Coupled Waves and Storm Surge during Hurricane Gustav

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C Dawson **Univ. Texas at Austin**

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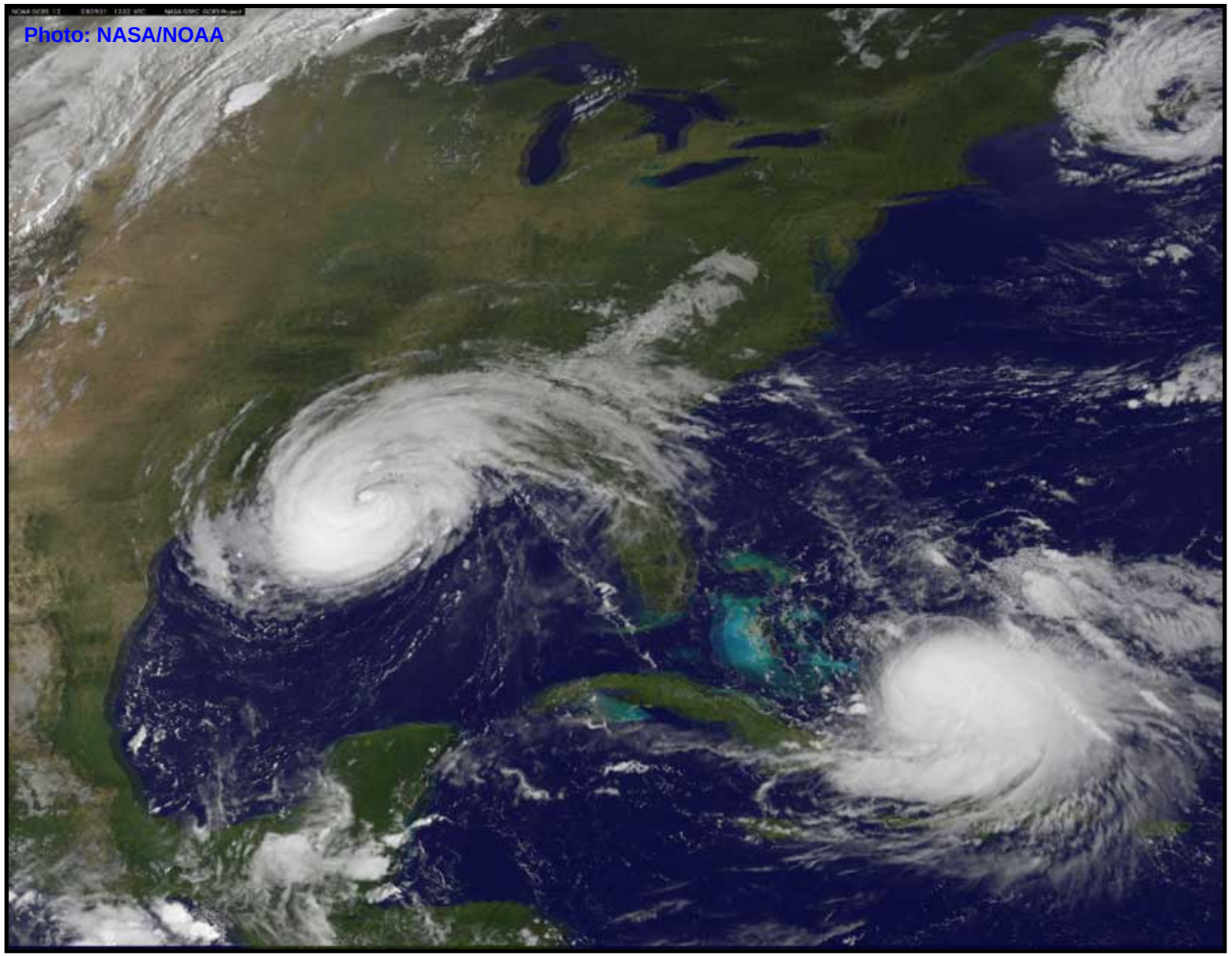
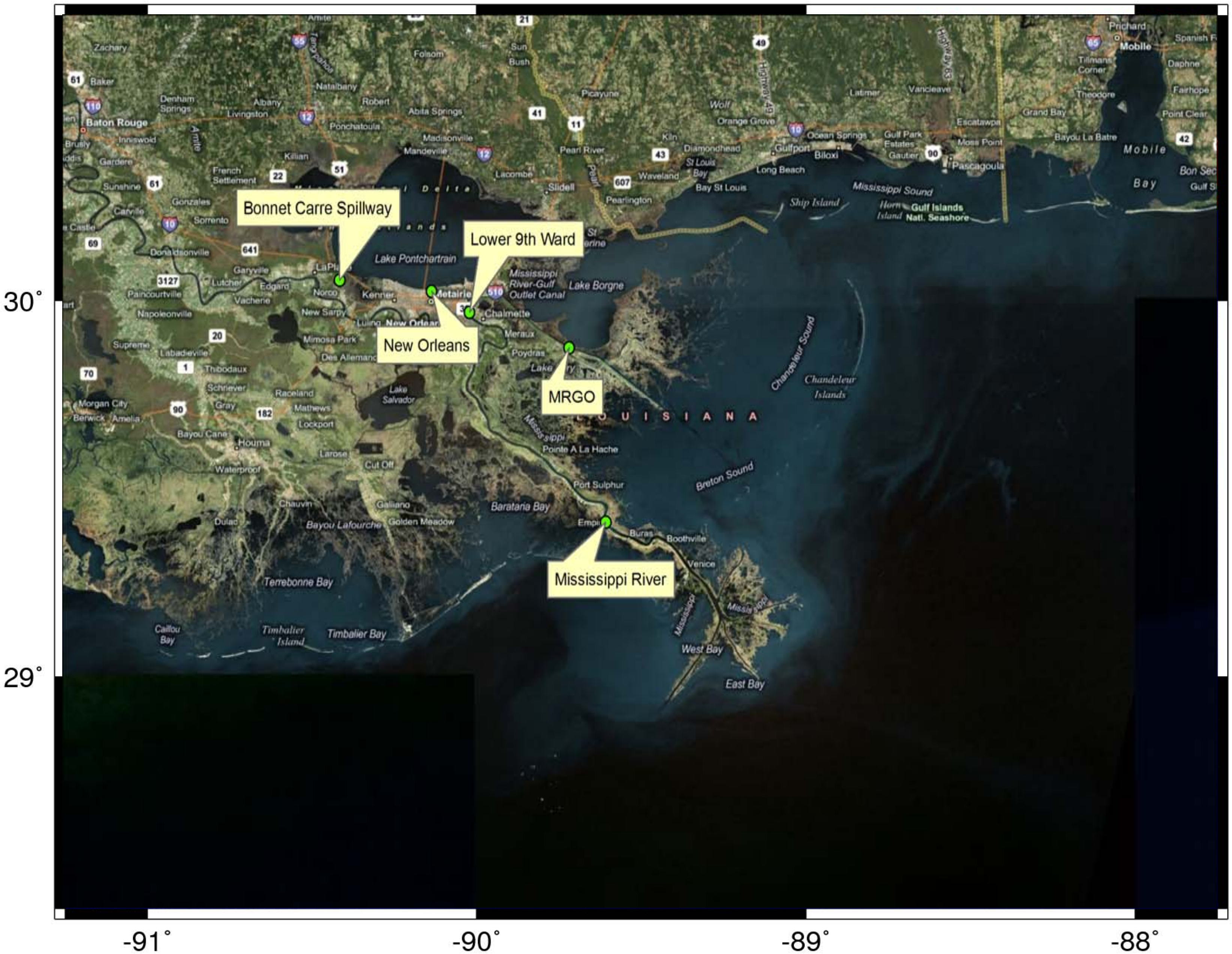
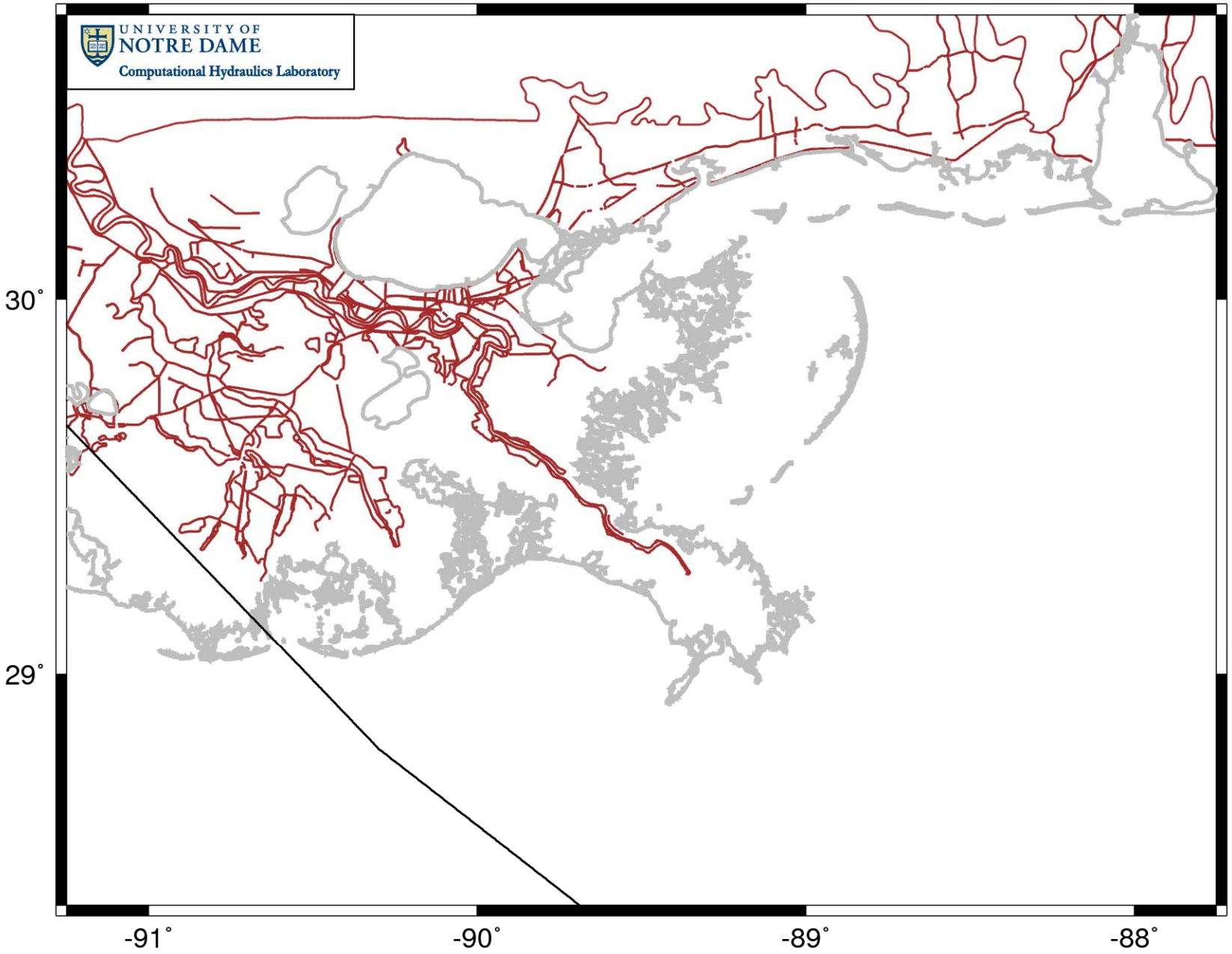
Hurricane Season 2008



