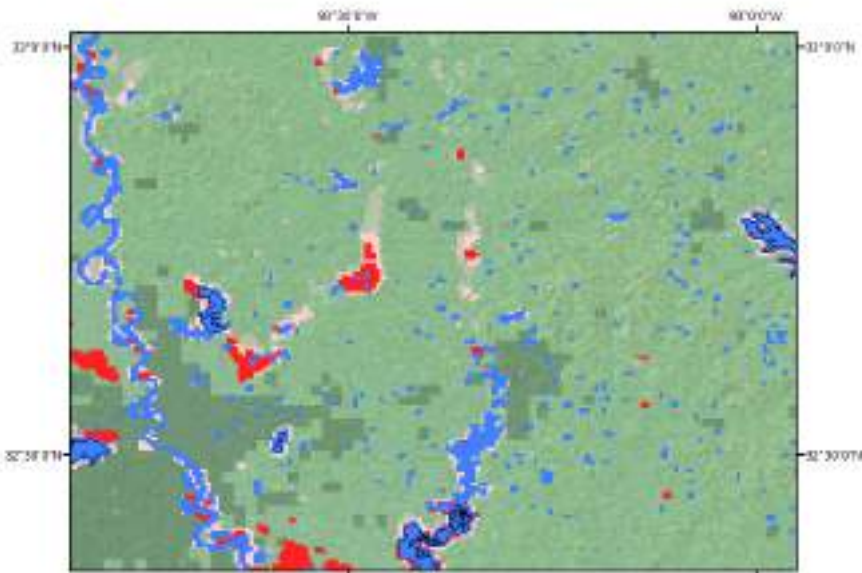
DFO MODIS Flood Mapping on Mar 16 (14-day combined)



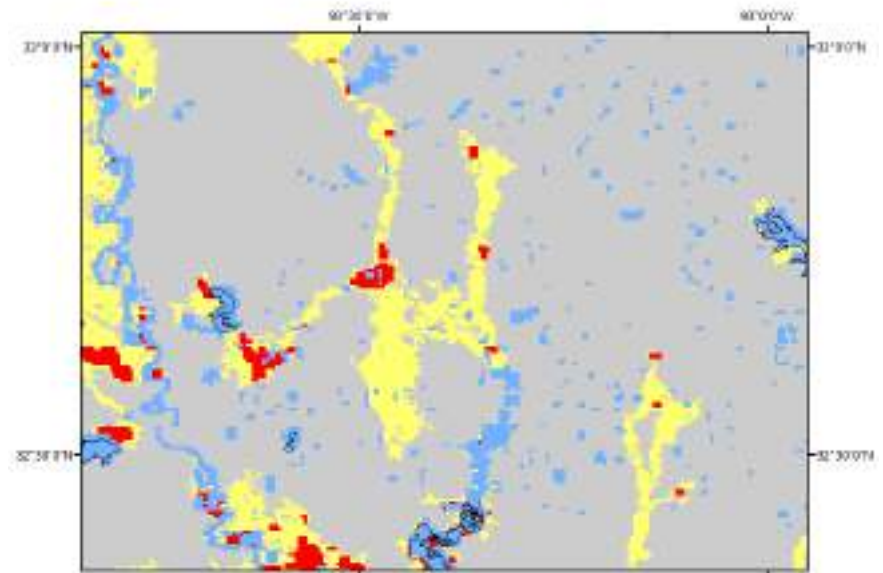


Yellow: modified flooding area

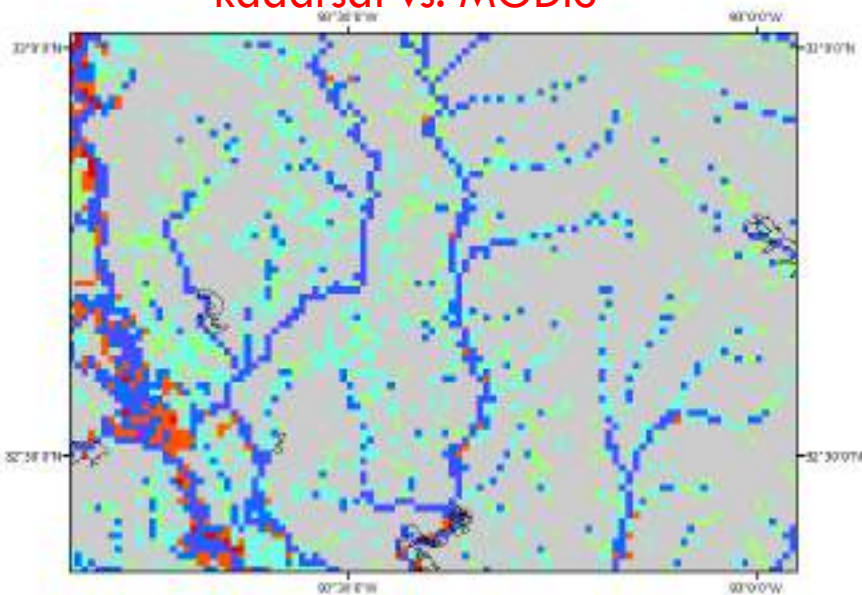
Radarsat Acquisition : 16 March 2016; (12:12:03 UTC).



