Operations, and Operational Modeling of Bayou Vermilion

Bayou Vermilion Conference
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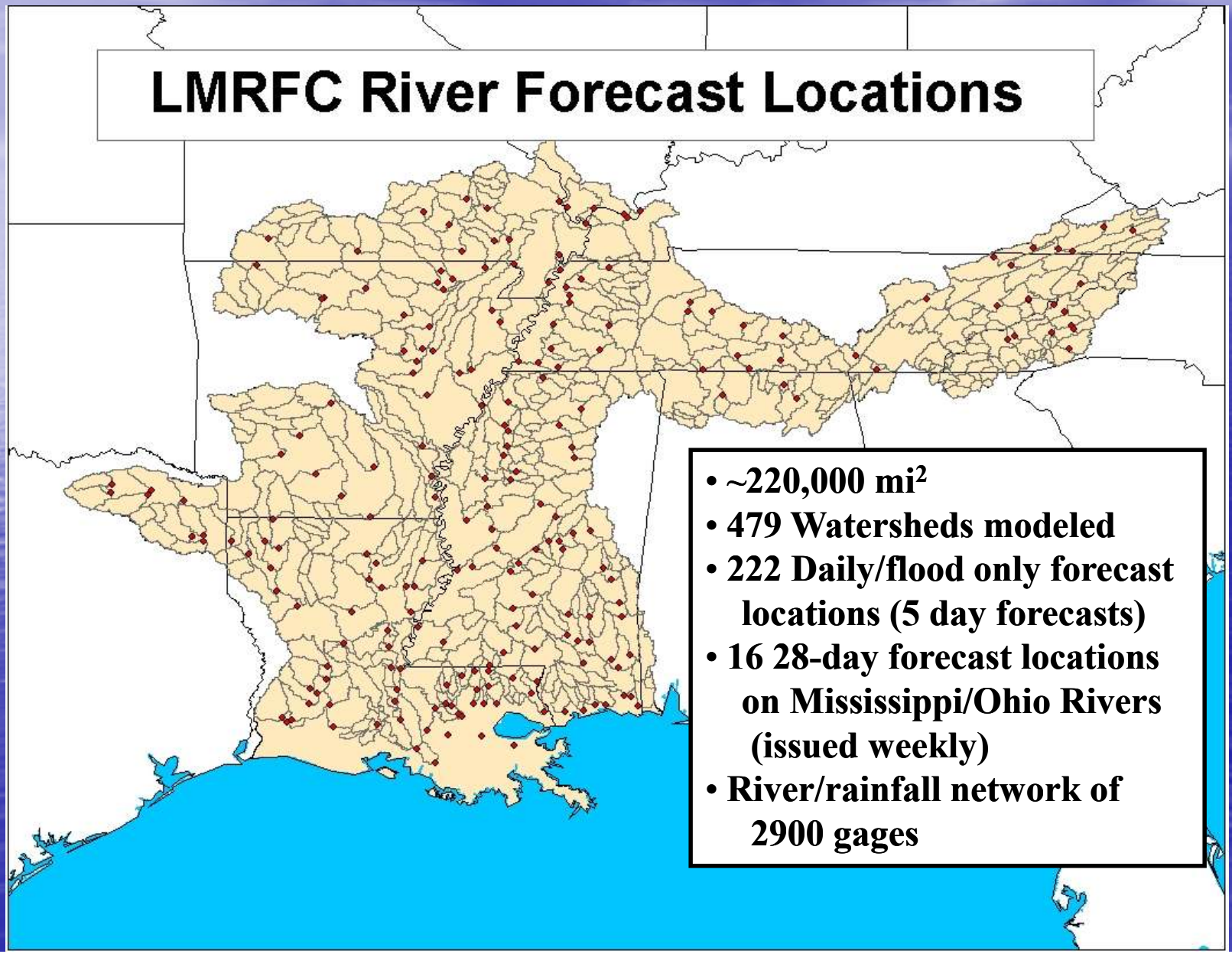
Area of Responsibility