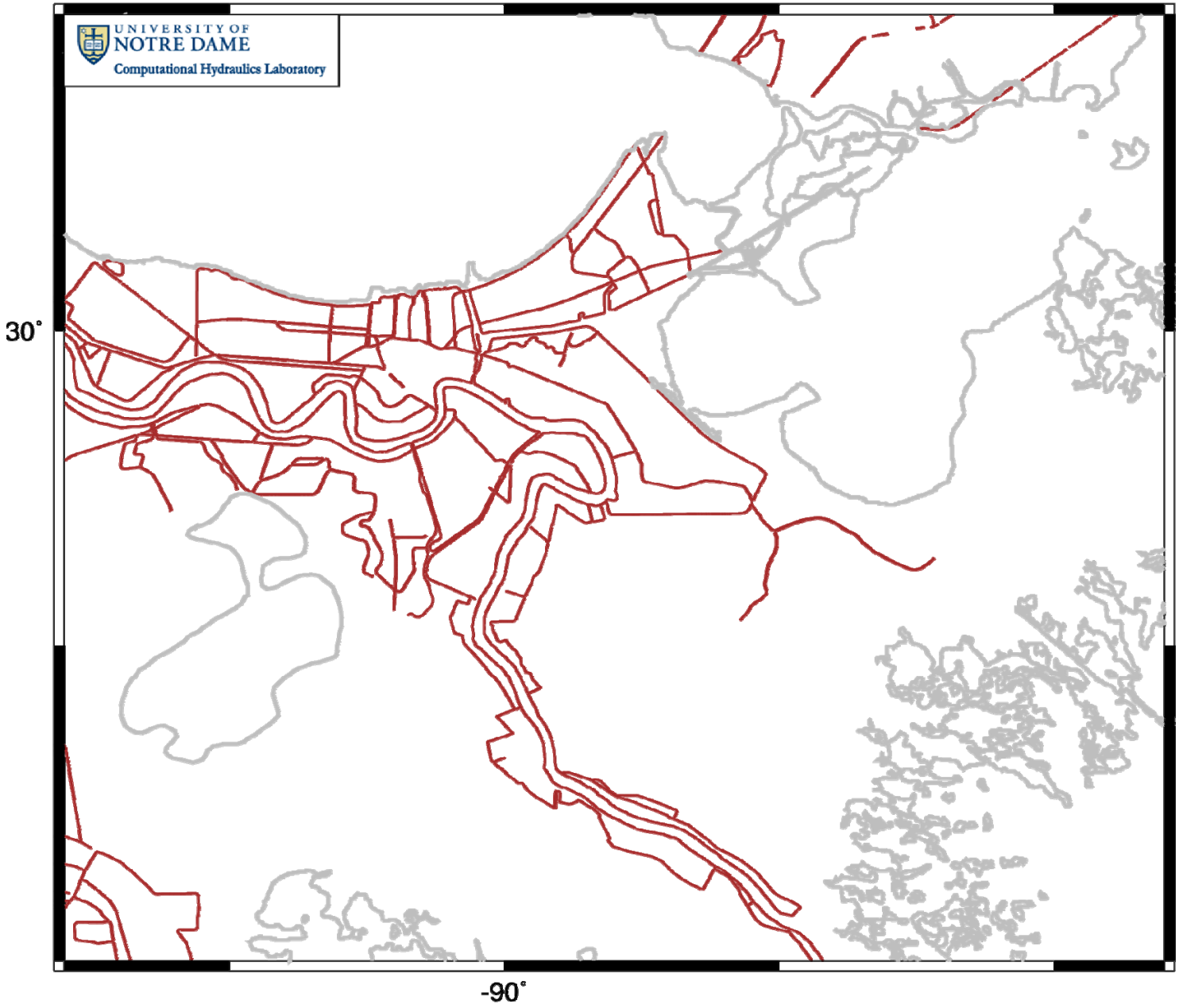
Southern Louisiana



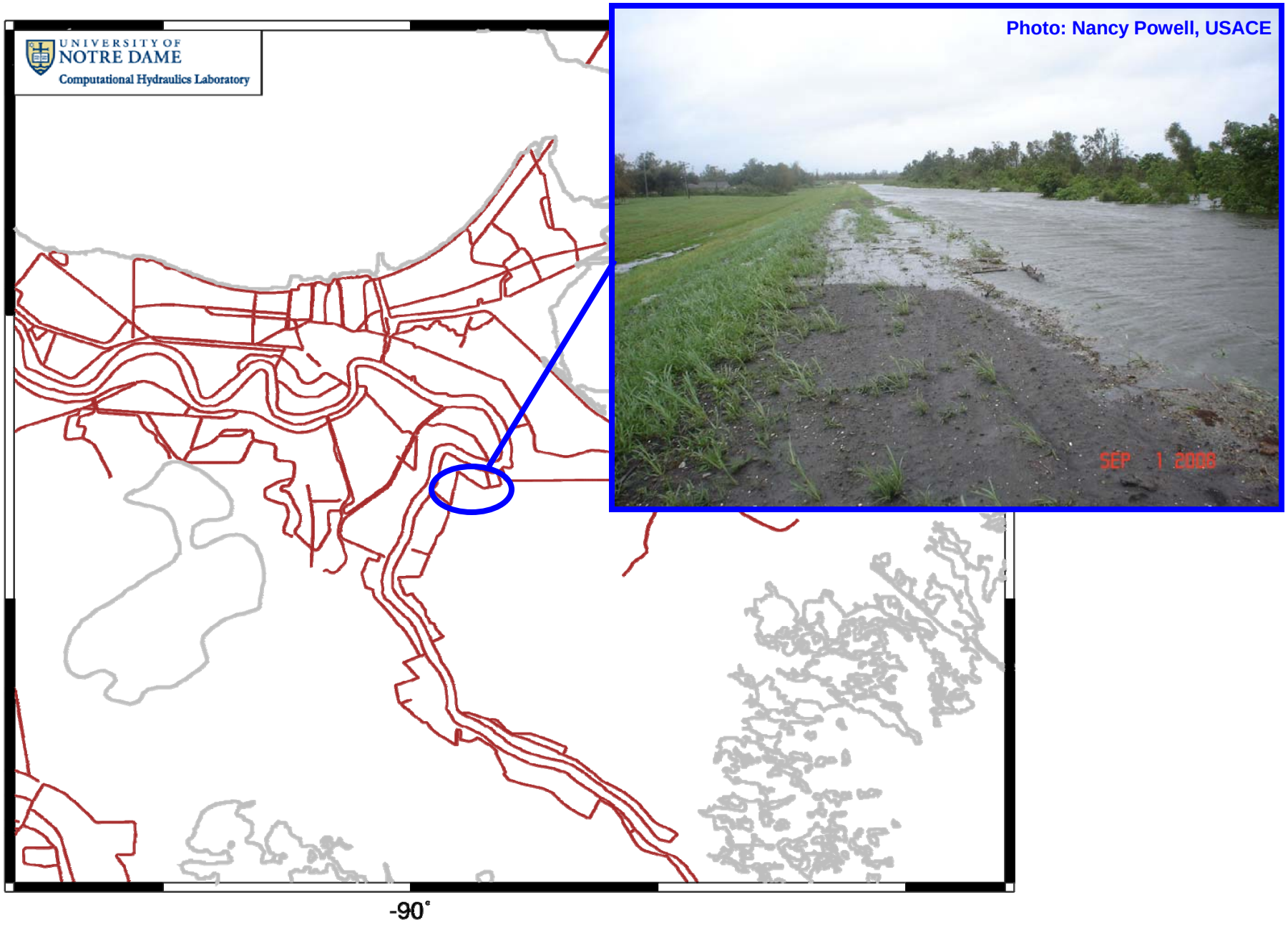
Gustav : Track



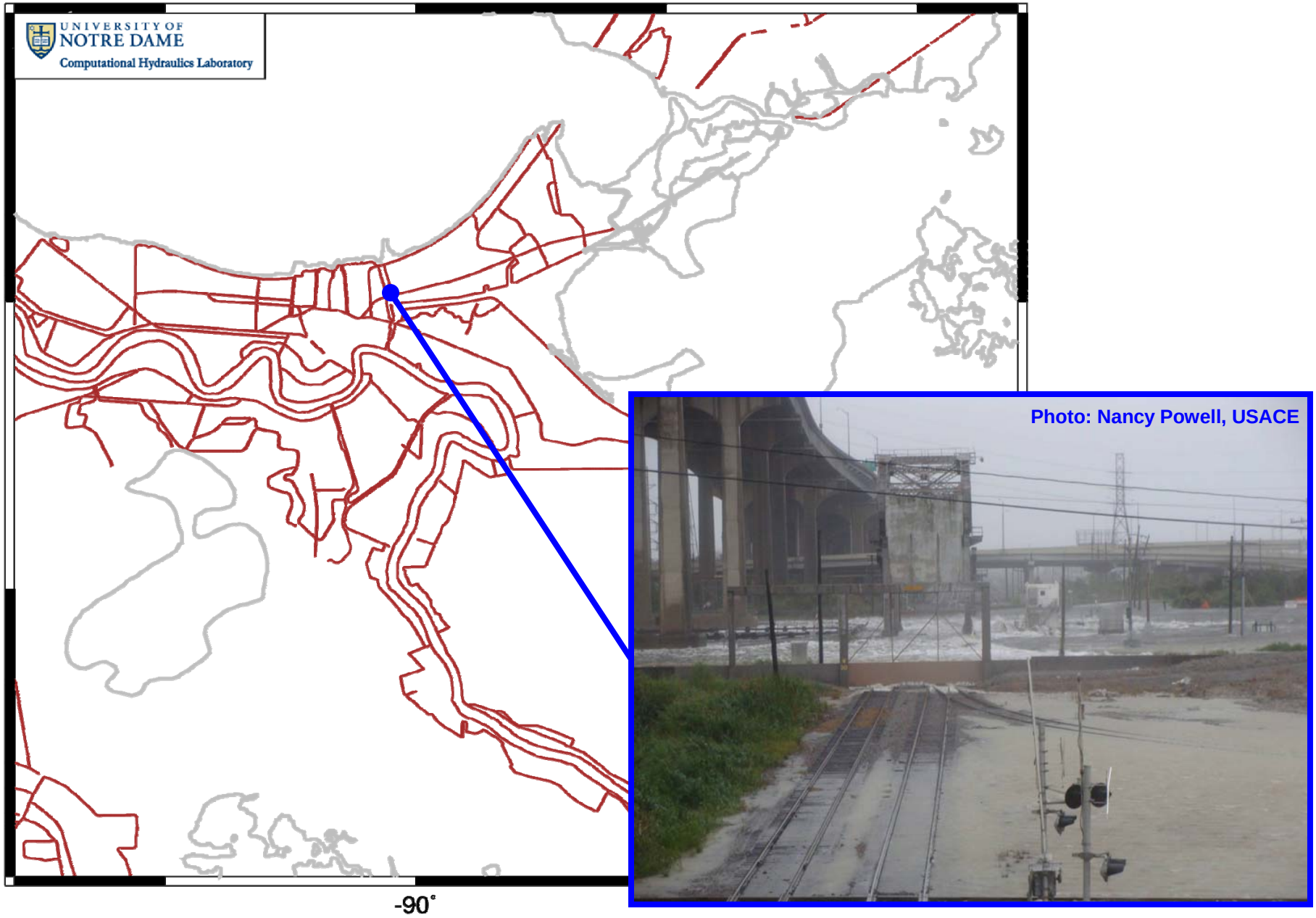
Gustav : Storm Surge near New Orleans



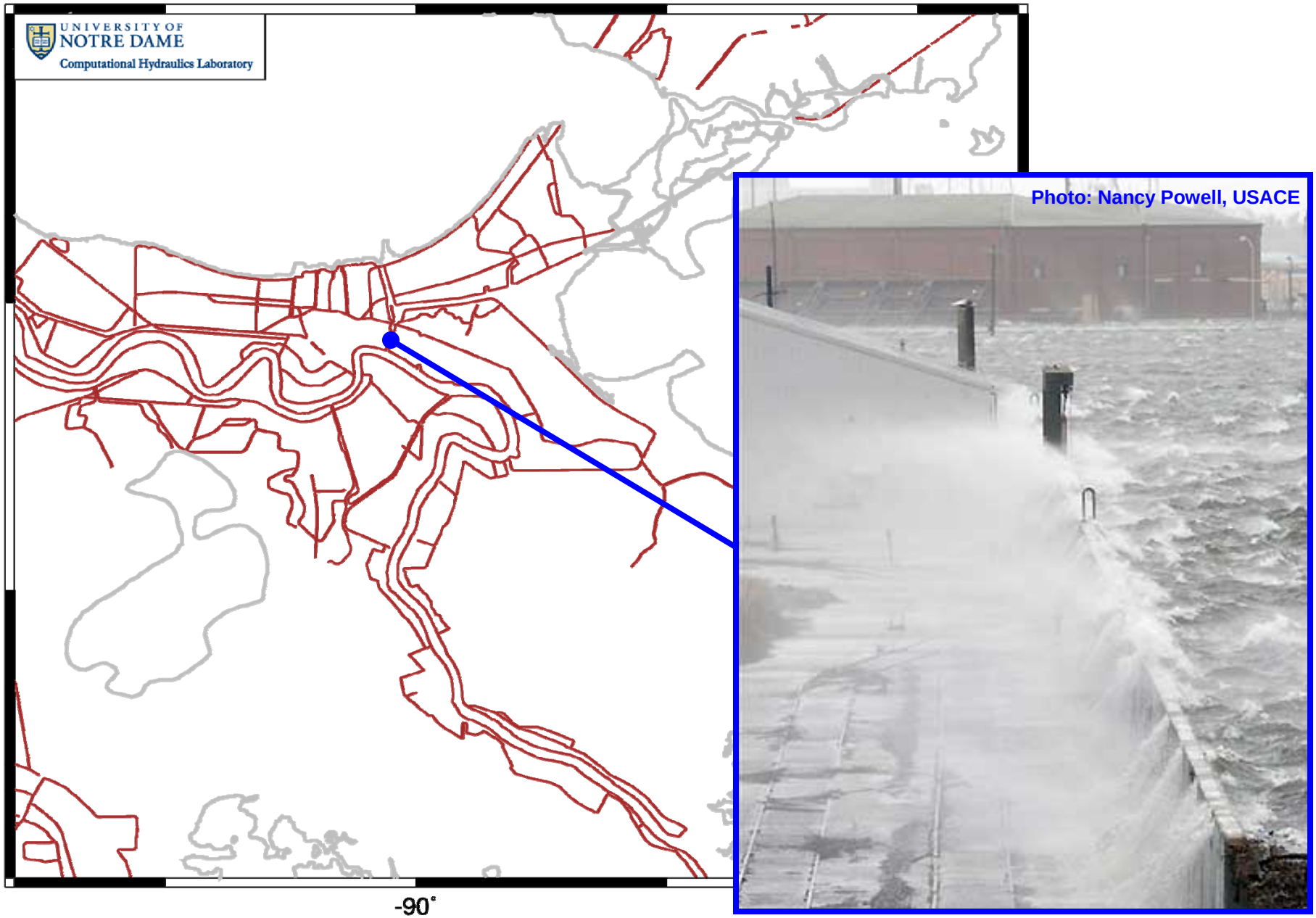