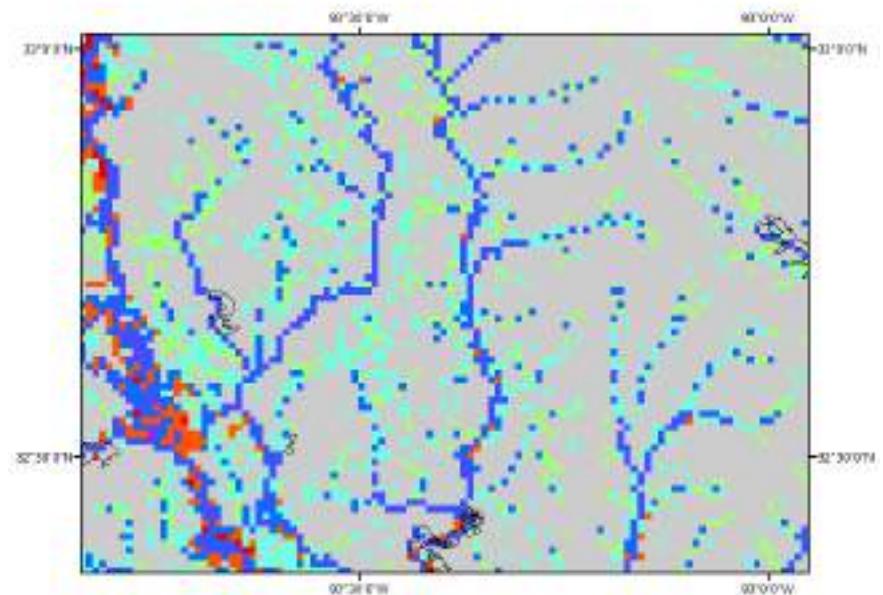
Radarsat vs. MODIS



Radarsat Vs. Modified MODIS

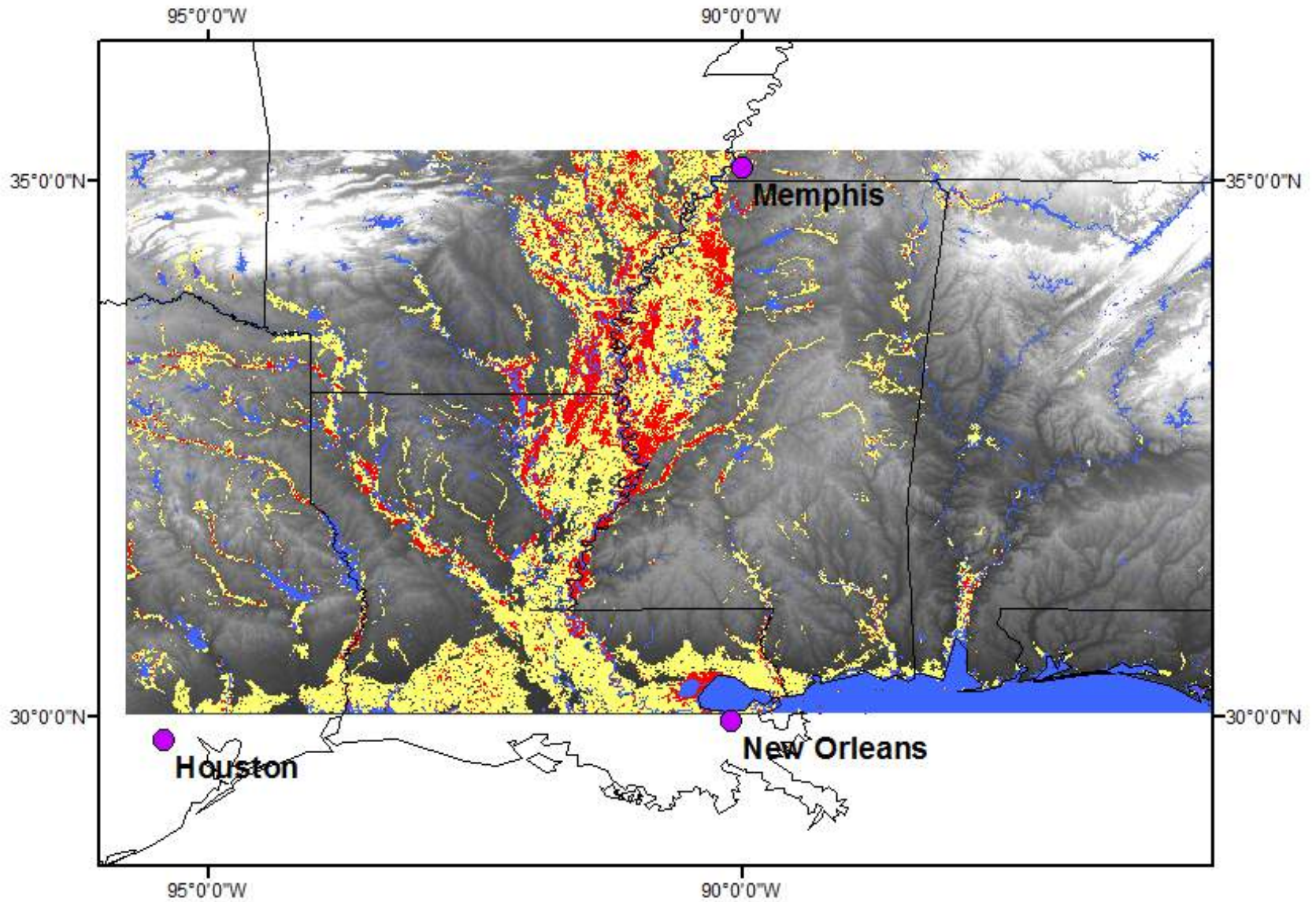


Radarsat vs. DRIVE model

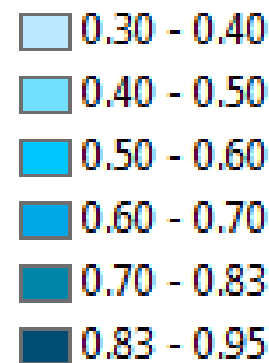
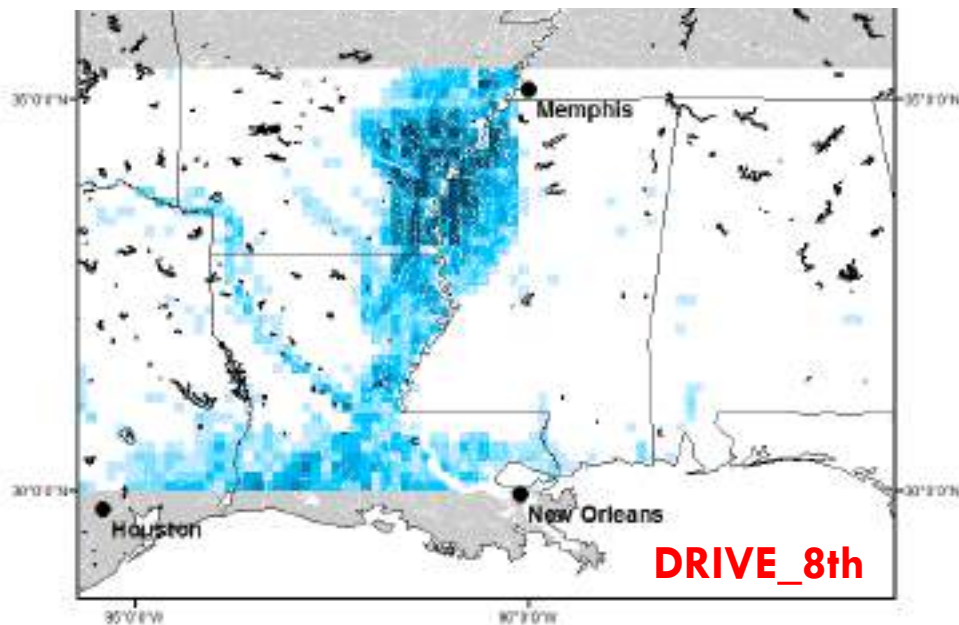
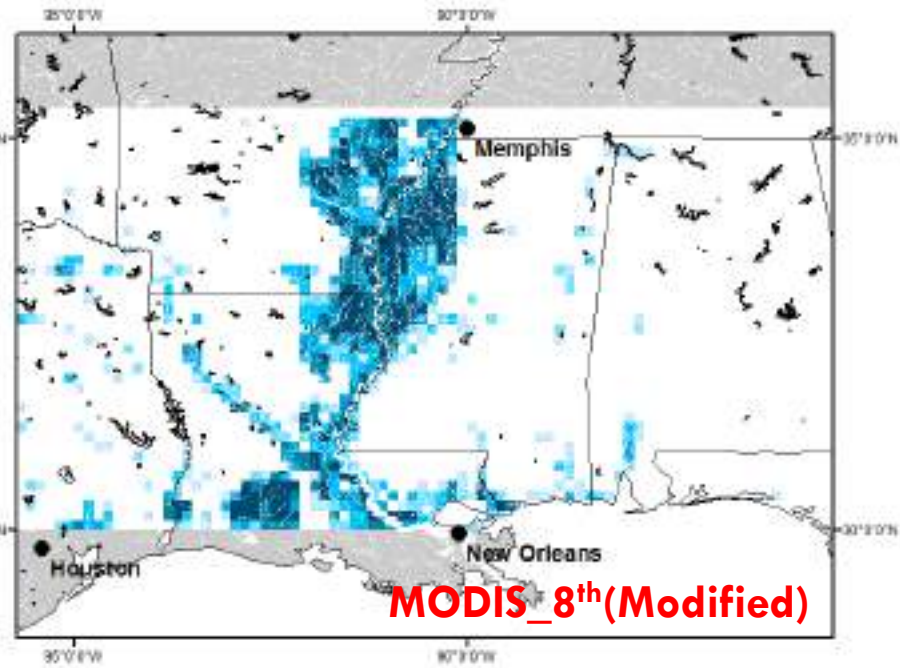
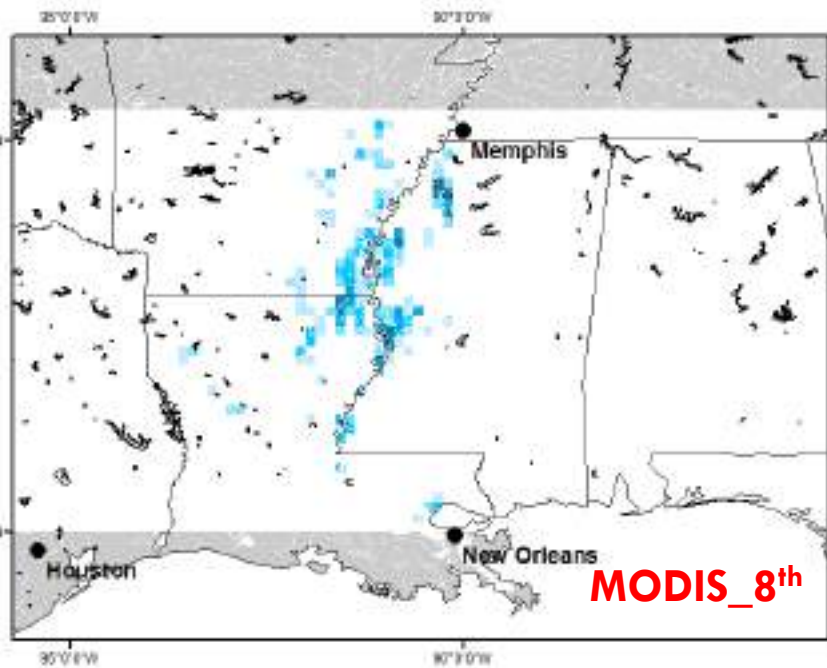


DRIVE model vs. Modified MODIS

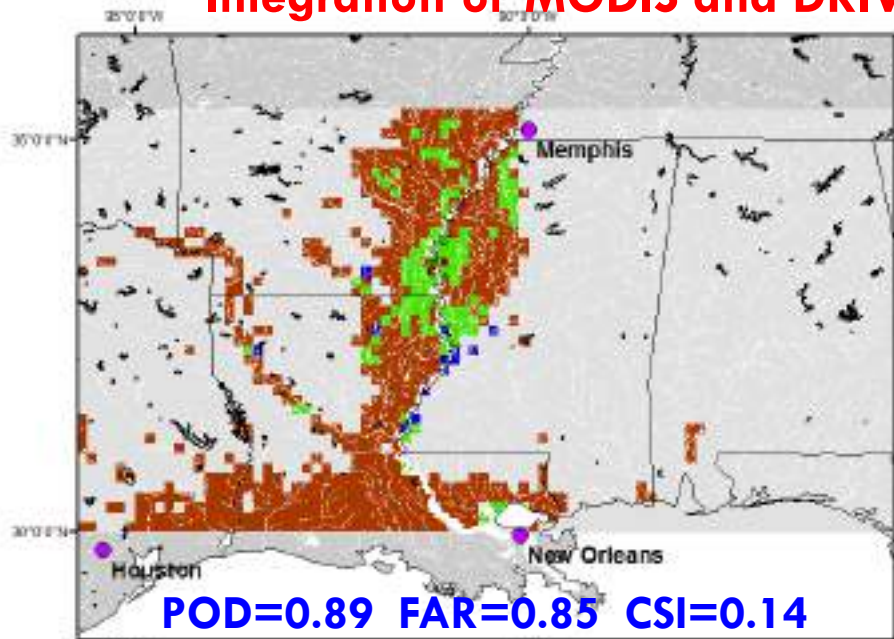
Modified MODIS flood mapping on Mar 16 (14-day combined)



