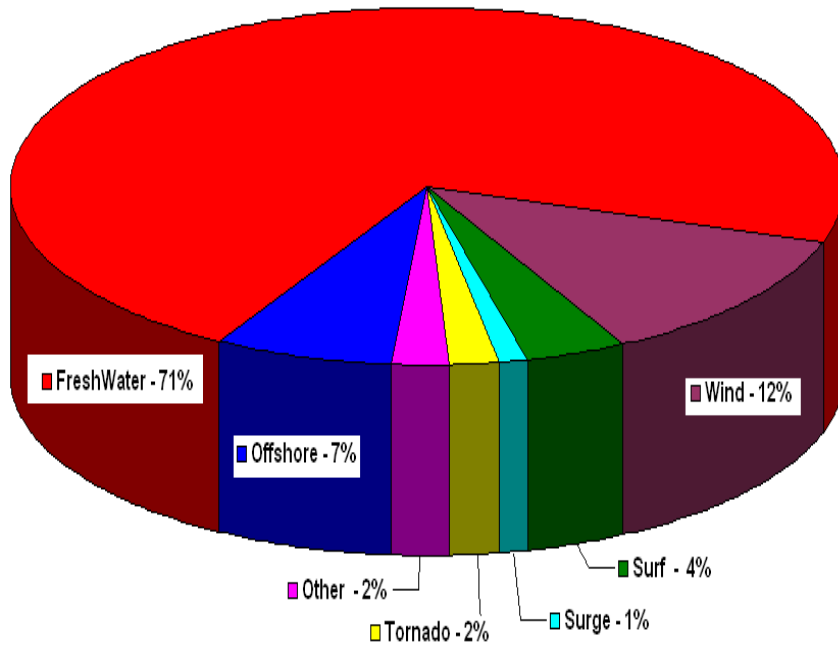


Test Results of Hurricane Related Inland Streamflow Forecasts

Yihua Wu and Mike Ek

NWS/NCEP/EMC
Camp Springs, MD

Cause of U.S. tropical cyclone-related deaths during 1970-99



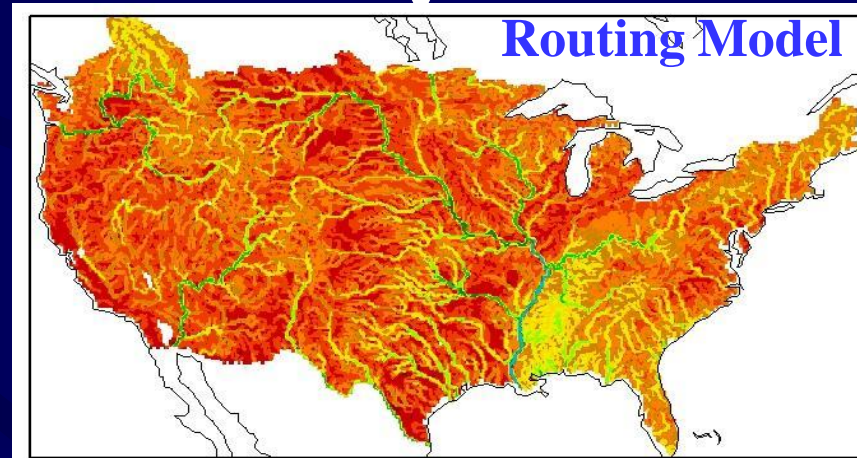
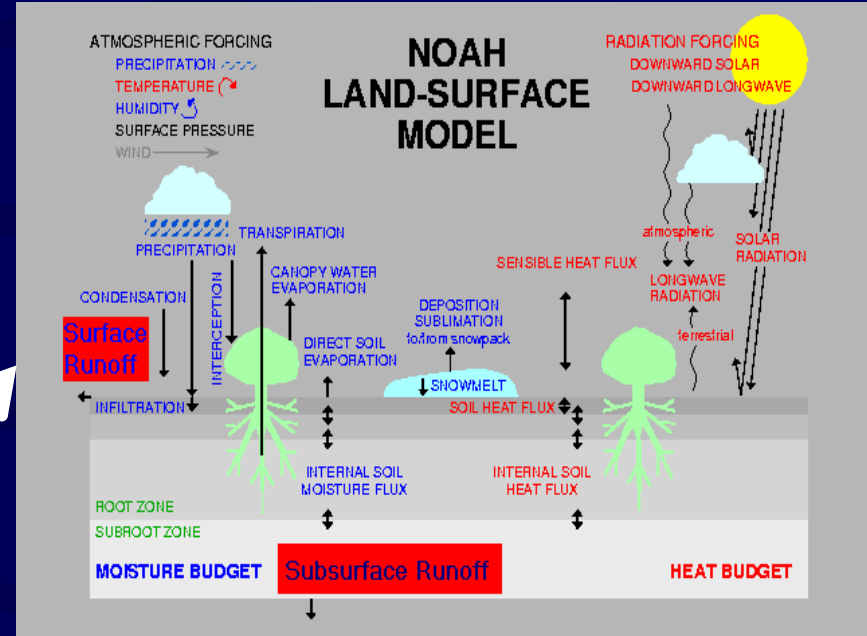
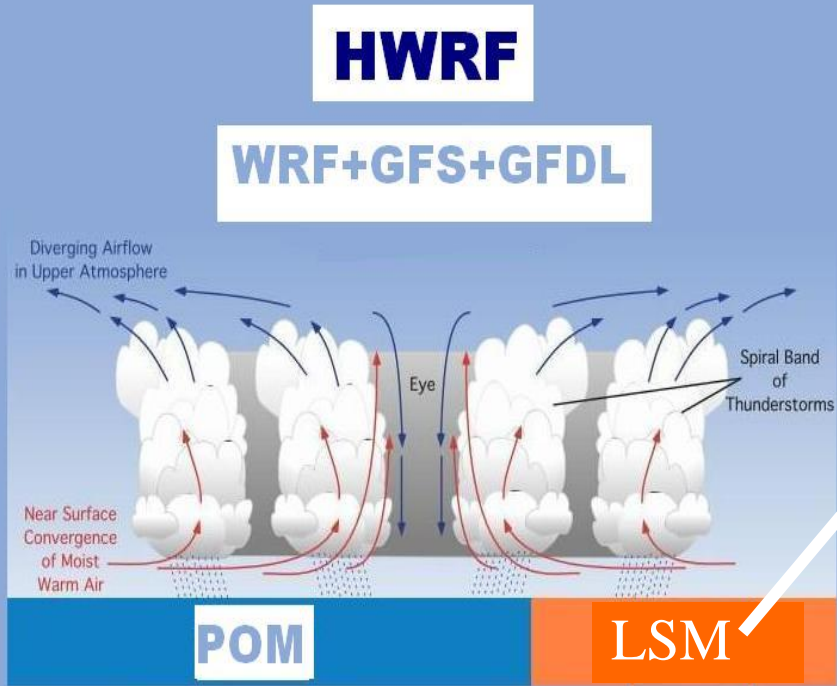
Reproduced from Table - 1 in Rappaport, 2000, Bull. Am. Meteorol. Soc.

Motivation:

- ❖ Hurricanes produce strong winds, storm surges and tidal flooding, tornadoes, and often the most deadly of all - inland flooding.