Gustav : Storm Surge near New Orleans



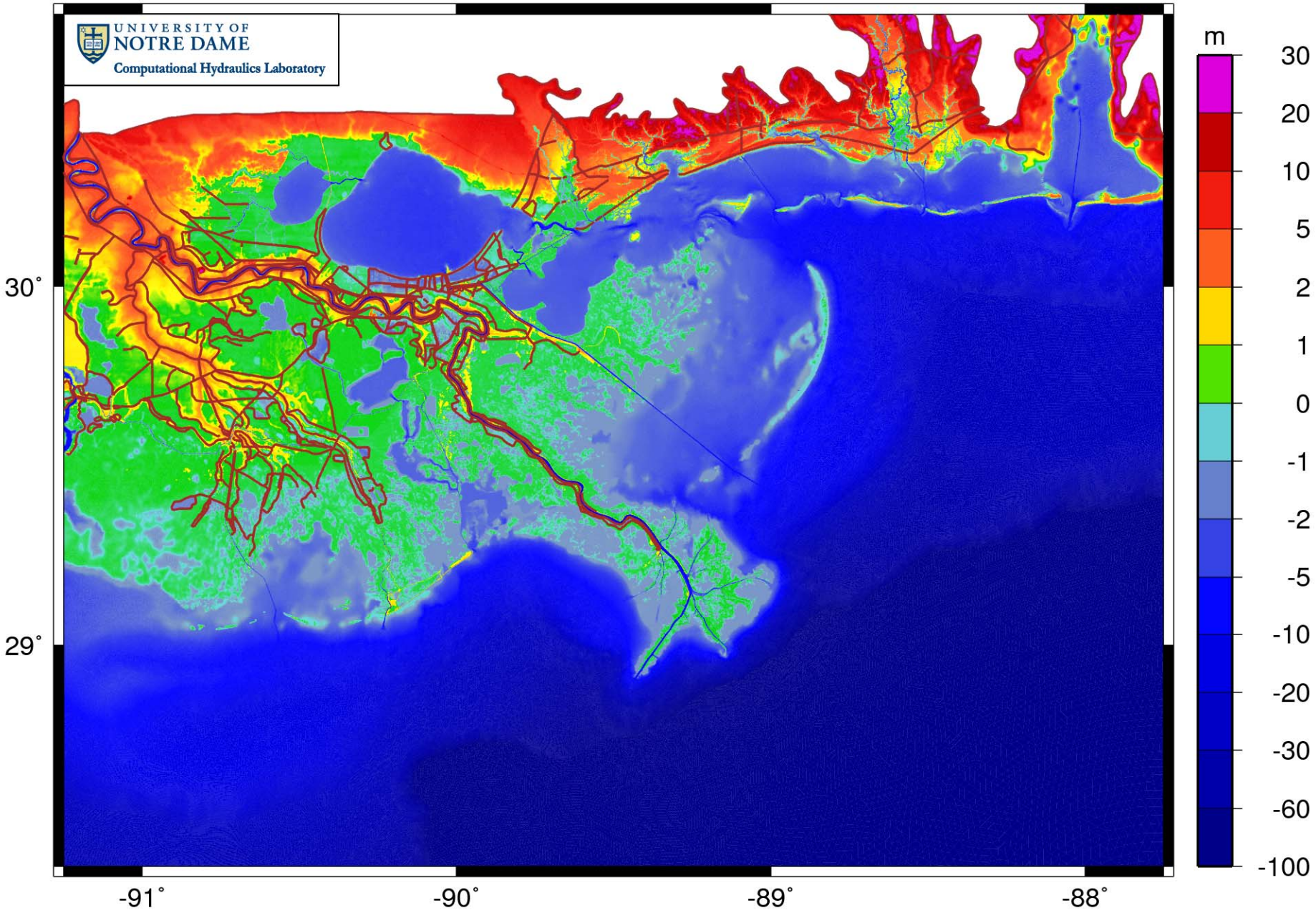
Gustav : Storm Surge near New Orleans



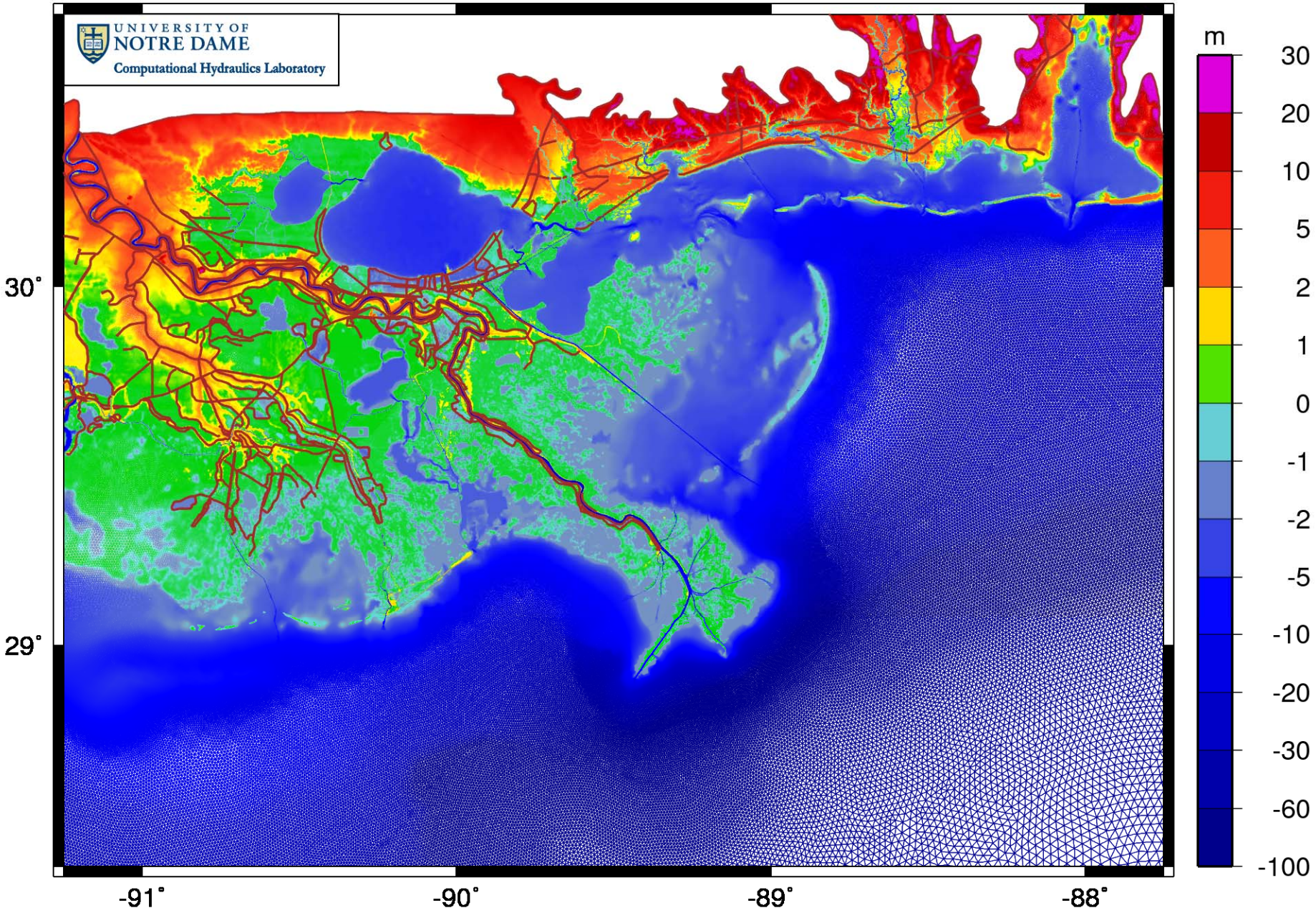
Gustav : Storm Surge near New Orleans