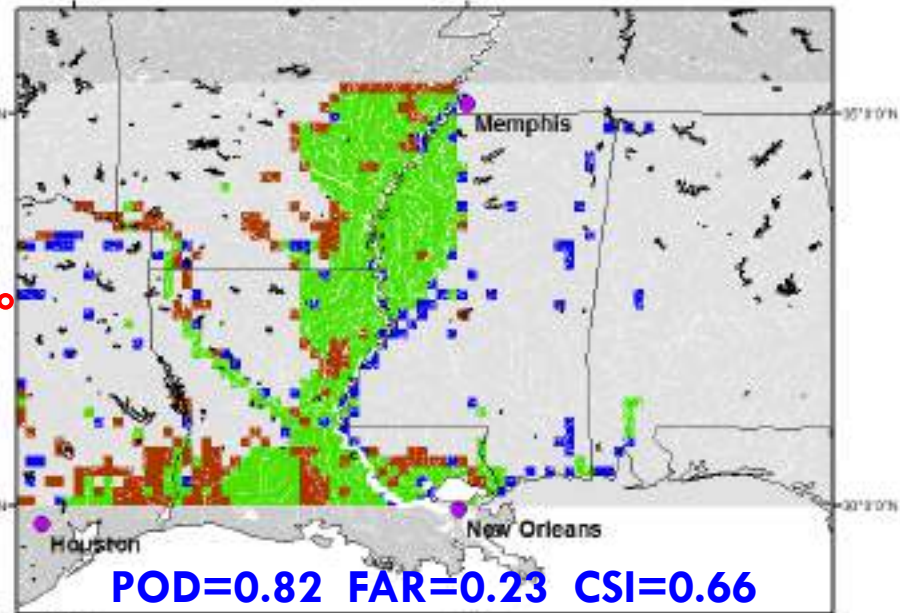
Inundation Fraction at 1/8th degree (%)