- ❖ Inland flooding accounts for the majority of U.S. hurricane-related deaths.

Objective: Develop a forecast technique for hurricane related inland flooding

Methodology



Driving Forcing: Surface runoff and baseflow

www.emc.ncep.noaa.gov/HWRP

Ek et al., 2003

Lohmann et al., 1998, 2004

Experiment Design

Study Case:

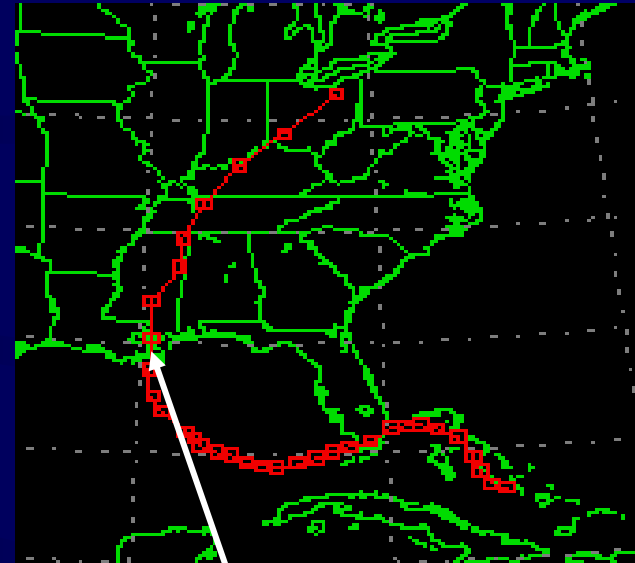
- Katrina was selected for study
- Initial time: 00Z 28 August 2005

Numerical Experiments:

- WET Run: initialized with GFS forecasting
- DRY Run: initialization is the same as in WET run except soil moisture, NAM soil moisture is used instead

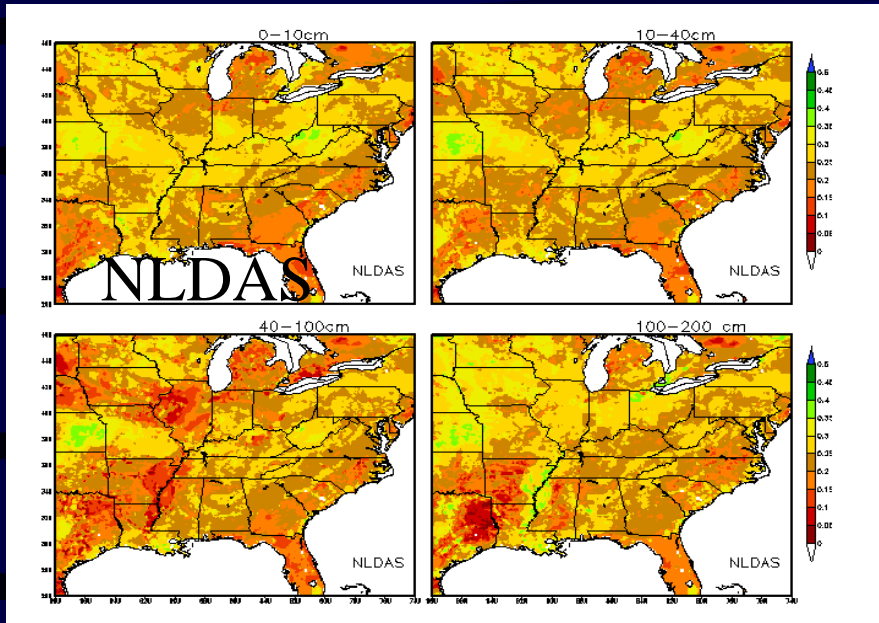
Streamflow Simulation

- NLDAS stream flow analysis is used as the initial condition
- NLDAS streamflow analysis and USGS daily measurements are used for verification



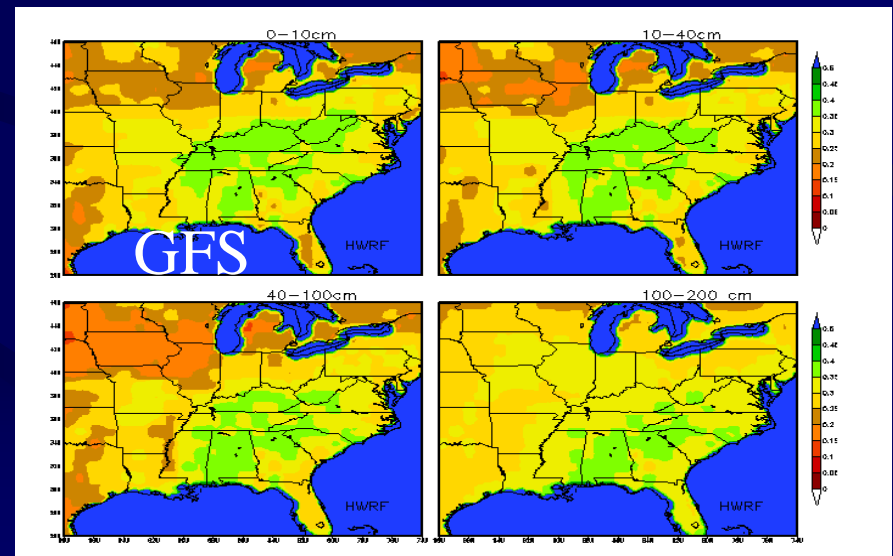
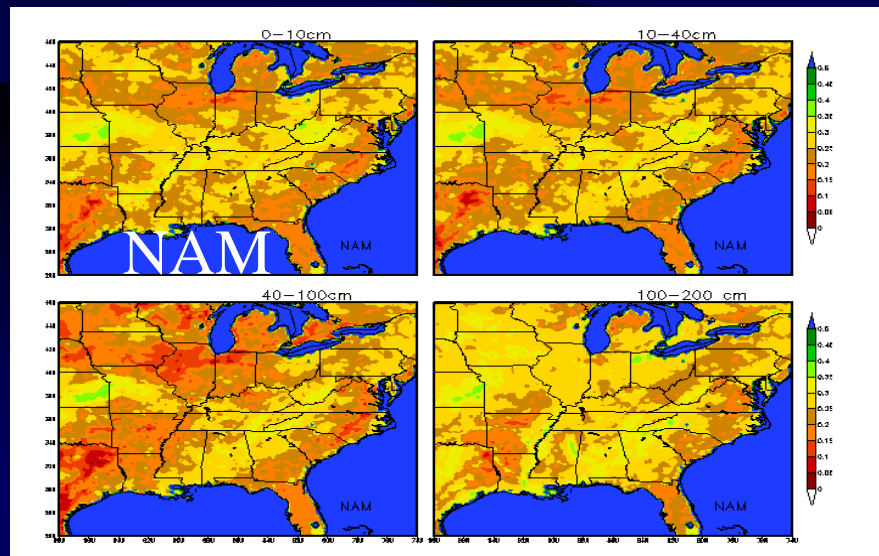
Landfall Time:
6:10 a.m. CDT,
Aug 29, 2005