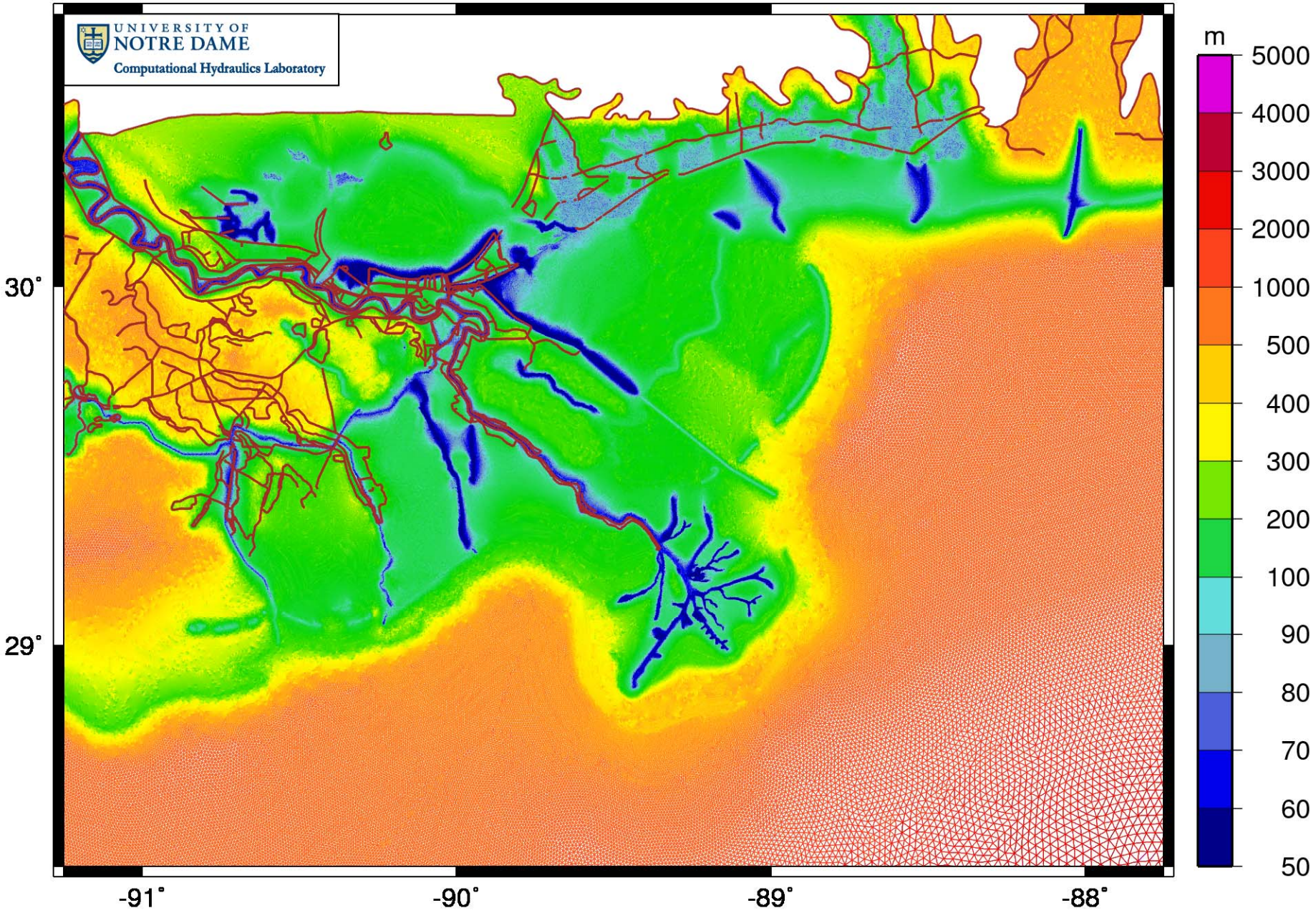
SL16 v18c3 : Bathymetry and Topography



SL16 v18c3 : Bathymetry and Topography



SL16 v18c3 : Mesh Sizes



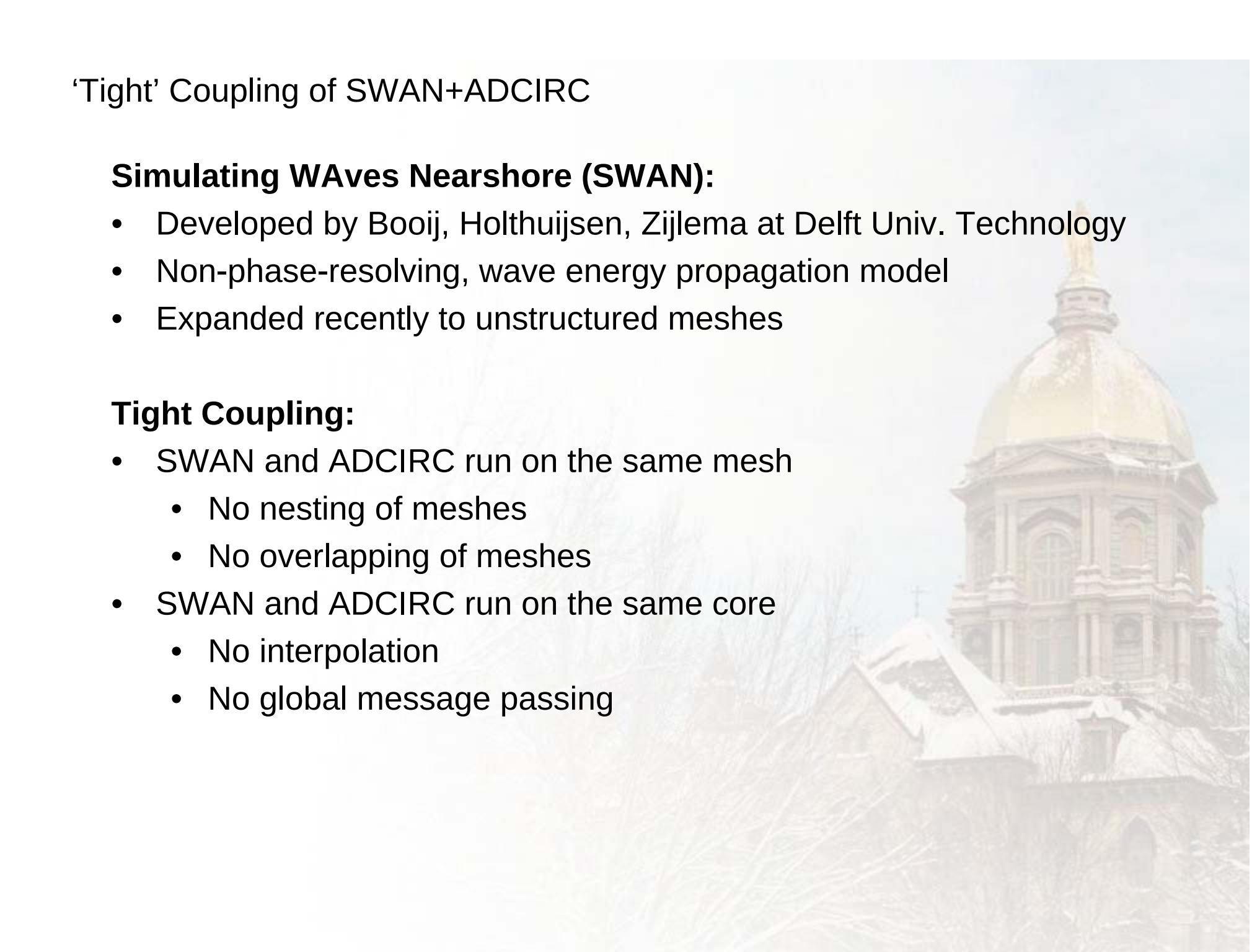
‘Tight’ Coupling of SWAN+ADCIRC

Simulating WAves Nearshore (SWAN):