Integration of MODIS and DRIVE model based flood mapping



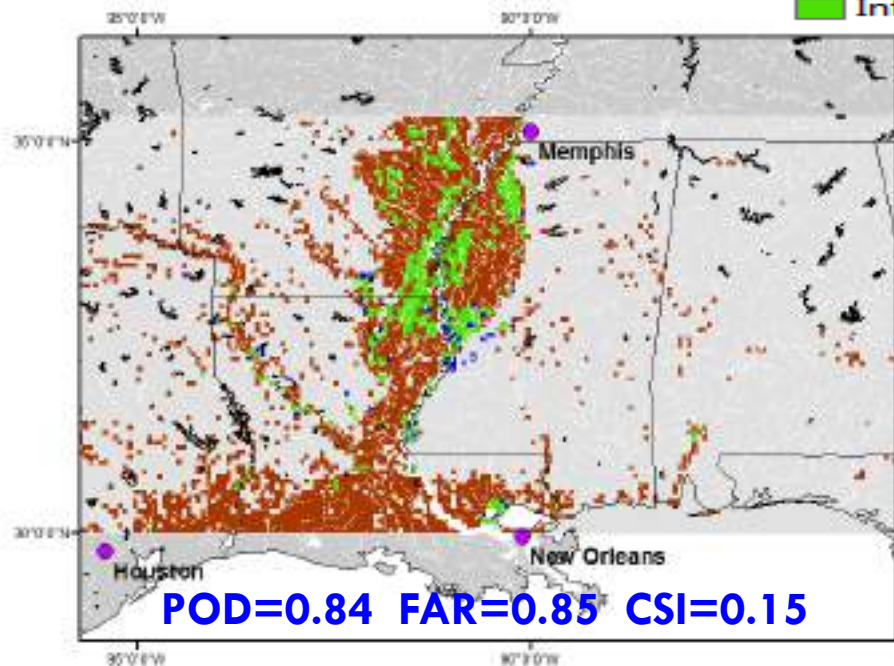
1/8°



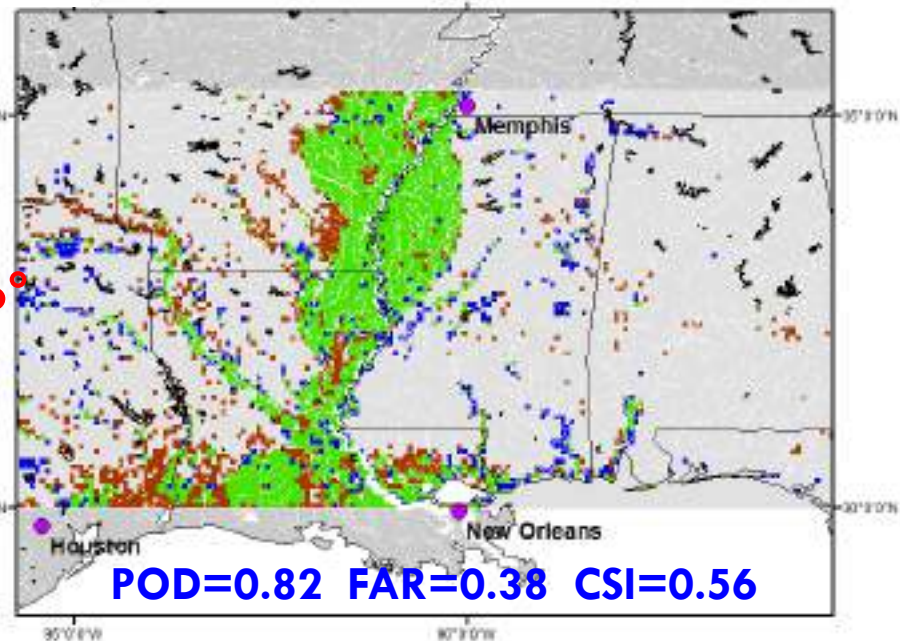
DFO MODIS

Modified MODIS

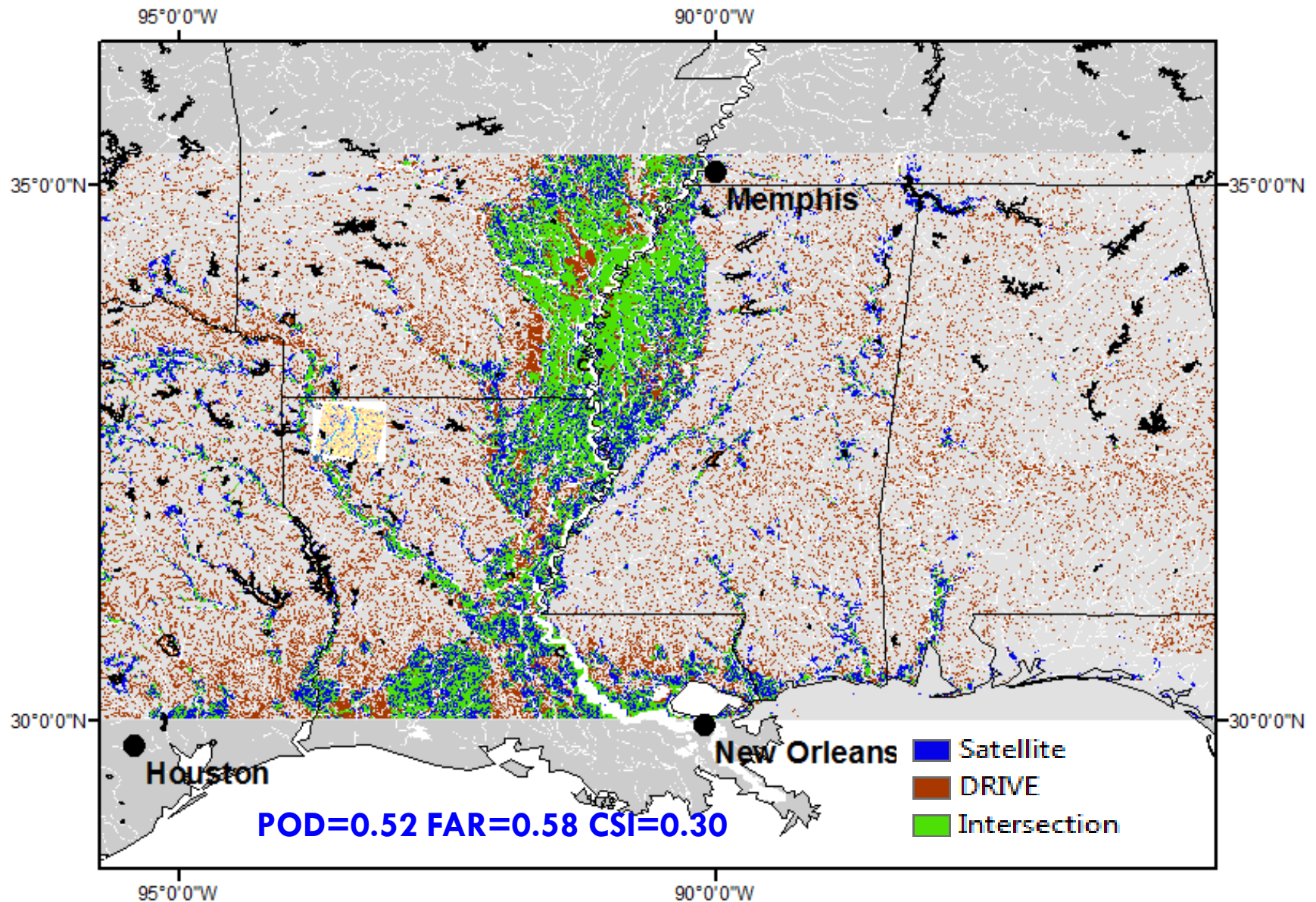
■ Satellite
■ DRIVE
■ Intersection



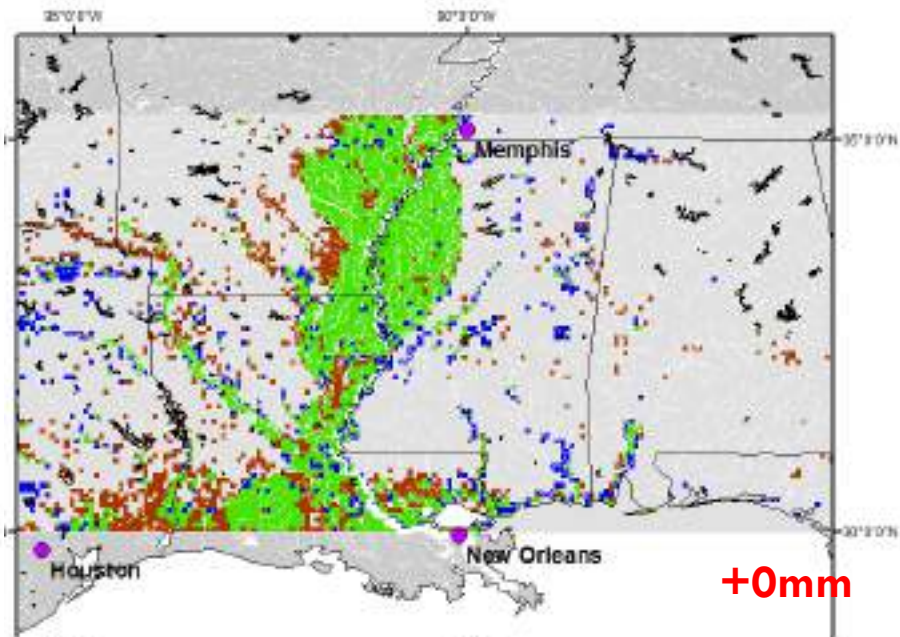
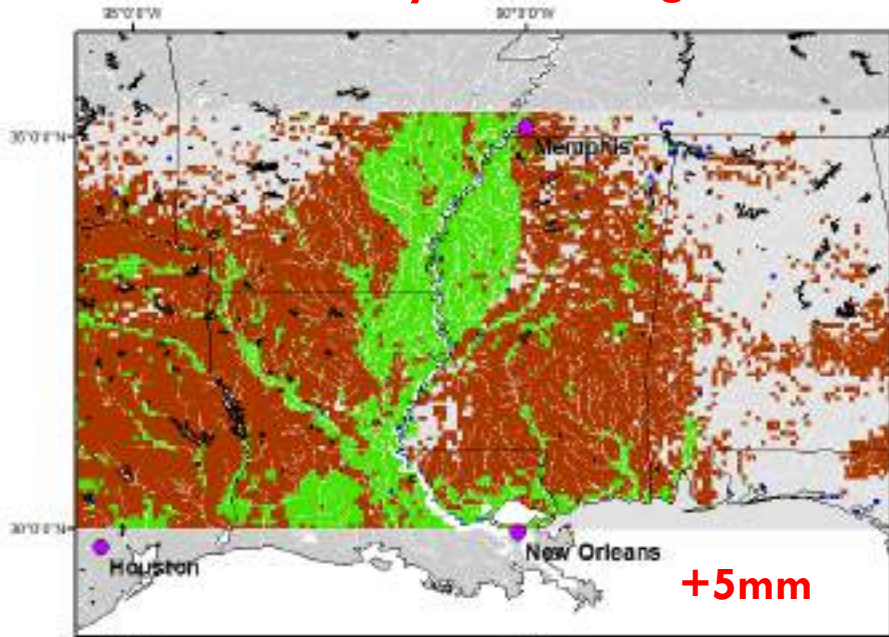
1/16°



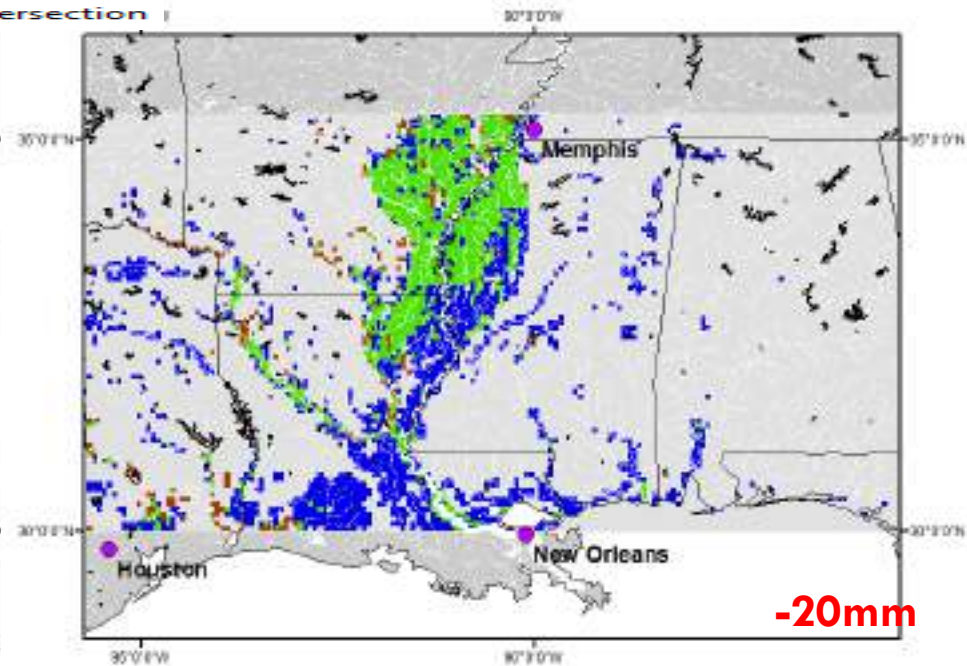
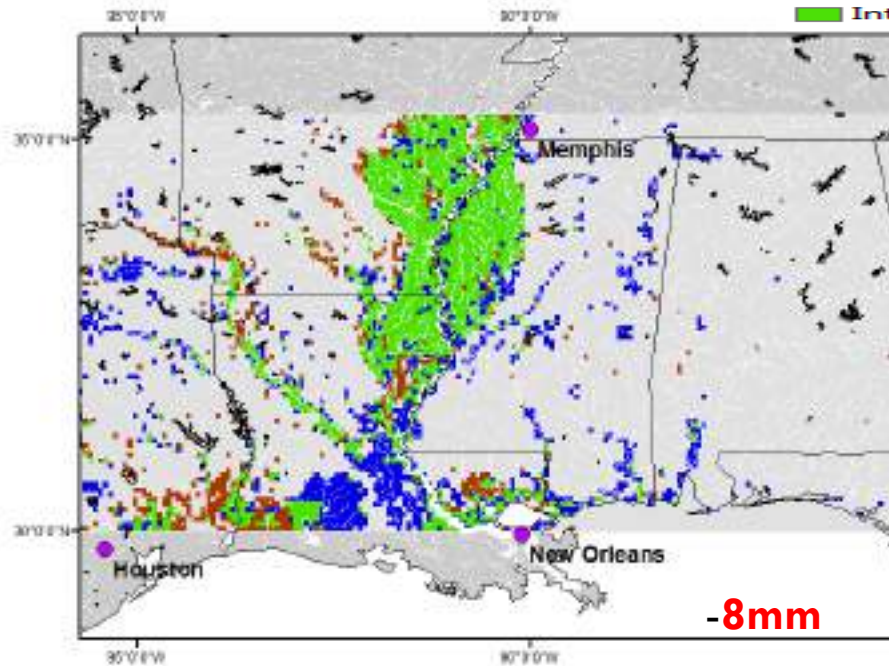
Integration of MODIS and DRIVE model based flood mapping @ 1km res.