4 Layer Soil Moisture at 00Z AUG 28, 2005 from LDAS Analysis, NAM and GFS Outputs

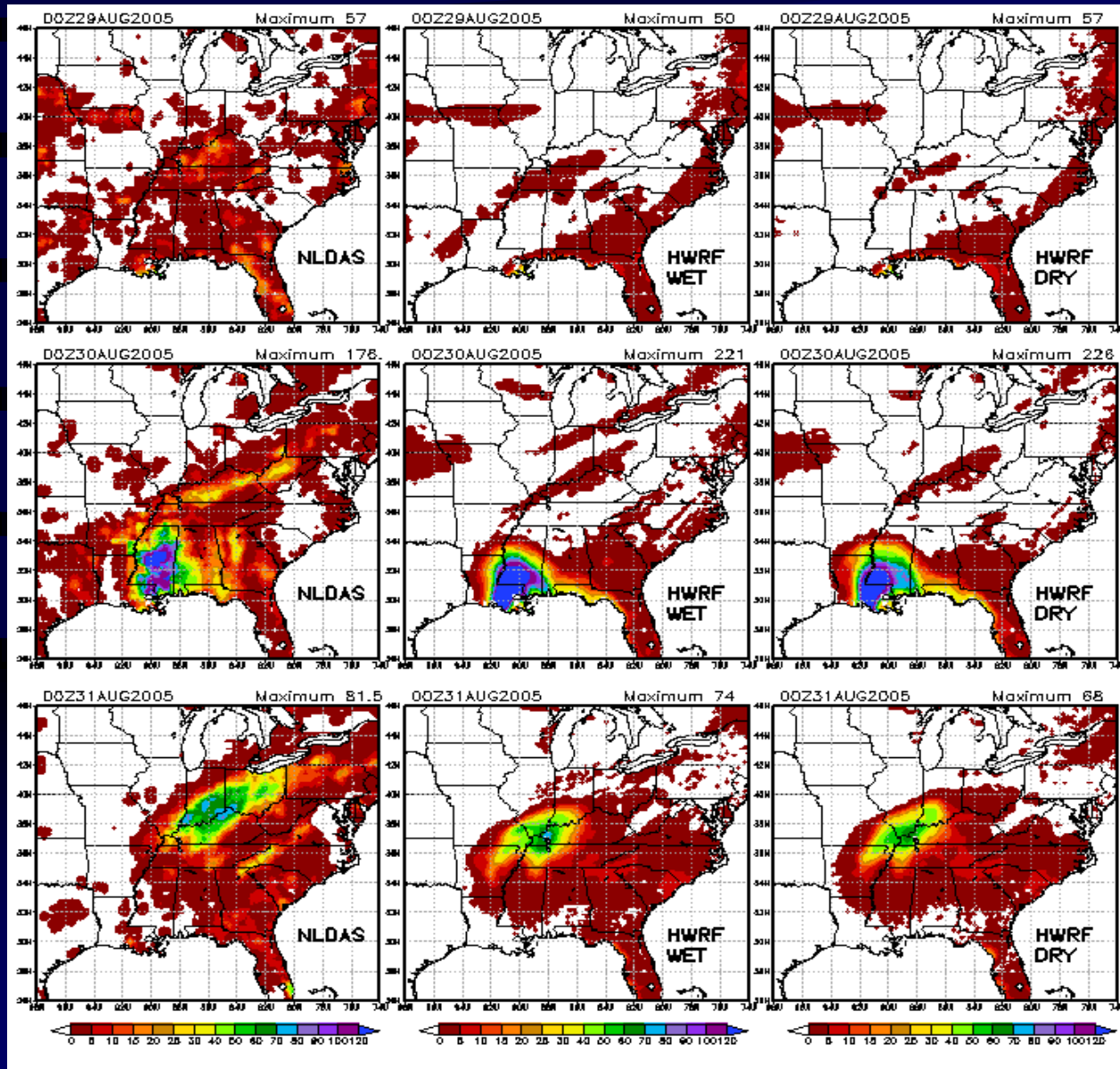


Soil moisture for NLDAS and NAM are driven by observed precipitation.