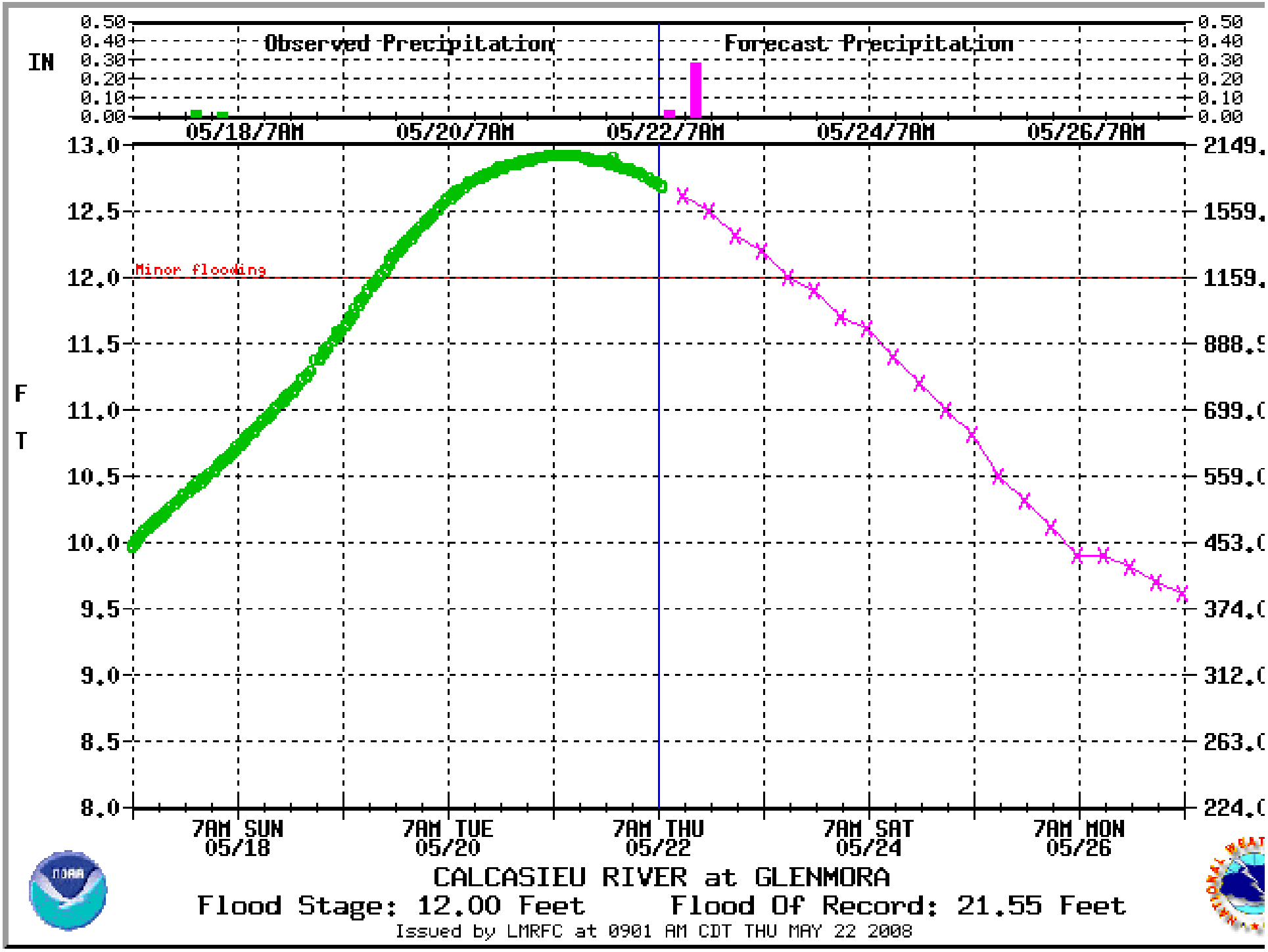
Hydrologic Operations

- Prepare and disseminate river/flood forecasts and other hydrometeorological guidance
- Maintain a close 16-hour hydromet watch and a full 24-hour watch when necessary
- Coordinate/service – Weather Forecast Offices, intra/inter agencies (COE, USGS, FEMA), state EMAs (LOEP, MEMA, TEMA) and state river authorities (TVA).
- Maintain - expand - enhance RFC hydrologic models

Approximate Workload

60% operations

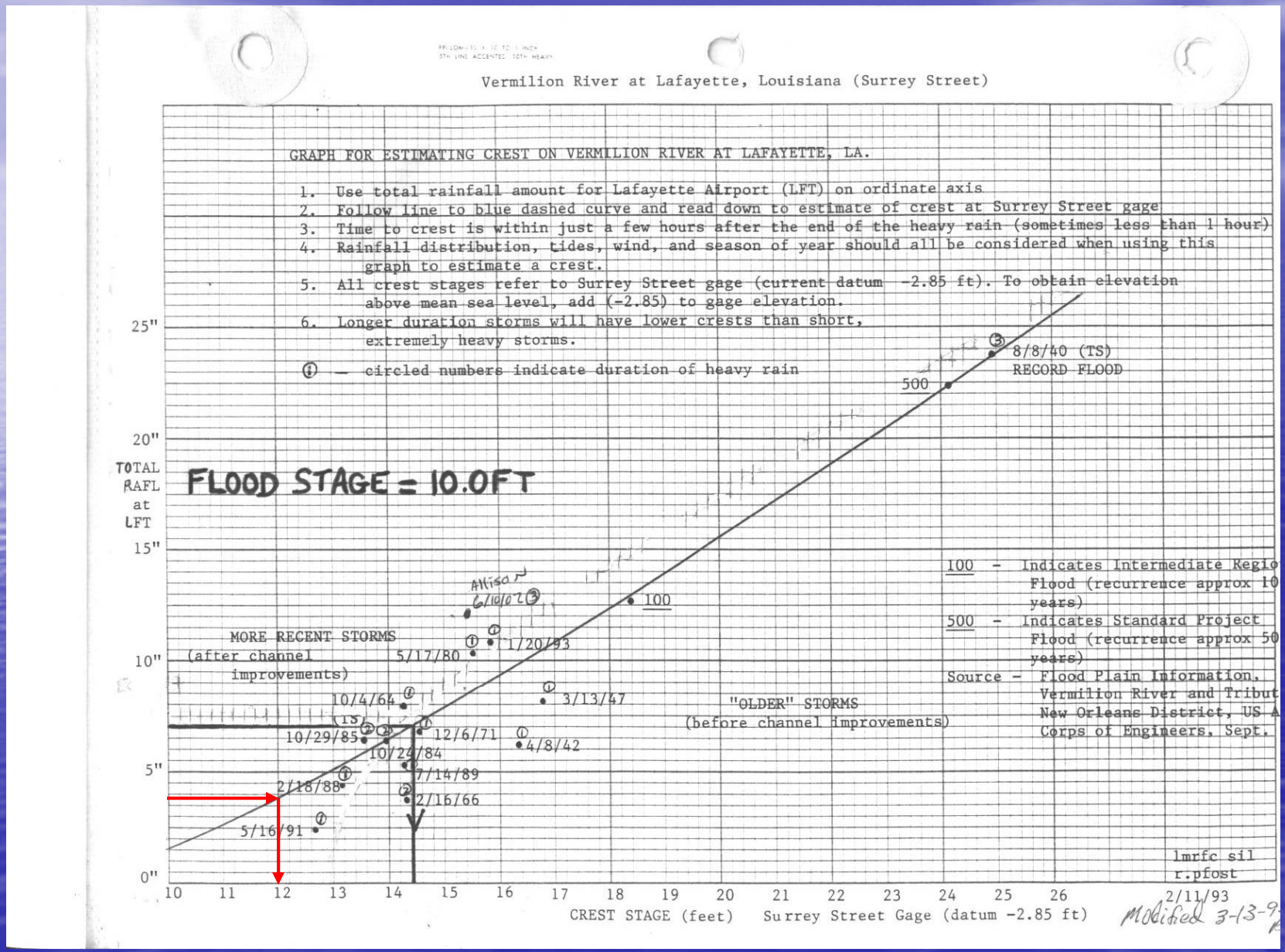
40% development


Observed Precipitation
Forecast Precipitation
IN
0.50
0.40
0.30
0.20
0.10
0.00
05/18/7AM
05/20/7AM
05/22/7AM
05/24/7AM
05/26/7AM
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
F
T
Minor flooding
2149.
1559.
1159.
888.9
699.0
559.0
453.0
374.0
312.0
263.0
224.0
7AM SUN 05/18
7AM TUE 05/20
7AM THU 05/22
7AM SAT 05/24
7AM MON 05/26
CALCASIEU RIVER at GLENMORA
Flood Stage: 12.00 Feet
Flood Of Record: 21.55 Feet
Issued by LMRFC at 0901 AM CDT THU MAY 22 2008

LMRFC Bayou Vermilion Forecast Tools

- Manual Methods
  - MAP Crest Curve/Headwater Tables
- NWS Site Specific Model
  - SAC-SMA/Kansas City API
- NWSRFS Hydrologic Model
- NWS FLDWAV
- USACE HEC-RAS

Manual Methods – MAP Crest Curve



Manual Methods – Headwater Table

- Keys off NWS Flash Flood Guidance (FFG)
- Use FFG with Precipitation to estimate crest

Lower_Mississippi_River_Forecast_Center
Station Name VERMILION
River Name SURREY STREET, LA

Flood stage= 10.0 ft.
Use Flash Flood Guidance from Zone LA2044
Gage height in feet above gage zero