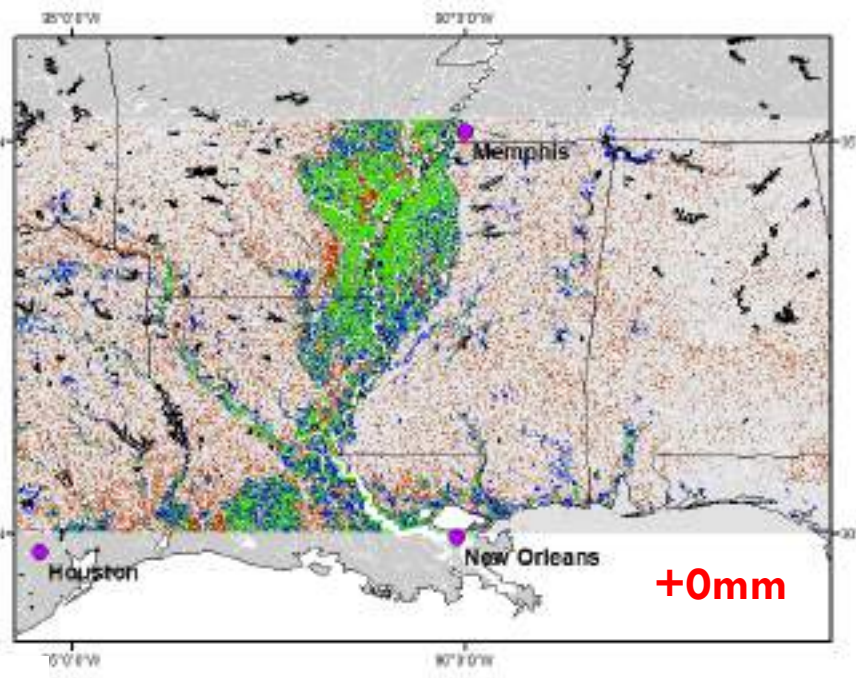
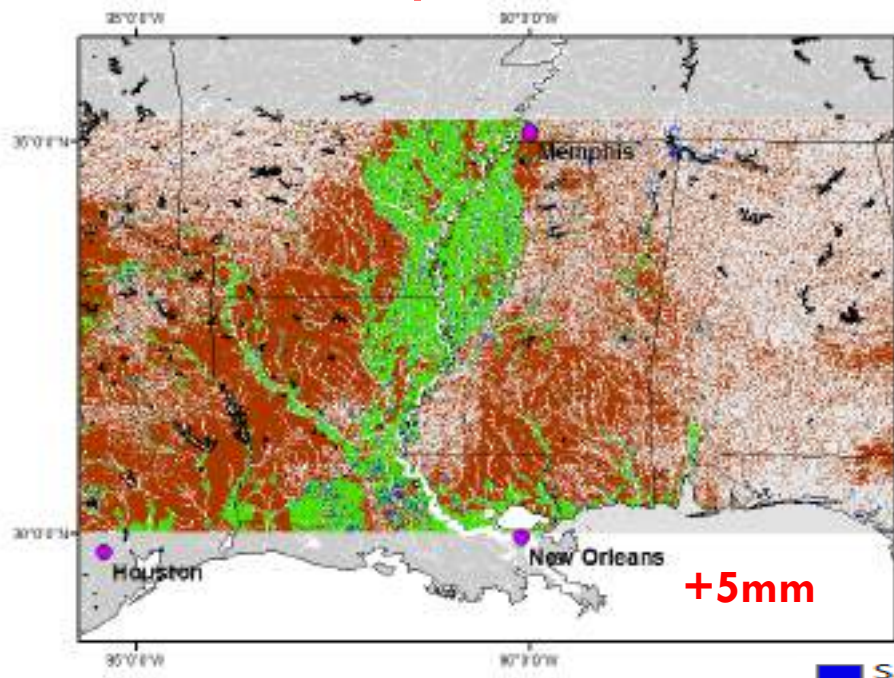
Sensitivity at 16th degree



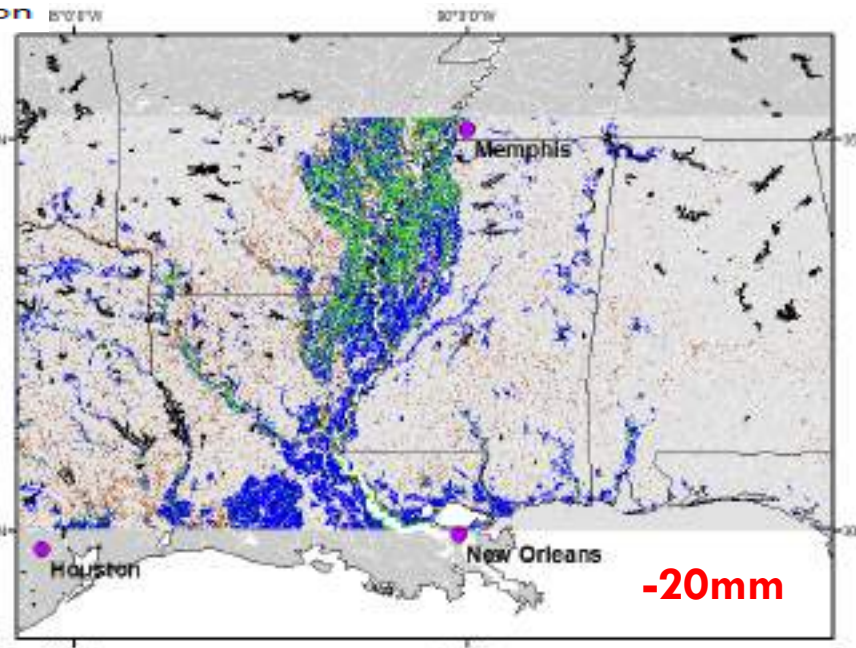
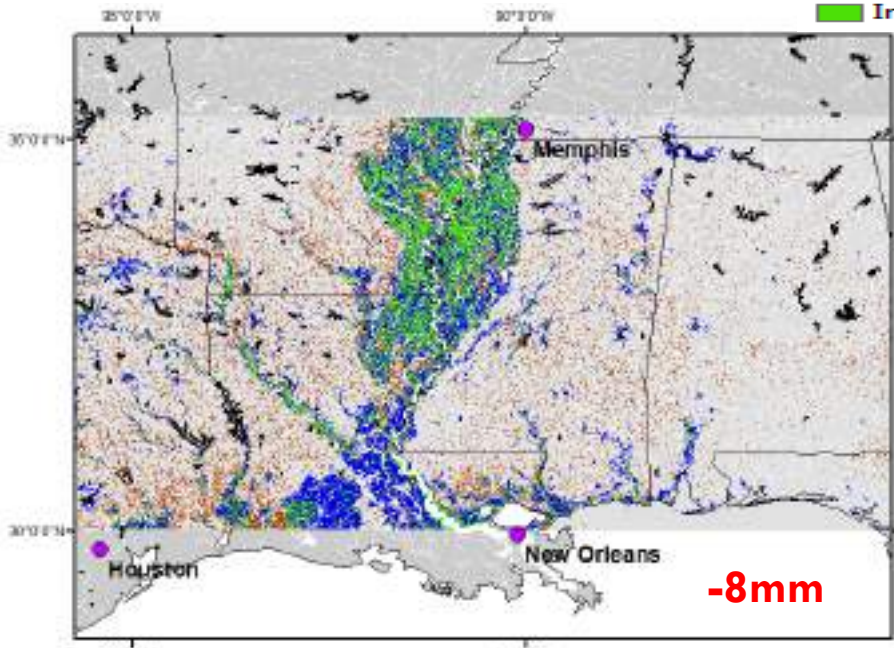
■ Satellite
■ DRIVE
■ Intersection



Sensitivity at 1km res.