GFS soil moisture is driven by GDAS predicted precipitation, plus nudging to a monthly soil moisture climatology.

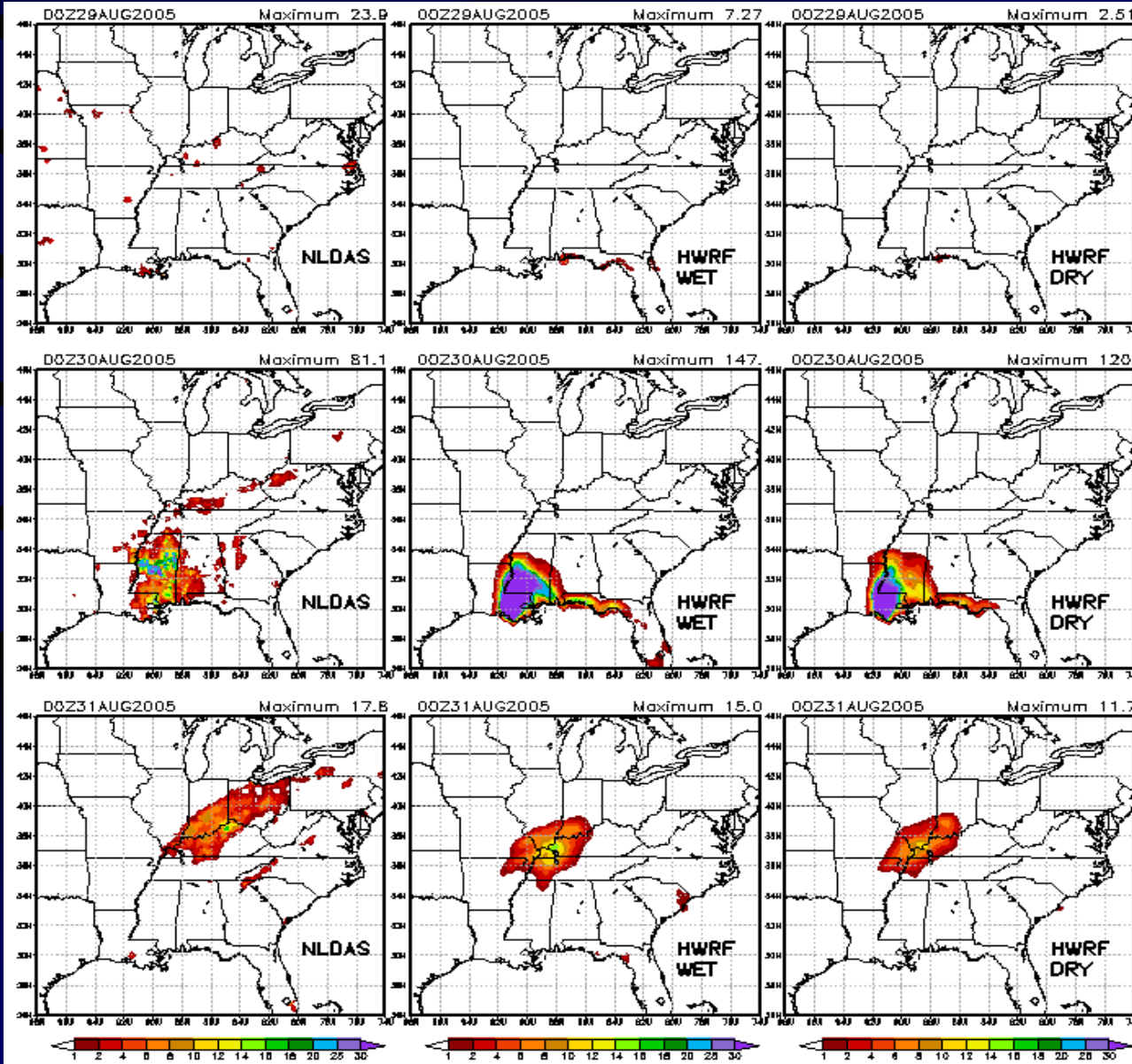


12-h Accum Rainfall (mm) at 00Z, Aug 29, 30 & 31, 2005 from Observation and WET Run and DRY Run