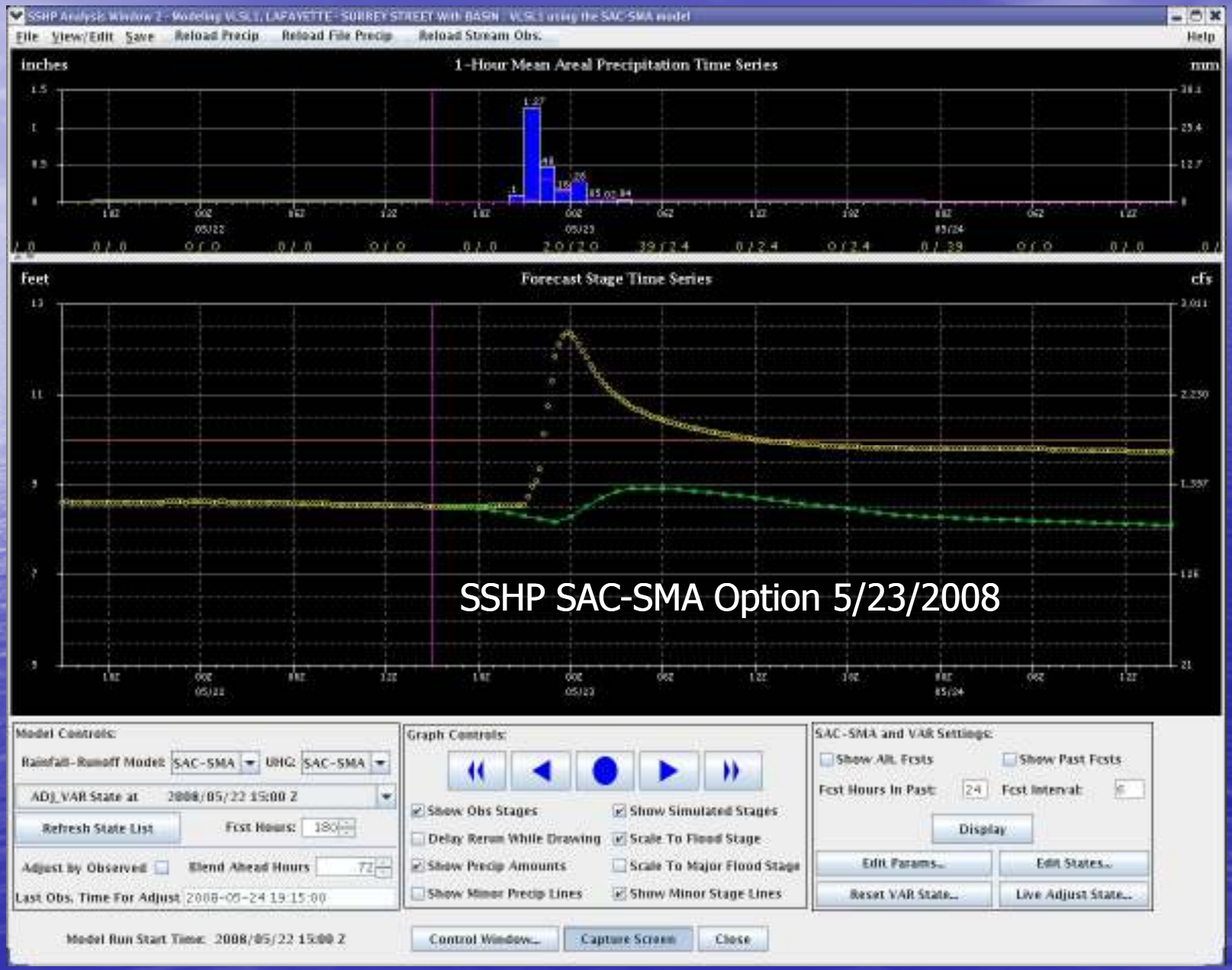
GAGE ZERO = -2.74 FT. MSL TIME TO PEAK = 6.0 HRS
Threshhold runoff 0.50 inches Unit hydrograph peak= 1500. cfs

INCHES OF RAINFALL IN A 1 HOUR PERIOD

	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
1.0	9.0	10.1	11.0	11.9	12.8	13.7	14.6	16.5	18.3	22.2	26.2
1.1	8.7	9.9	10.8	11.8	12.6	13.5	14.4	16.3	18.1	22.0	26.0
1.2	8.5	9.7	10.6	11.6	12.5	13.3	14.2	16.1	17.9	21.8	25.9
1.3	8.2	9.4	10.5	11.4	12.3	13.1	14.0	15.9	17.7	21.6	25.7
FI 1.4	7.8	9.2	10.3	11.2	12.1	13.0	13.8	15.7	17.5	21.4	25.5
I 1.5	7.1	9.0	10.1	11.0	11.9	12.8	13.7	15.5	17.4	21.2	25.3
A 1.6	4.6	8.7	9.9	10.8	11.8	12.6	13.5	15.3	17.2	21.0	25.1
S 1.7	******	8.5	9.7	10.6	11.6	12.5	13.3	15.2	17.0	20.8	24.9
H 1.8	******	8.2	9.4	10.5	11.4	12.3	13.1	15.0	16.8	20.6	24.7
1.9	******	7.8	9.2	10.3	11.2	12.1	13.0	14.8	16.7	20.4	24.5
F 2.0	******	7.1	9.0	10.1	11.0	12.0	12.8	14.6	16.5	20.2	24.4
I 2.1	******	4.8	8.7	9.9	10.8	11.8	12.6	14.4	16.3	20.0	24.2
C 2.2	**********	3.5	9.7	10.6	11.6	12.5	14.2	16.1	19.8	24.0	
C 2.3	**********	8.2	9.4	10.5	11.4	12.3	14.0	16.0	19.7	23.8	
D 2.4	**********	7.8	9.2	10.3	11.2	12.1	13.8	15.8	19.5	23.6	
2.5	**********	7.1	9.0	10.1	11.0	12.0	13.7	15.6	19.3	23.4	
G 2.6	**********	4.8	8.7	9.9	10.8	11.8	13.5	15.4	19.1	23.3	
D 2.7	**********	8.5	9.7	10.6	11.6	13.3	15.2	18.9	23.1		
I 2.8	**********	8.2	9.4	10.5	11.4	13.2	15.0	18.7	22.9		
D 2.9	**********	7.8	9.2	10.3	11.2	13.0	14.8	18.6	22.7		
A 3.0	**********	7.1	9.0	10.1	11.0	12.8	14.6	18.4	22.5		
N 3.1	**********	4.8	8.7	9.9	10.8	12.6	14.4	18.2	22.3		
C 3.2	**********	8.5	9.7	10.6	12.5	14.2	18.0	22.1			
F 3.3	**********	8.2	9.4	10.5	12.3	14.0	17.8	21.9			
3.4	**********	7.8	9.2	10.3	12.1	13.9	17.7	21.7			
M 3.5	**********	7.1	9.0	10.1	12.0	13.7	17.5	21.4			
A 3.6	**********	4.8	8.7	9.9	11.8	13.5	17.3	21.2			
L 3.8	**********	8.2	9.4	11.4	13.2	16.9	20.8				
J 4.0	**********	7.1	9.0	11.0	12.8	16.6	20.4				
F 4.2	**********	8.5	10.6	12.5	16.2	20.0					
S 4.4	**********	7.8	10.3	12.1	15.8	19.7					
4.6	**********	4.8	9.9	11.8	15.5	19.3					
4.8	**********	9.4	11.4	15.1	18.9						
5.0	**********	9.0	11.0	14.7	18.5						