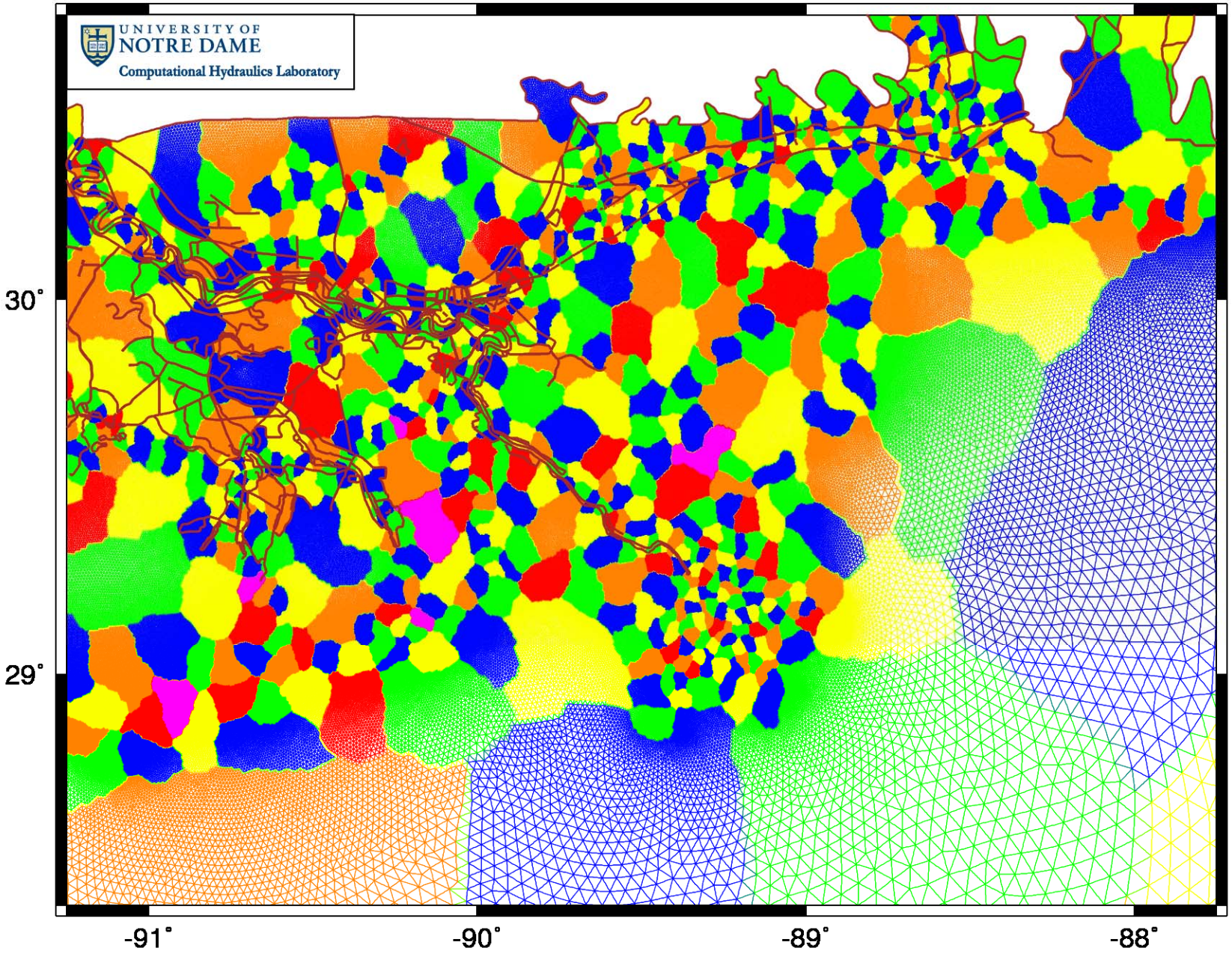
- Developed by Booij, Holthuijsen, Zijlema at Delft Univ. Technology
- Non-phase-resolving, wave energy propagation model
- Expanded recently to unstructured meshes

Tight Coupling:

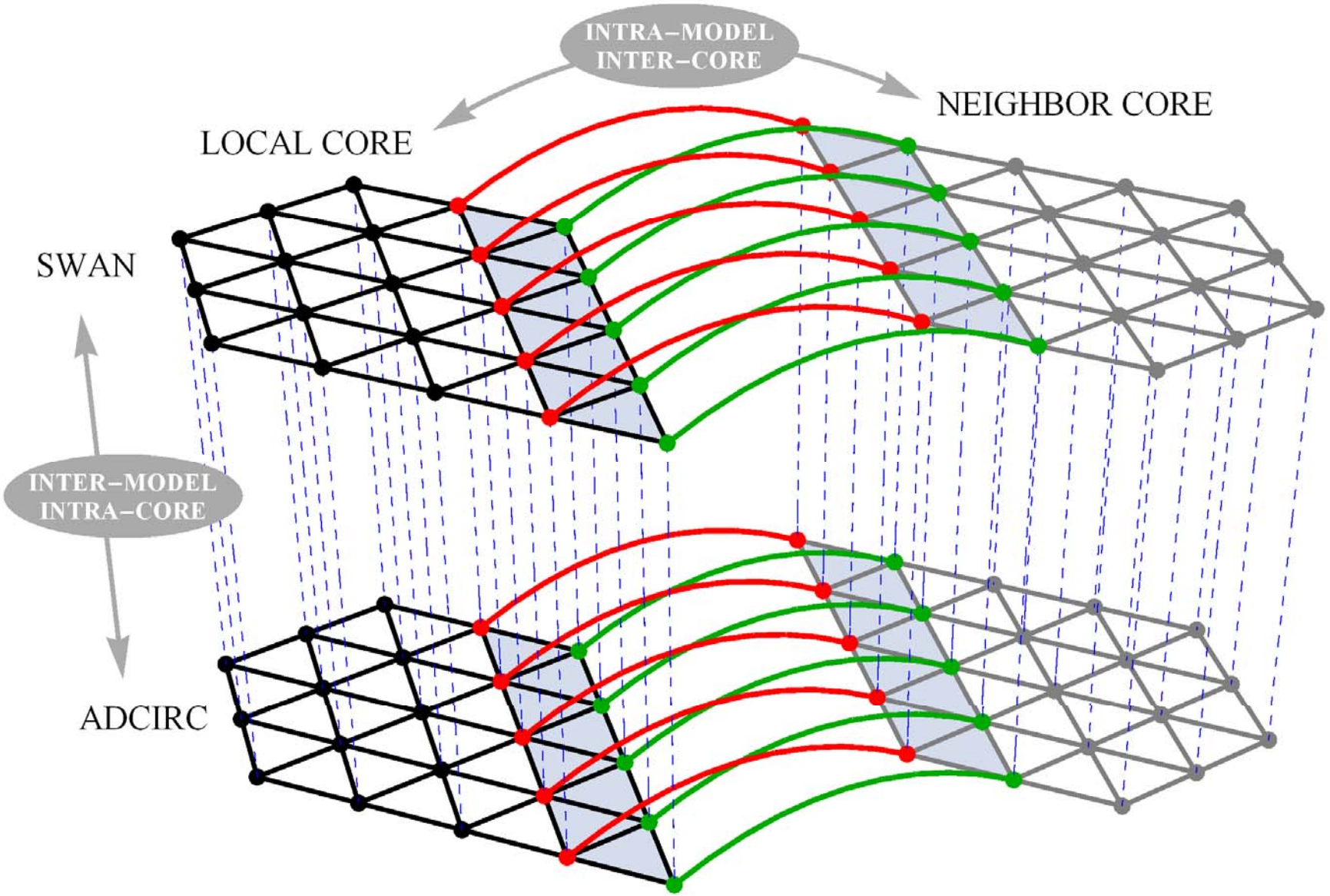
- SWAN and ADCIRC run on the same mesh
  - No nesting of meshes
  - No overlapping of meshes
- SWAN and ADCIRC run on the same core
  - No interpolation
  - No global message passing