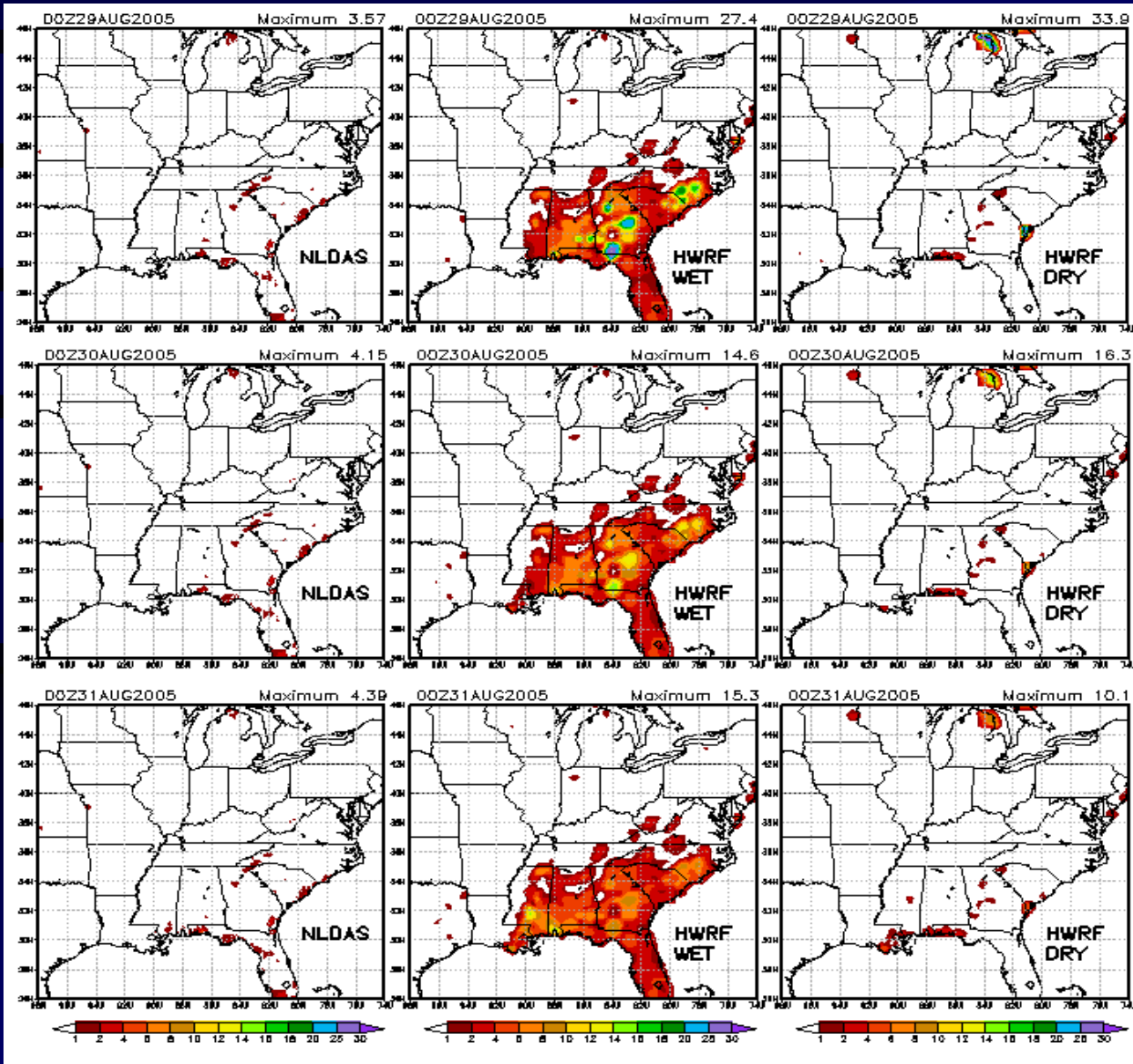
1. Katrina brought a lot rainfall to the land, causing severe inland flooding
2. Rainfall in WET run is very similar to that in DRY run

12-h Accum Surface Runoff (mm) at 00Z Aug 29, 30 & 31, 2005 from NLDAS, WET Run and DRY Run