Date Table Prepared = 5/19/2008

NWS Site Specific Model



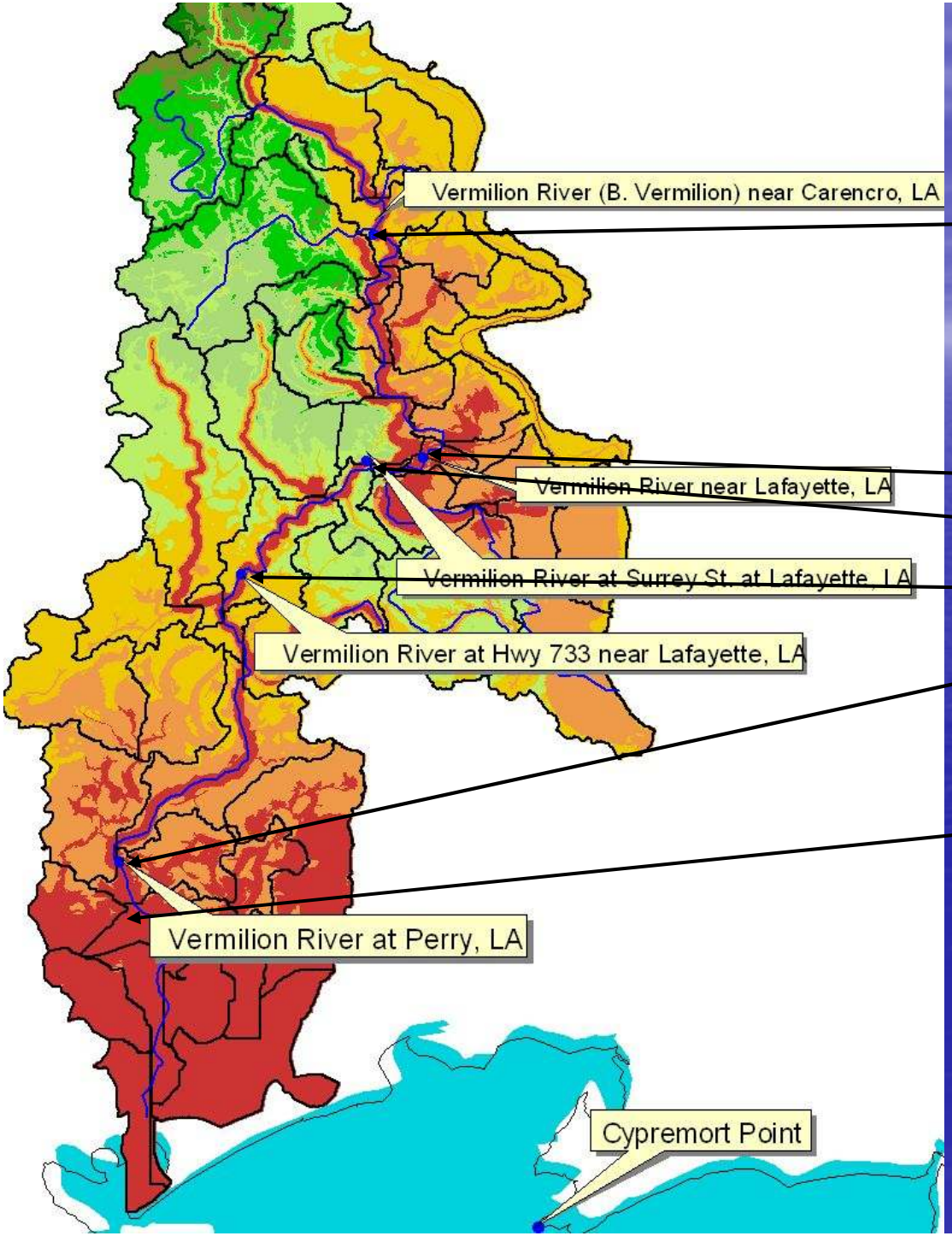
NWSRFS – Hydrologic Model
National Weather Service River Forecast System

- Set of hydrologic techniques and models used to perform hydrologic forecasting.
- Vermilion system uses:
  - Lag-K routing
  - SAC-SMA rainfall-runoff model
  - Routinely use 12hr forecast rainfall (up to 72hr)
- Does not handle backwater/storage/tides.
- All rating curves are “dummy ratings”.

NWSRFS Forecast

NWS FLDWAV – Hydraulic Model

- Developed by NWS
- One-dimensional, unsteady flow model
- Conservation of mass and energy
  - Initial conditions (stage and flow)
  - Boundary conditions (stage and flow)
- Movement of waves upstream and downstream
- Lateral inflows/outflows
- Calibration – Manning's roughness coefficient
  - Based on observed stages/discharges