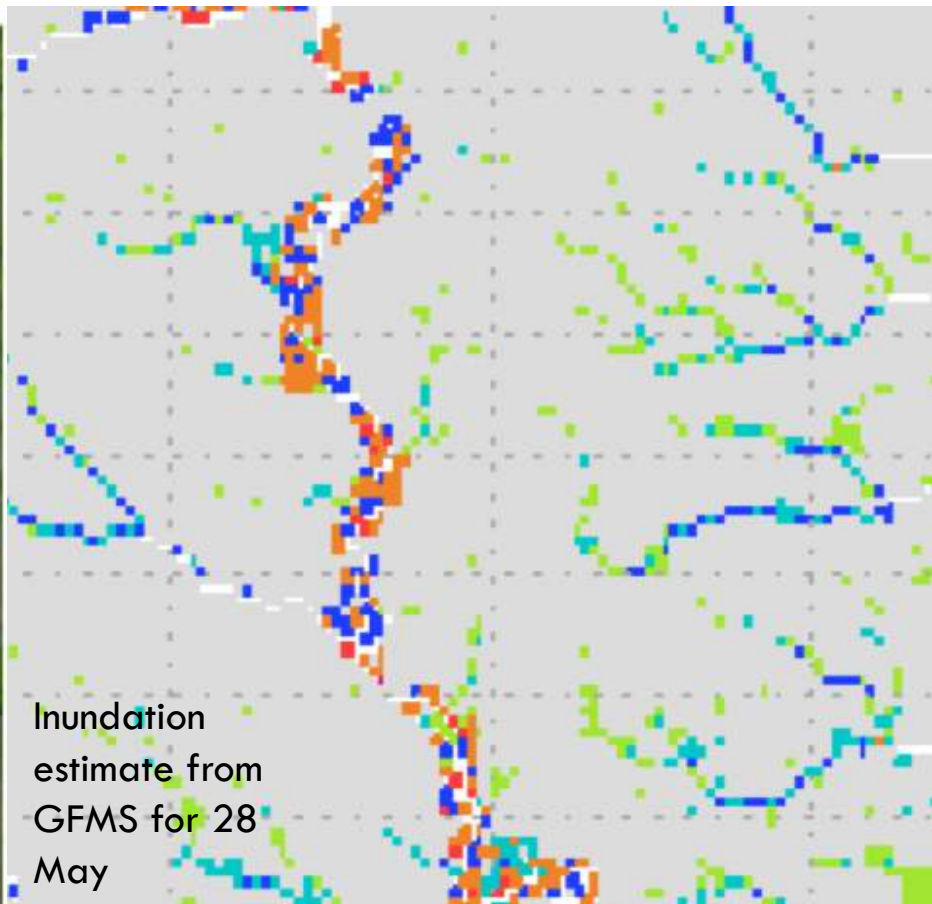
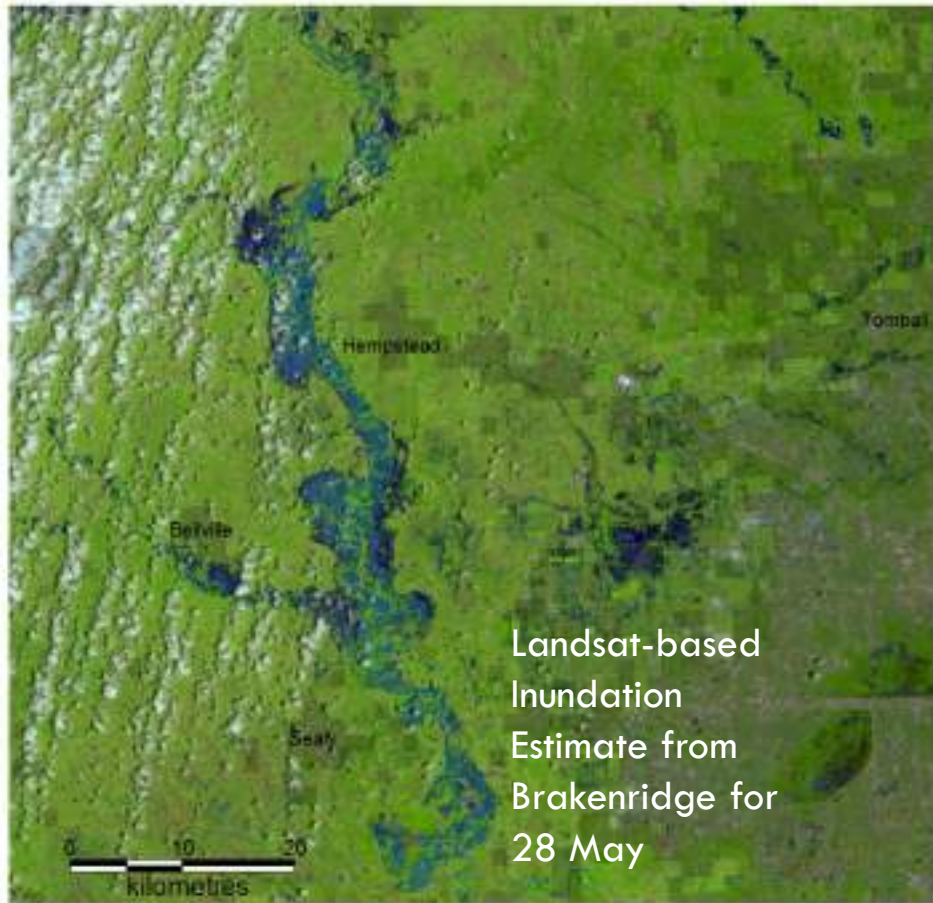
- Satellite
- DRIVE
- Intersection



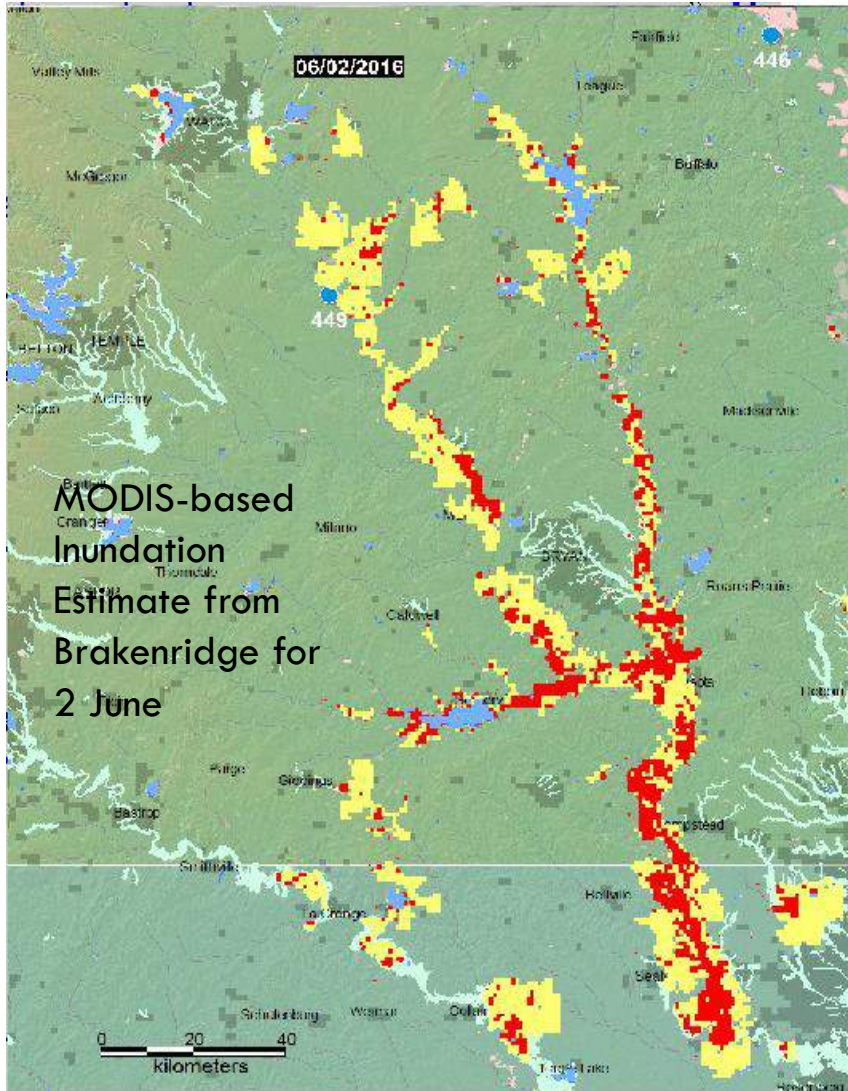
Main areas of flooding along Brazos show up in both optical-based inundation estimate and GFMS calculations

East Texas Flooding, May 28, 2016, from NASA/USGS Landsat 8 data.