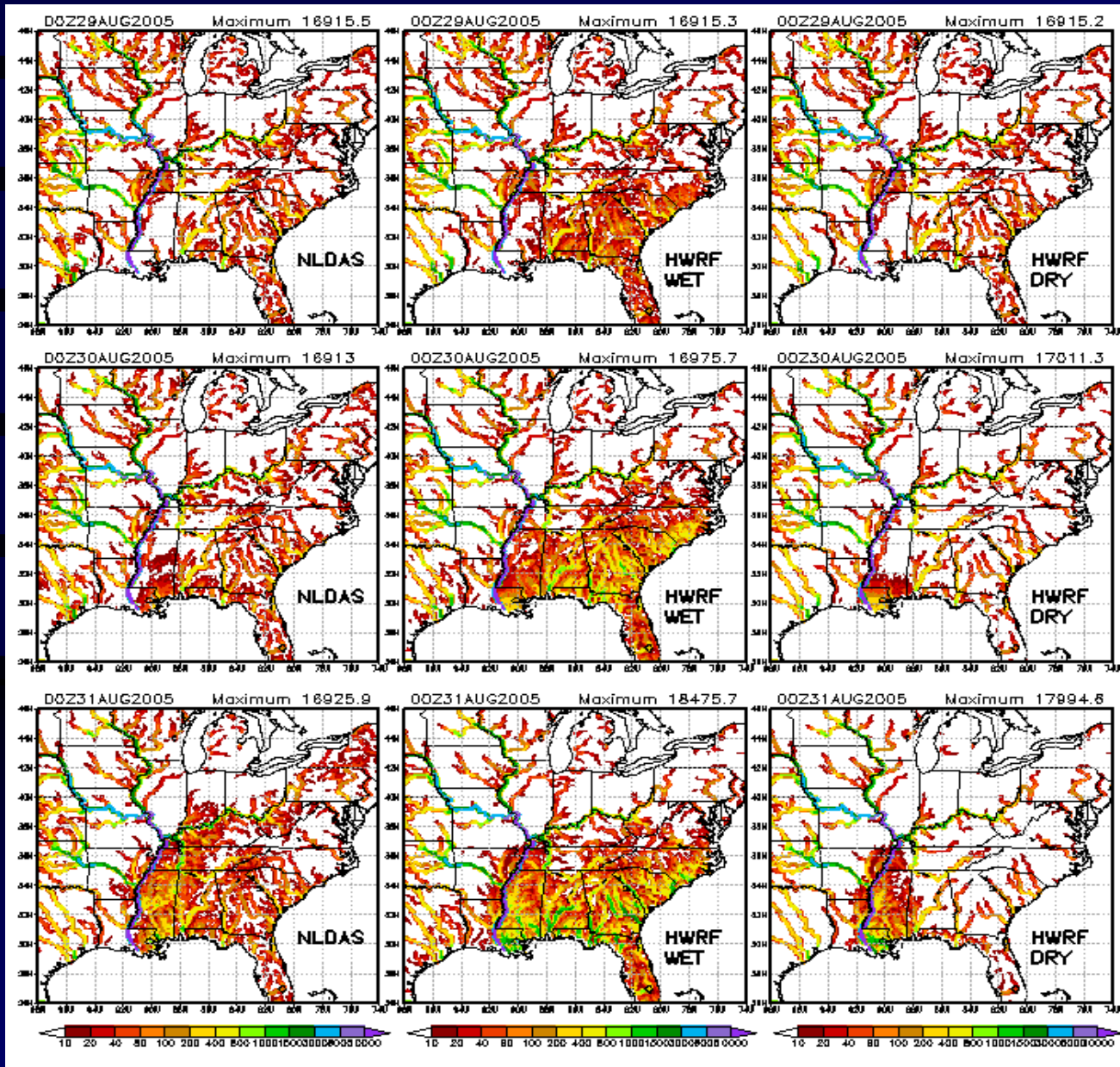
1. Simulated surface runoff in both runs are much stronger than NLDAS analysis over the LA coast
2. Difference between WET run and DRY run is very small

12-h Accum Baseflow (mm) at 00Z Aug 29, 30 & 31, 2005 from NLDAS, WET Run and DRY Run



- Much more Baseflow in WET run than in DRY run and NLDAS analysis
- Baseflow in DRY run is comparable to NLDAS analysis