Vermilion FLDWAV Model

Stage Upstream Boundary

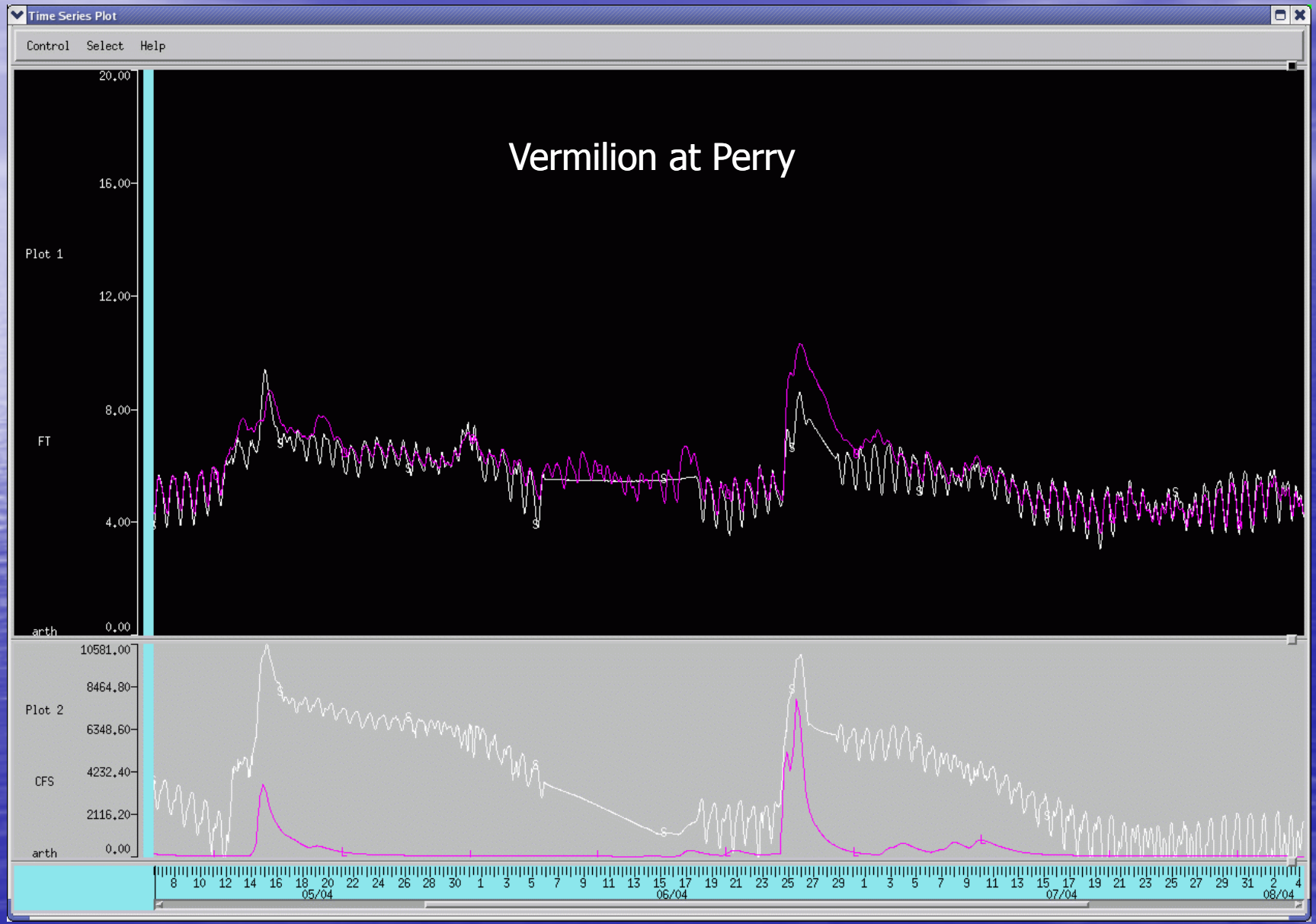
Lateral inflows derived from NWSRFS hydrologic model inserted into the Vermilion at:

- Lafayette
- Surrey St
- Hwy 733
- Perry

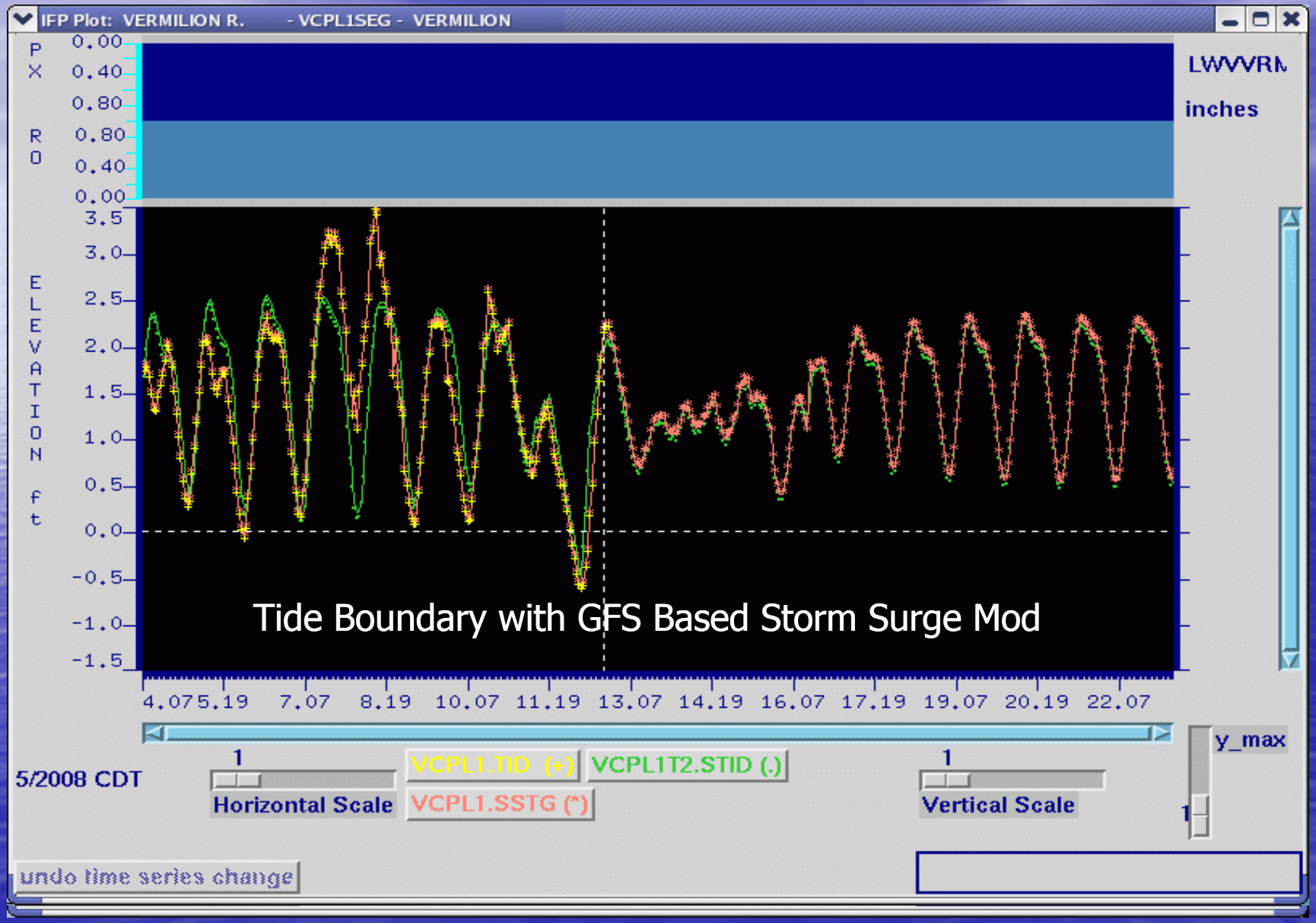
Downstream Bound: VCPL1 NOS Tide blended with GFS Storm Surge. Inserted 5 miles below Perry (VRPL1).