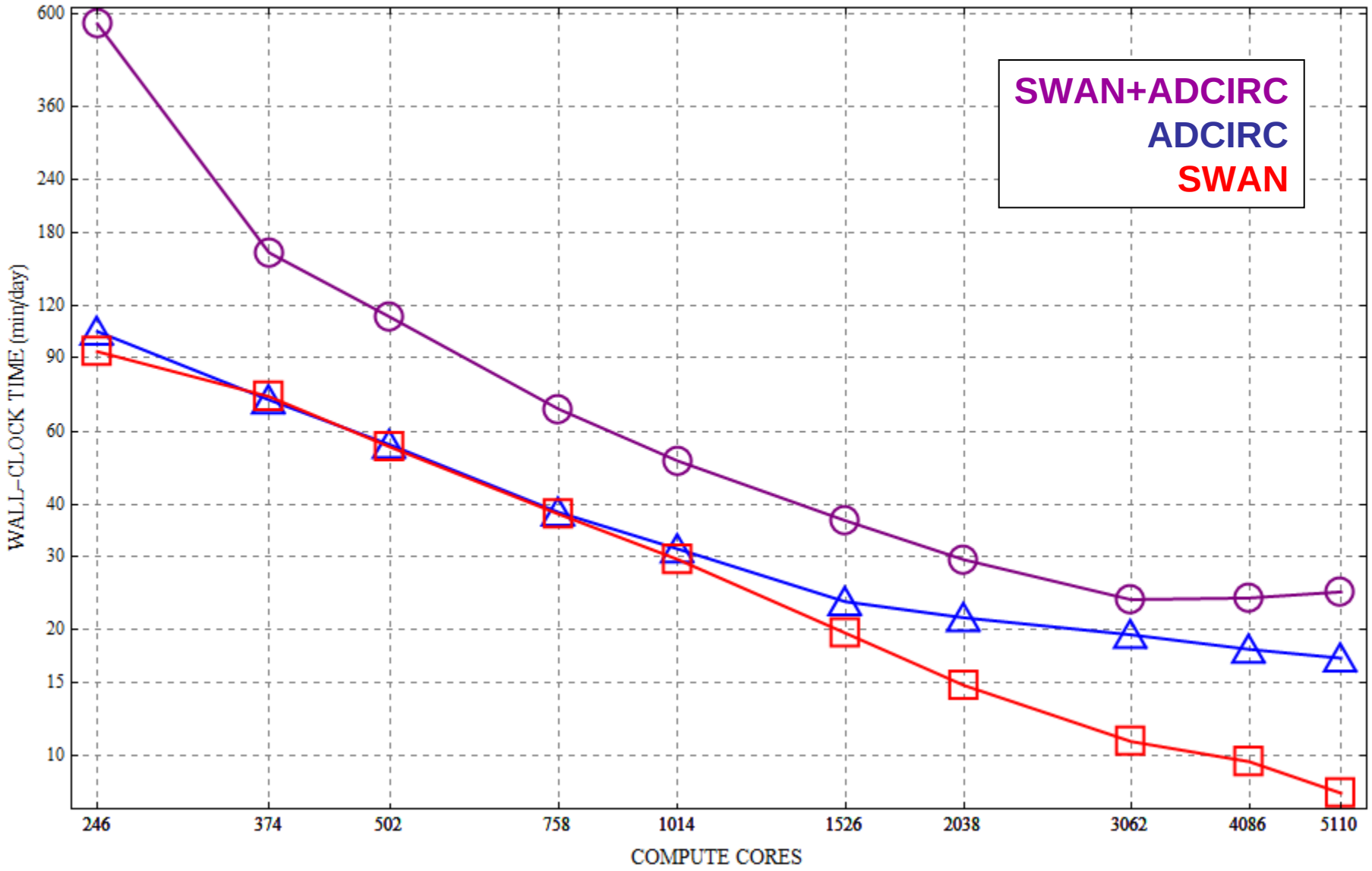
‘Tight’ Coupling of SWAN+ADCIRC



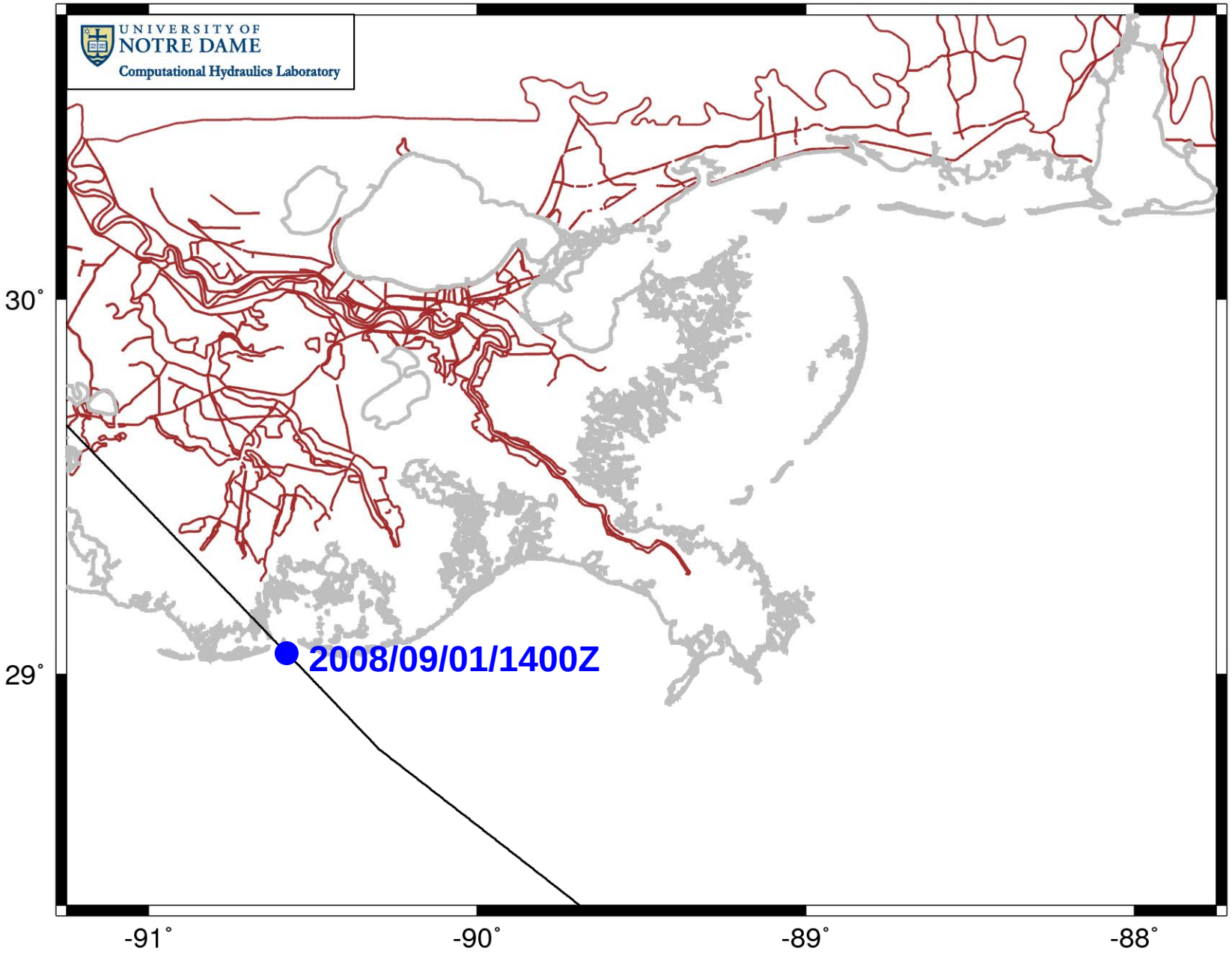
‘Tight’ Coupling of SWAN+ADCIRC