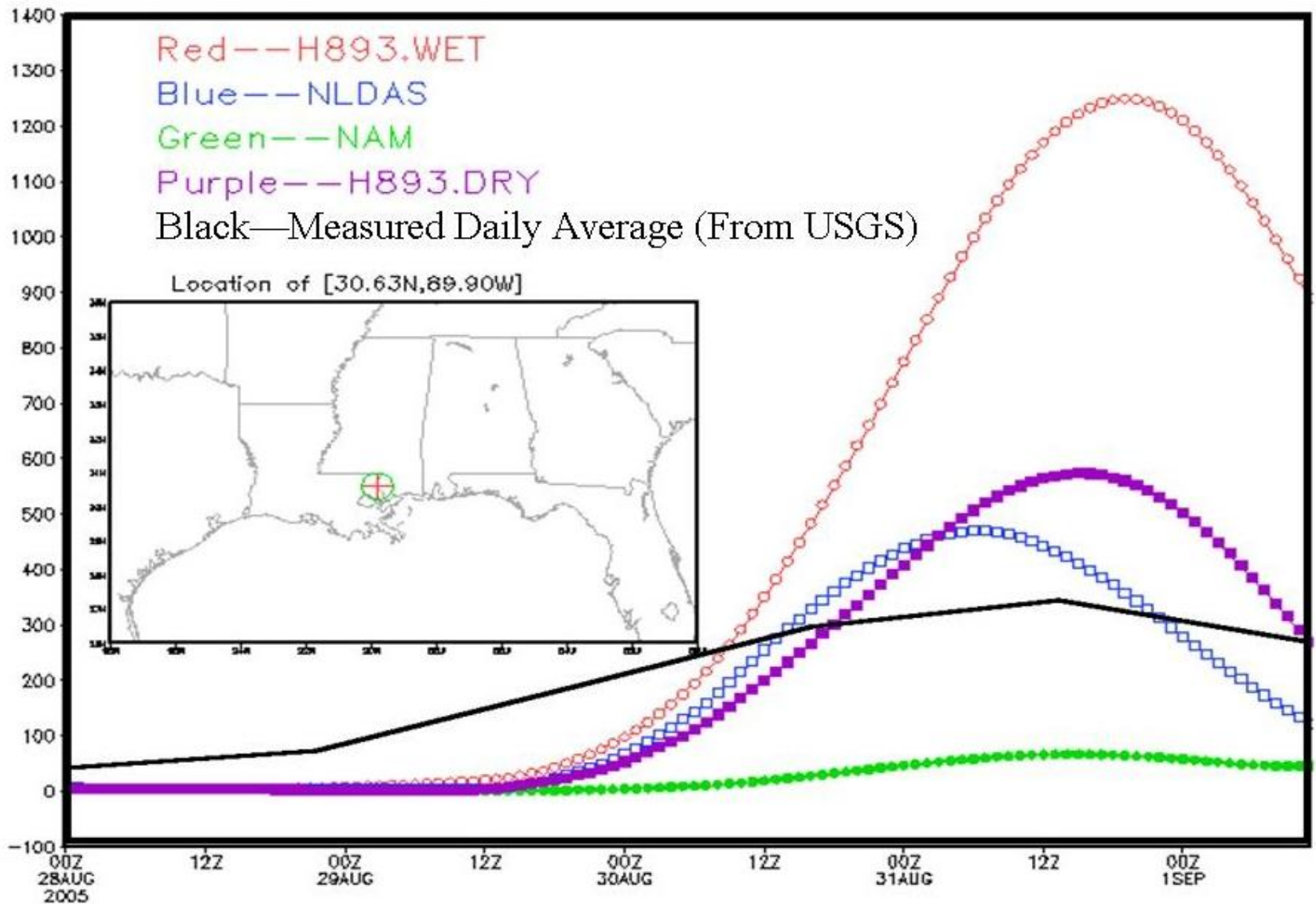
Forecasted Stream Flow ($\text{m}^3 \text{s}^{-1}$) at 00Z Aug. 29, 30 & 31, 2005 from NLDAS, WET Run and DRY Run



1. More streamflow in WET run than in DRY run and NLDAS analysis.

1. Streamflow in DRY run is comparable to NLDAS analysis.

Stream flow At 30.63N and 89.90W



IMAGERY COURTESY: CIMSS/SSEC



29 AUG 2005 - G-12 IMG - 01:15:00UTC

Summary

- A hurricane related inland streamflow forecast technique developed.
- HWRF-Noah forecasted runoff as well as the forecasted stream flow is sensitive to the initial soil moisture
- Stream flow forecasted from the HWRF-Noah predicted runoff is more realistic with NAM soil moisture as the initial field.
- More tests and validations will be conducted.