Geometry derived from HEC-RAS deck provided to LMRFC by USACE

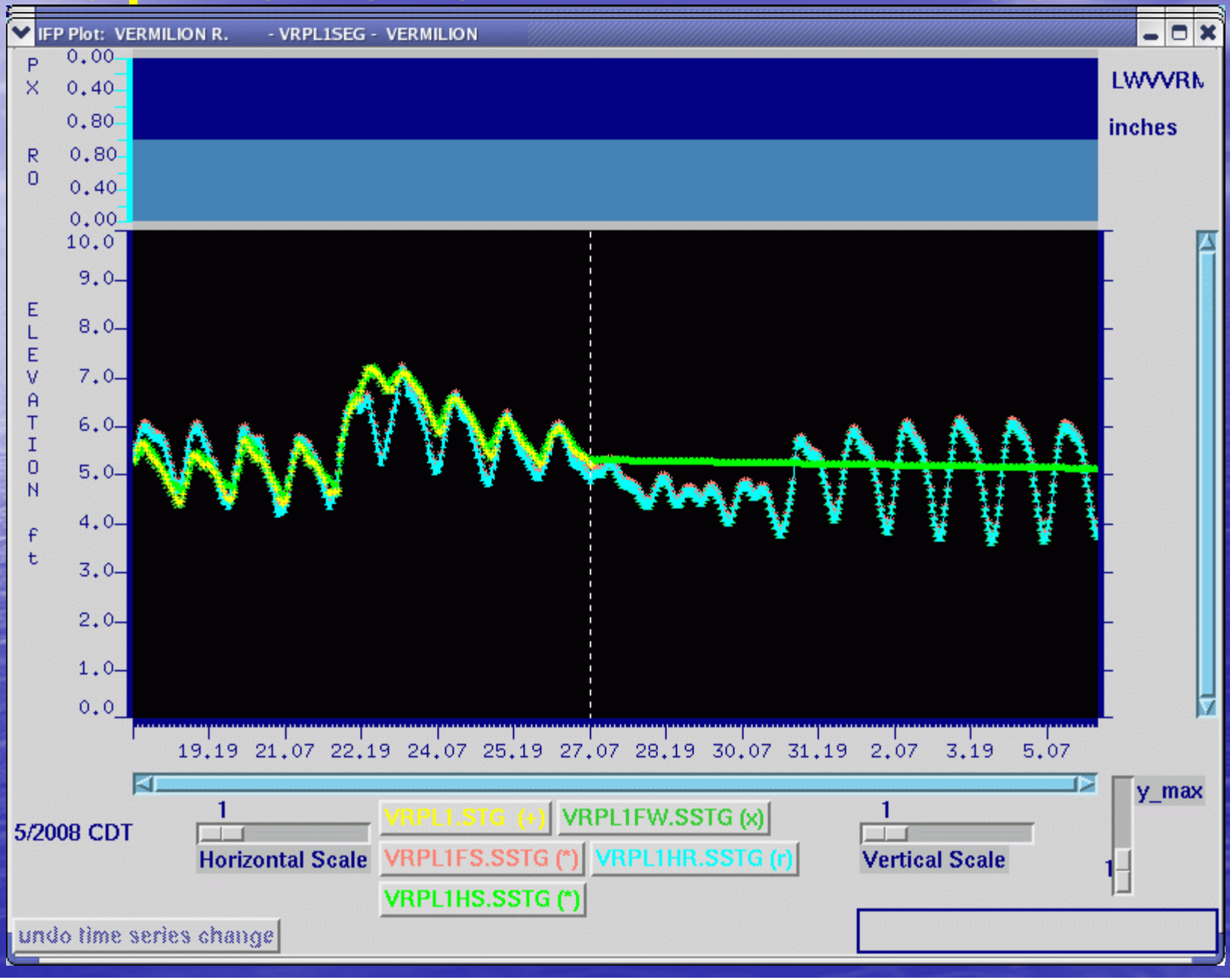
FLDWAV Calibration Efforts



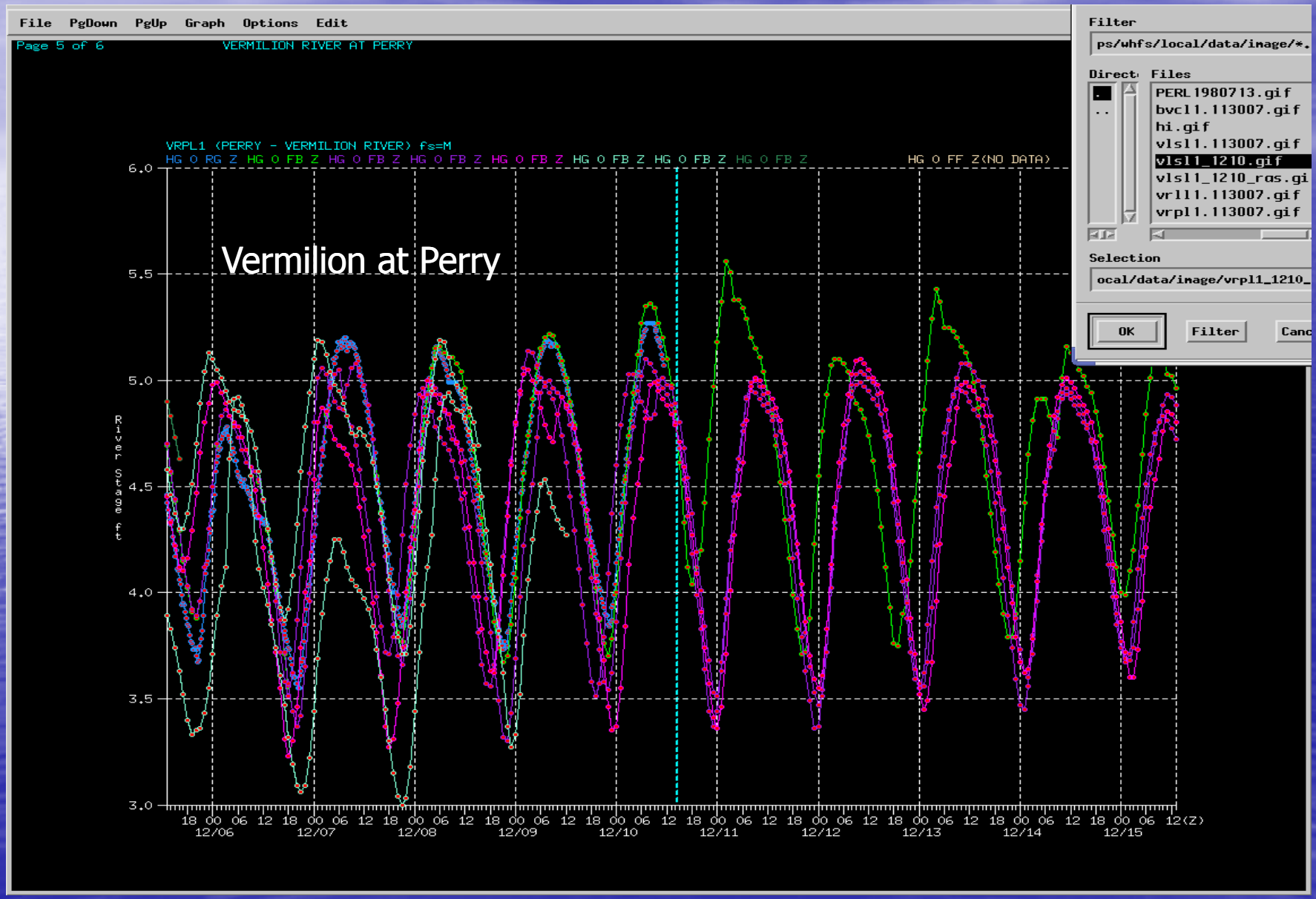
Downstream Tide Boundary



Operational FLDWAV Model



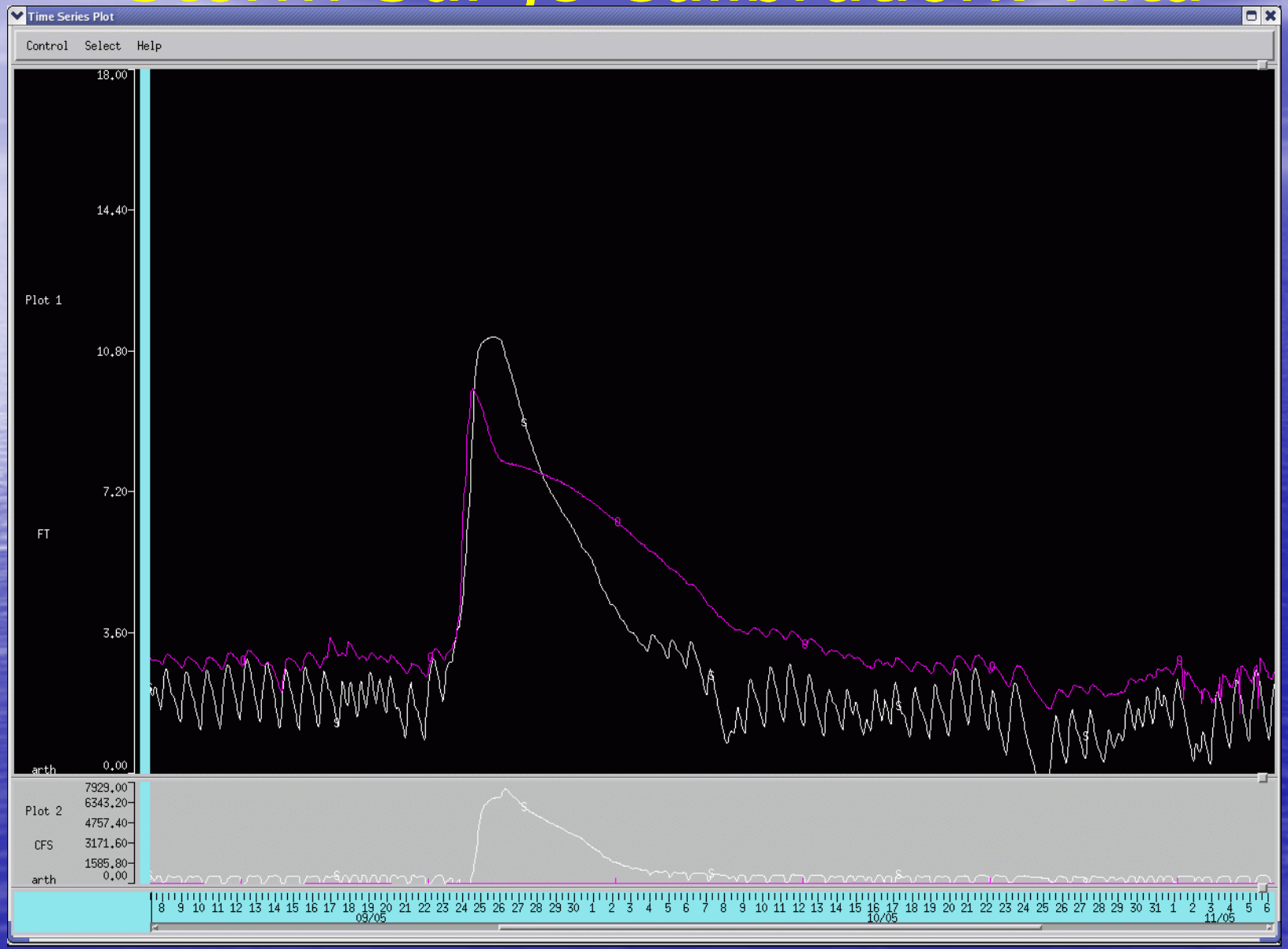
FLDWAV Forecast Progression



Hurricane Storm Surge

- Model calibrated with data from Hurricane Rita (2005).
- Operational model will use a stage hydrograph from the Sea, Lake, and Overland Surge Heights (SLOSH) model issued within 24 hours of landfall.
- A variety of hurricane storm surge scenarios can also be run for different storm tracks and intensities.