Top: Multispectral color composite from 3 bands. Bottom: Blue is classified water. [Click here to access map data](#)

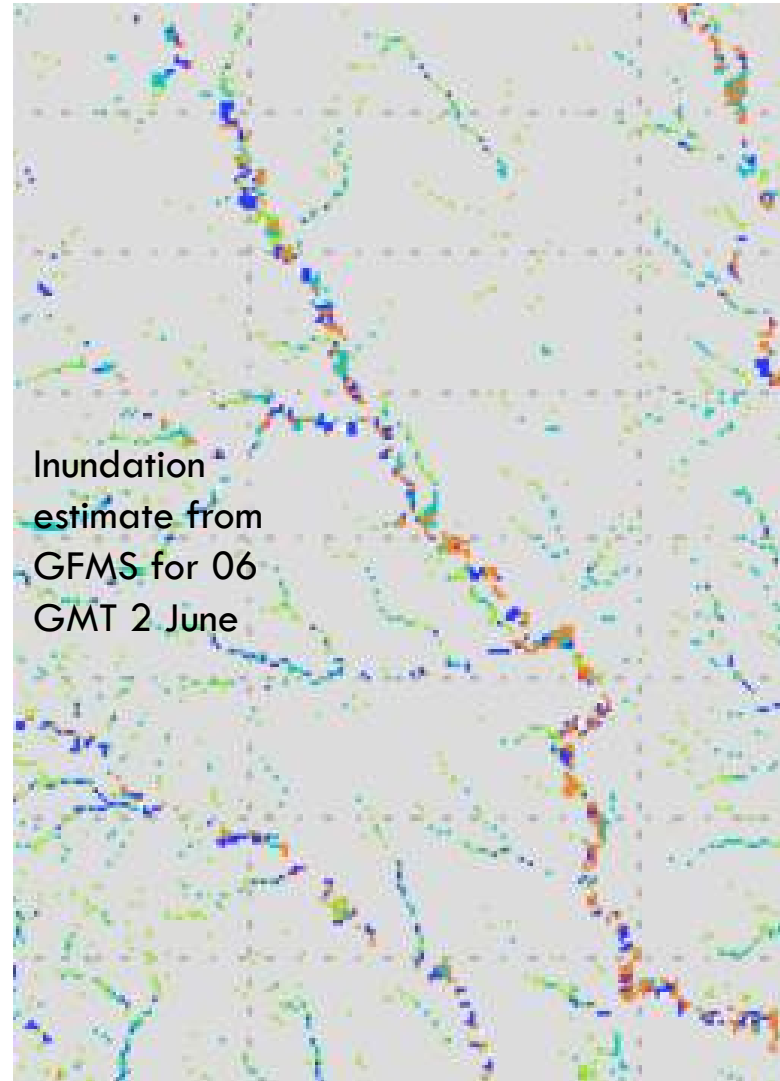


Some interesting similarities and differences between MODIS-based inundation estimate and GFMS calculation for 2 June. Main areas of flooding along Brazos show up in both, with some less flooded areas also agreeing—but still lots of differences, especially at fine scales.



MODIS-based
Inundation
Estimate from
Brakenridge for
2 June

Yellow: modified flooding area



Inundation
estimate from
GFMS for 06
GMT 2 June



Summary



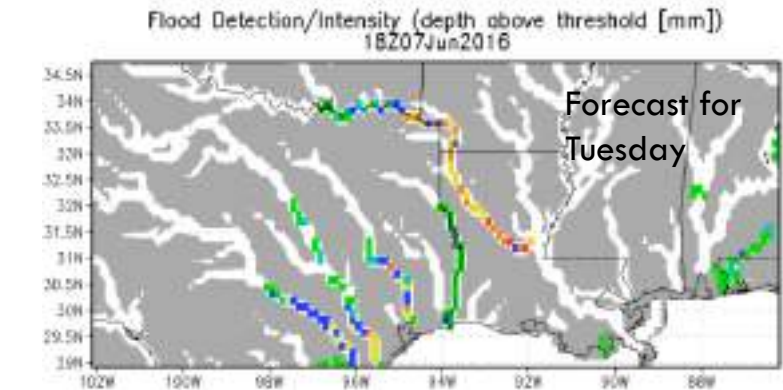
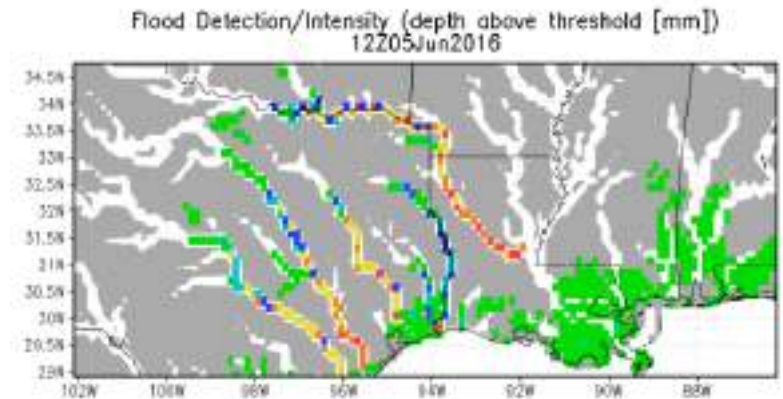
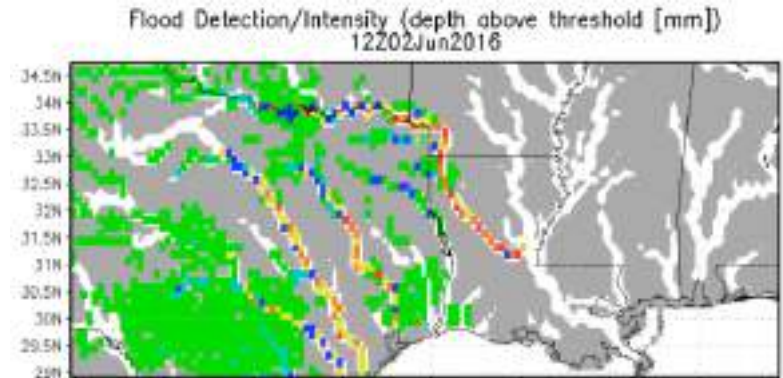
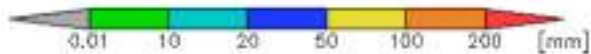
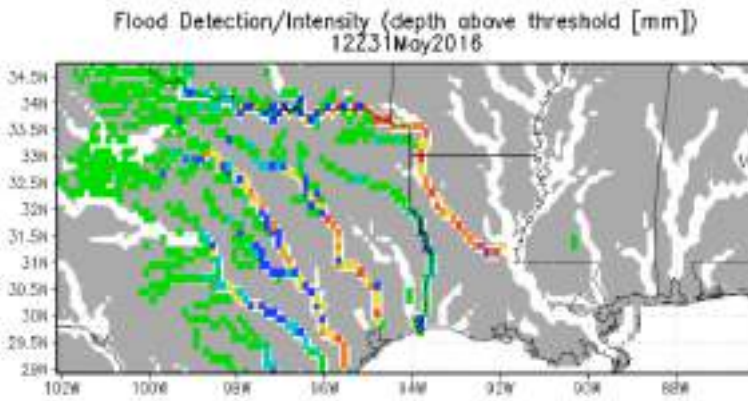
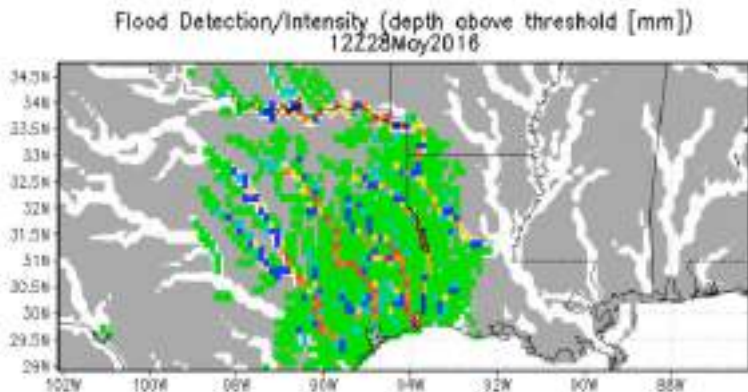
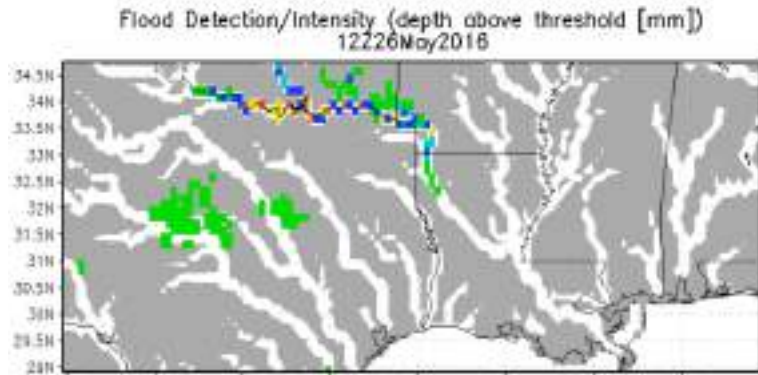
- (1) GFMS well detected the recent flood events over southern states of USA.
- (2) DEM based hydraulic modification of MODIS flood mapping seems positive in recovering the missing flooding areas while it assumes the validity of the identified inundation area by MODIS.
- (3) This kind of comparison can be the first step and very useful for integration of various satellite and hydrological model derived flood information.
- (4) The consistency in the satellite and modeled inundation extent is a function of spatial resolution, which indicates the values of the integrated flood mapping at various spatial resolutions.

Thank You!