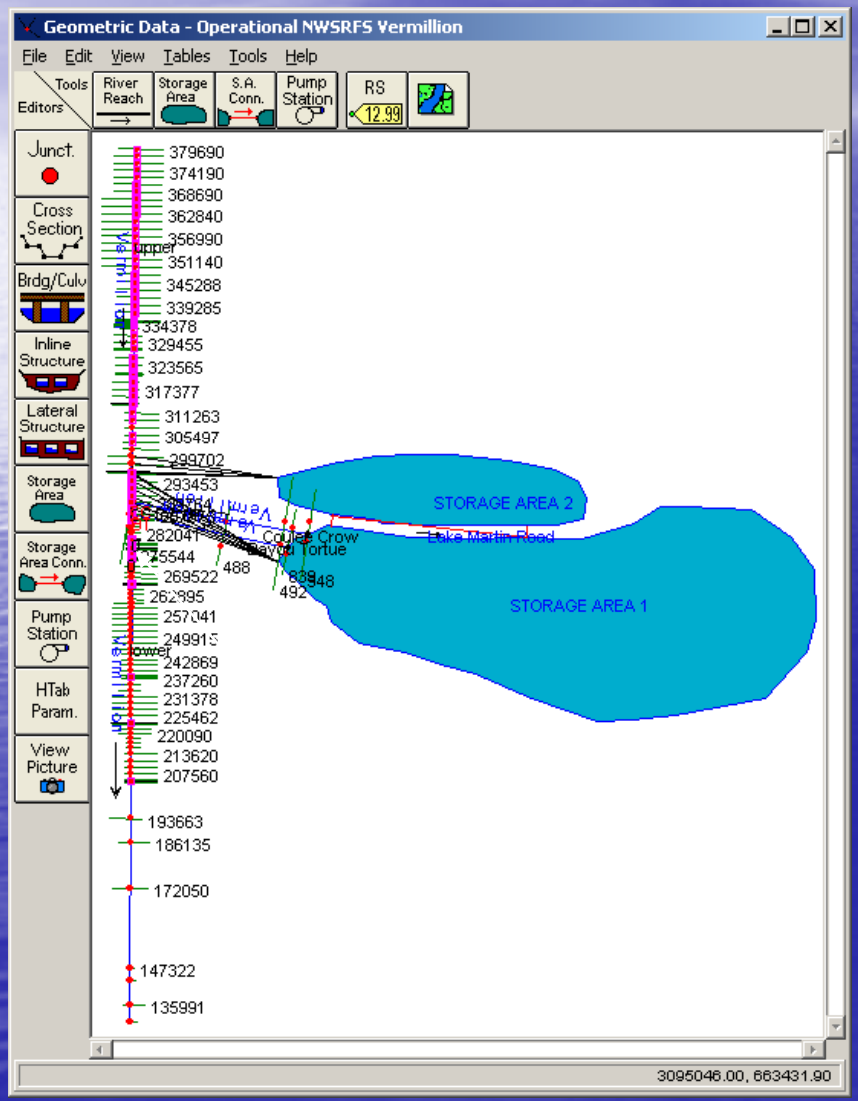
Storm Surge Calibration: Rita



Hydrologic Engineering Center River Analysis System (HEC-RAS)

- Developed by the USACE
- Steady and unsteady-state one-dimensional model.
- Current capabilities:
  - Pure subcritical flow
  - Pure supercritical flow
  - Mixed regime (transcritical flow)
  - Hydraulic structures, e.g. culverts, bridges, weirs, etc.
  - Sediment transport analysis
  - Water quality analysis

HEC-RAS Geometry
Vermilion River Coastal LA

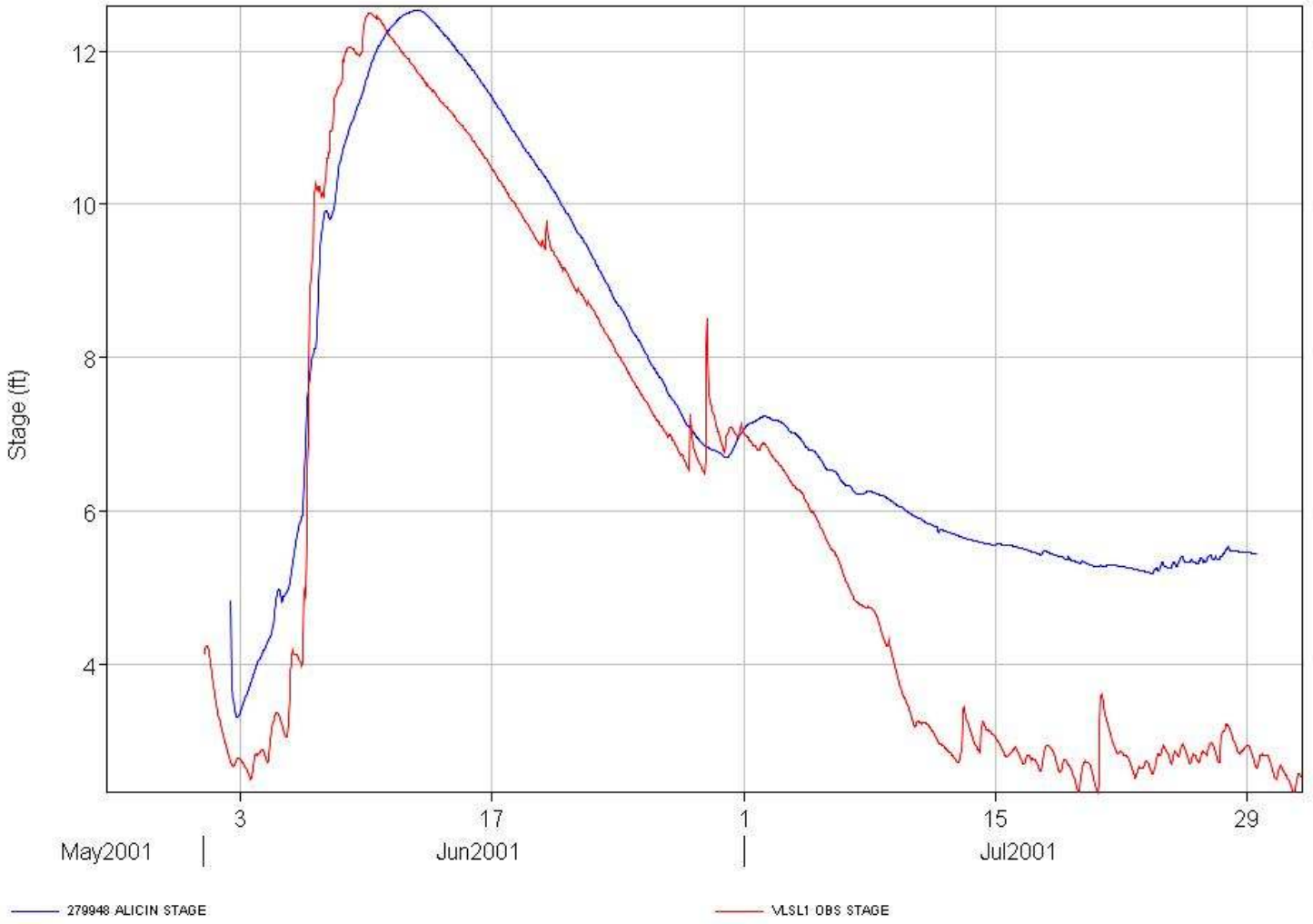


Geometry data provided to LMRFC courtesy of the New Orleans District USACE

HEC-RAS - geometry uses levees with storage areas.

FLDWAV – levee option does not work in OFS, used "cave-in-bank" method to account for storage area represented in HEC geometry.

HEC-RAS Calibration Efforts
Tropical Storm Alison, June 2001



Conclusions

- Simple manual methods based on historical events and the NWS site specific model are useful forecast tools for short term rainfall-runoff based flood events.
- We should be able to model low-flow tidal fluctuations with existing LMRFC hydraulic models.
- We may be able to use LMRFC hydraulic models for guidance in hurricane storm surge.
- LMRFC hydraulic models need improvement to be used for flood forecasting.

Questions