Texas Floods Early June 2016

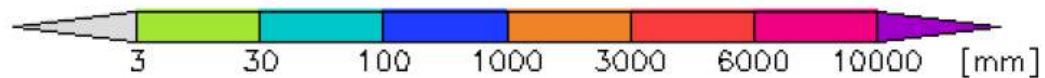
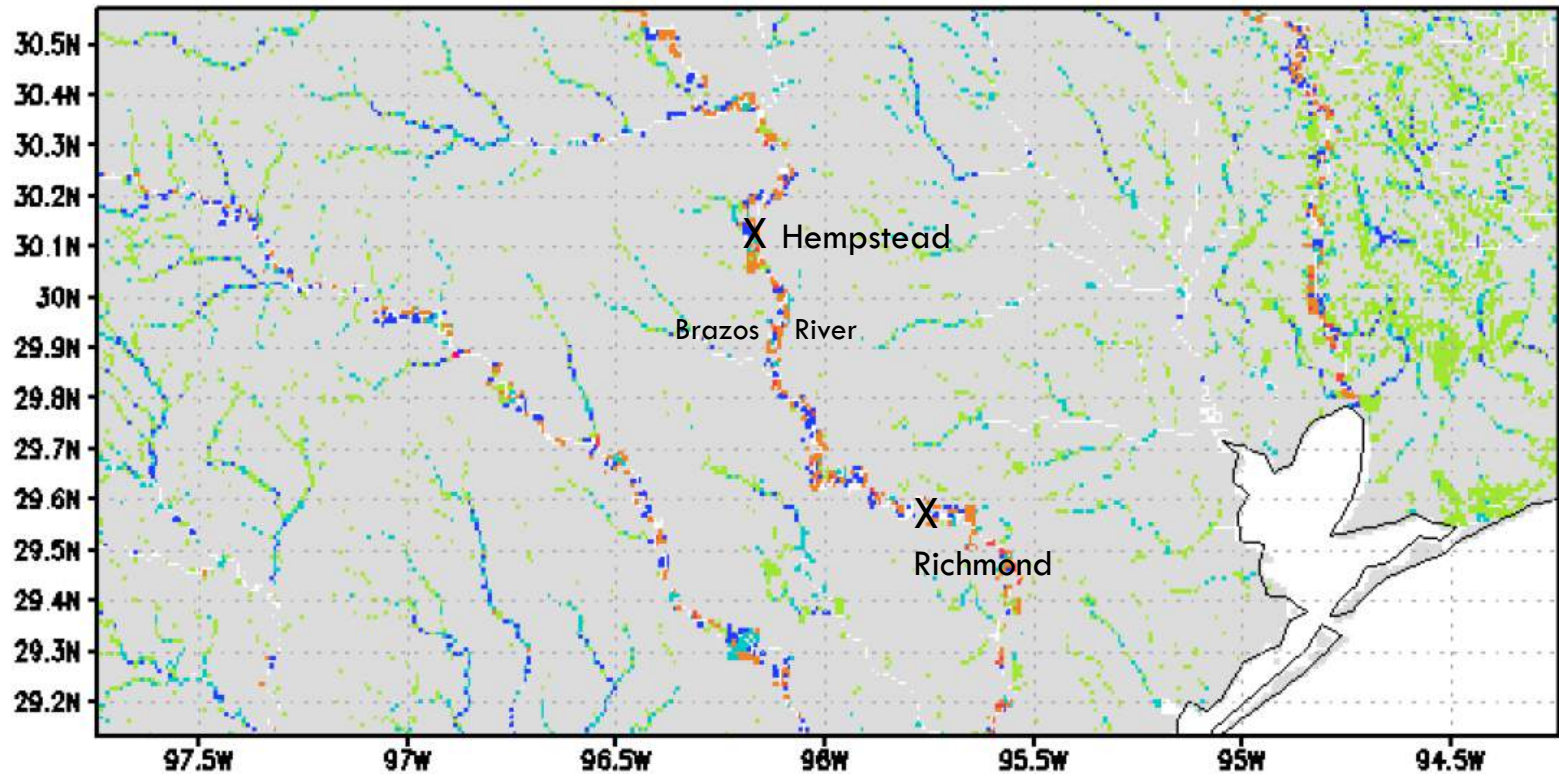
Global Flood Monitoring System (GFMS)

Adler/Wu UMD



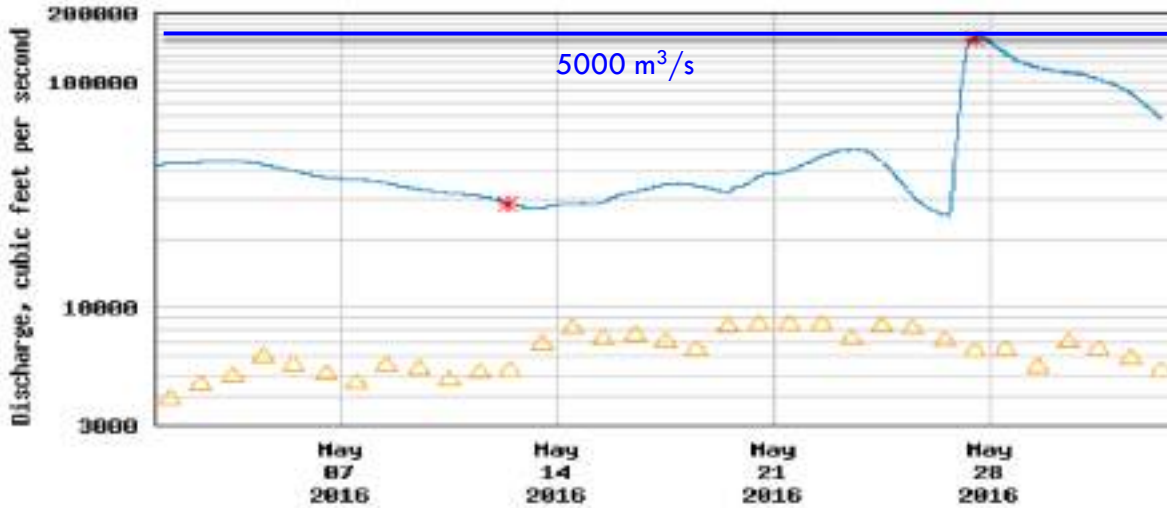
1 km Inundation Estimates

Inundation map 1km res. [mm]
09Z02Jun2016



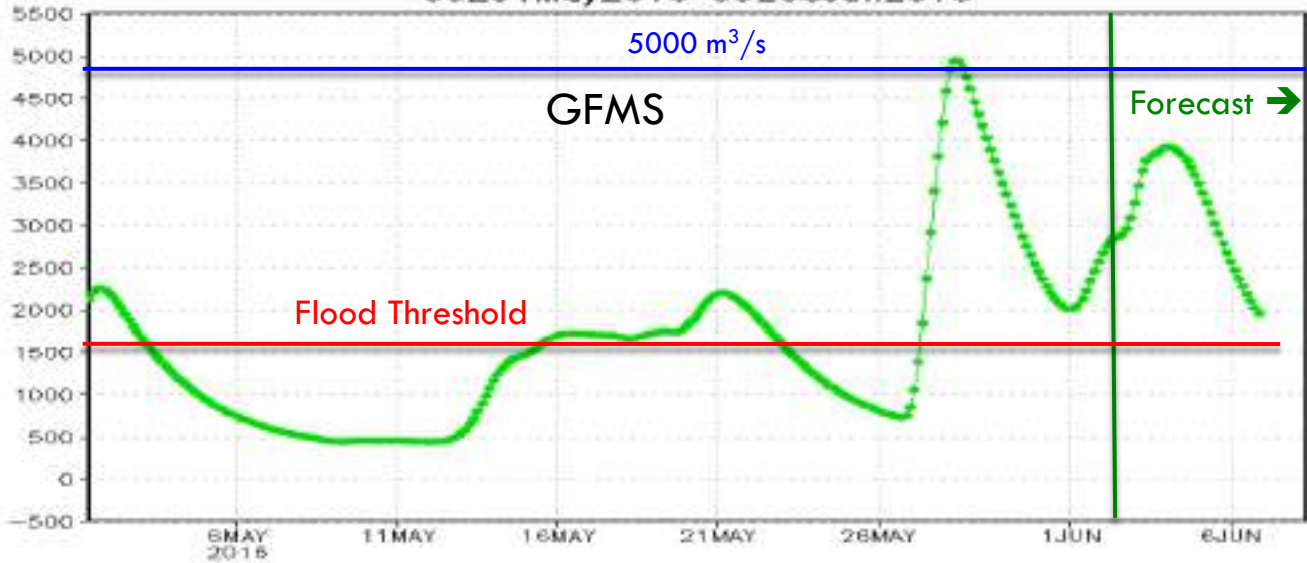
Streamgauge

USGS 80111500 Brazos Rv nr Hempstead, TX



GFMS calculated streamflow at Hempstead, TX streamgauge along Brazos River (31.10N, 96.08W) matches well in magnitude and timing, but shows larger dip over last day (different units, linear plot vs. log, and GMT vs. Local time). Forecast indicates another peak (not as big) in next couple of days.

Streamflow 12km res. [m³/s]
09Z01May2016 09Z03Jun2016



July 6, 2016

Inundation map 1km res. [mm]
18Z06Jul2016