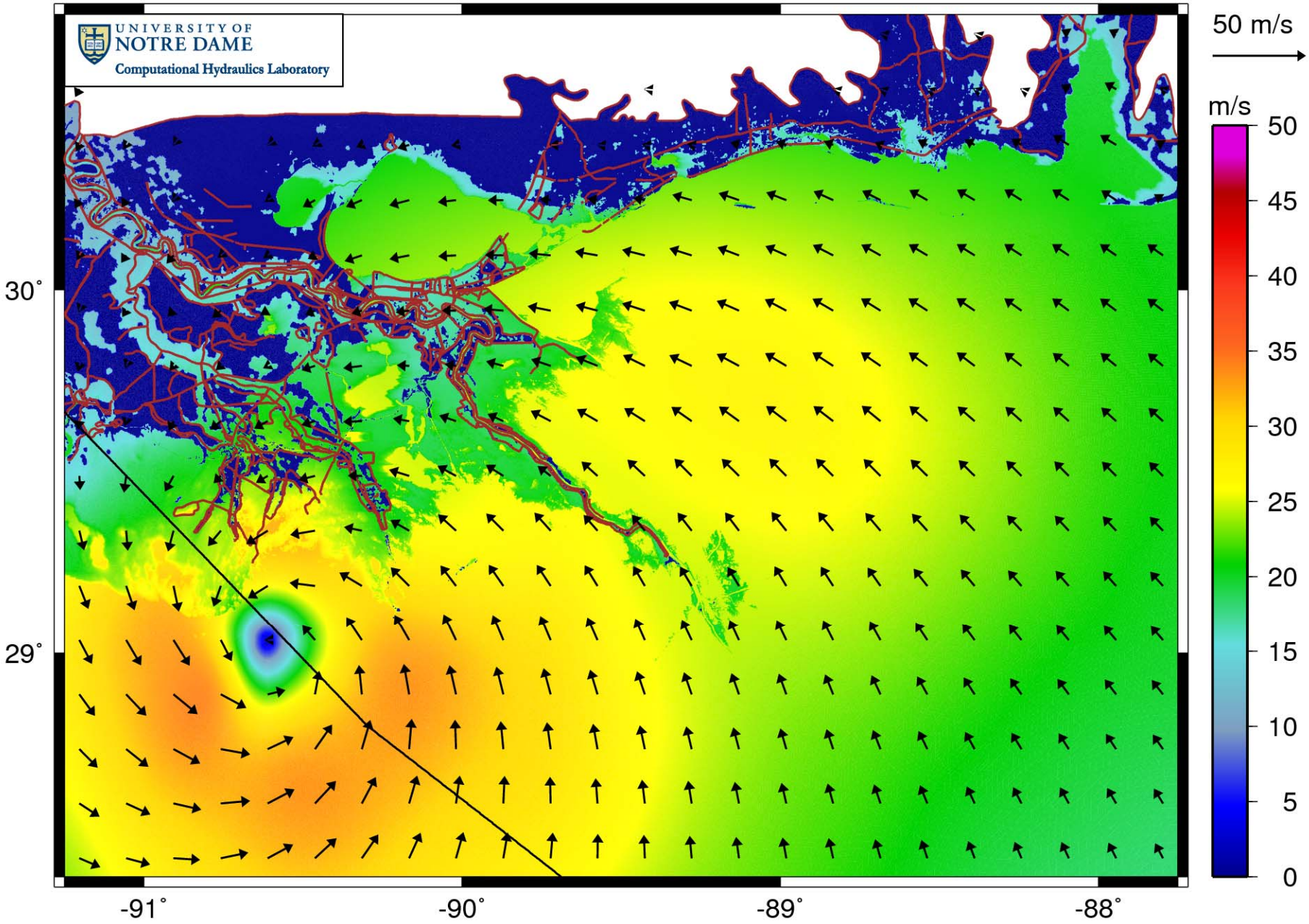
‘Tight’ Coupling of SWAN+ADCIRC



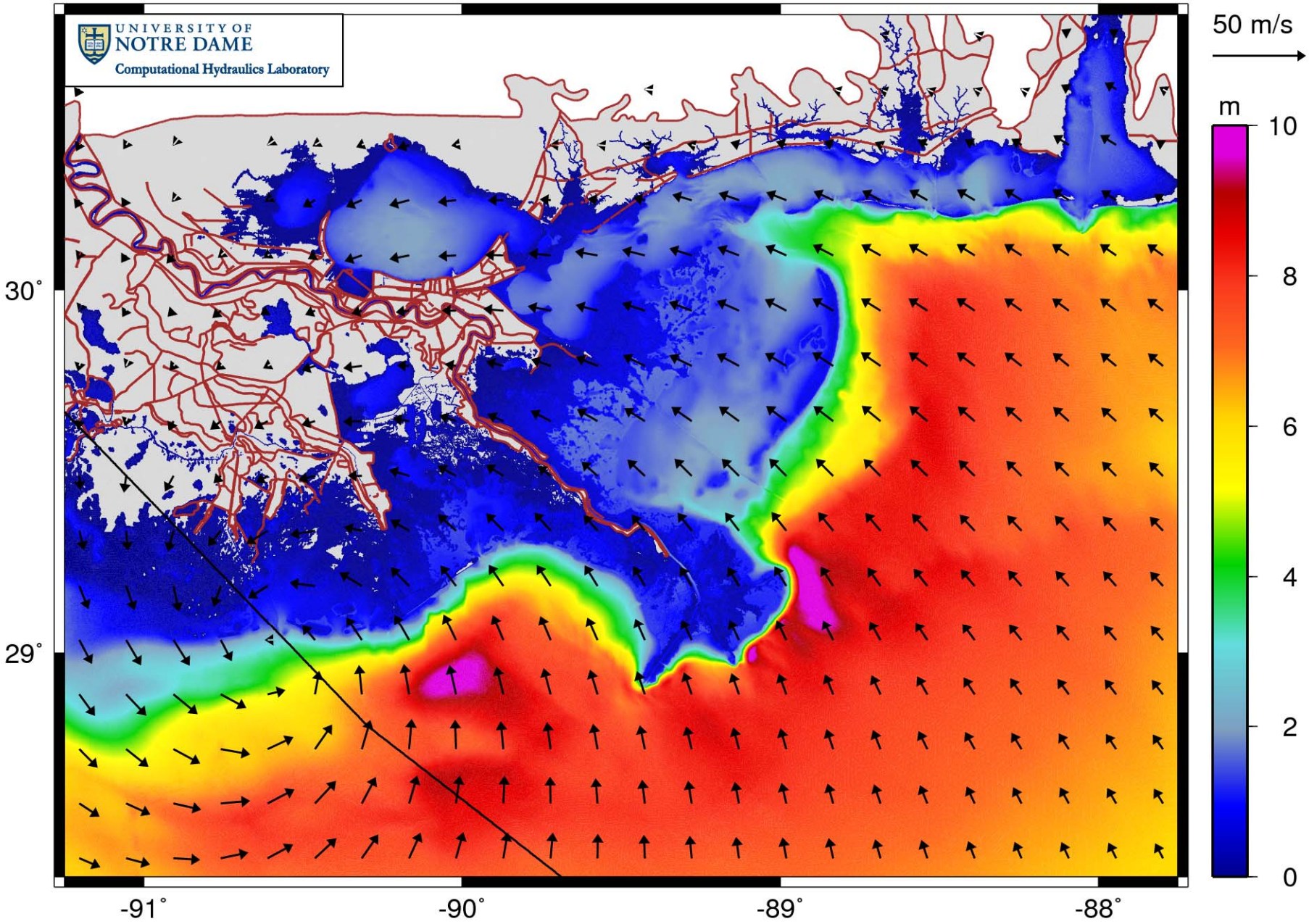
Gustav : Track



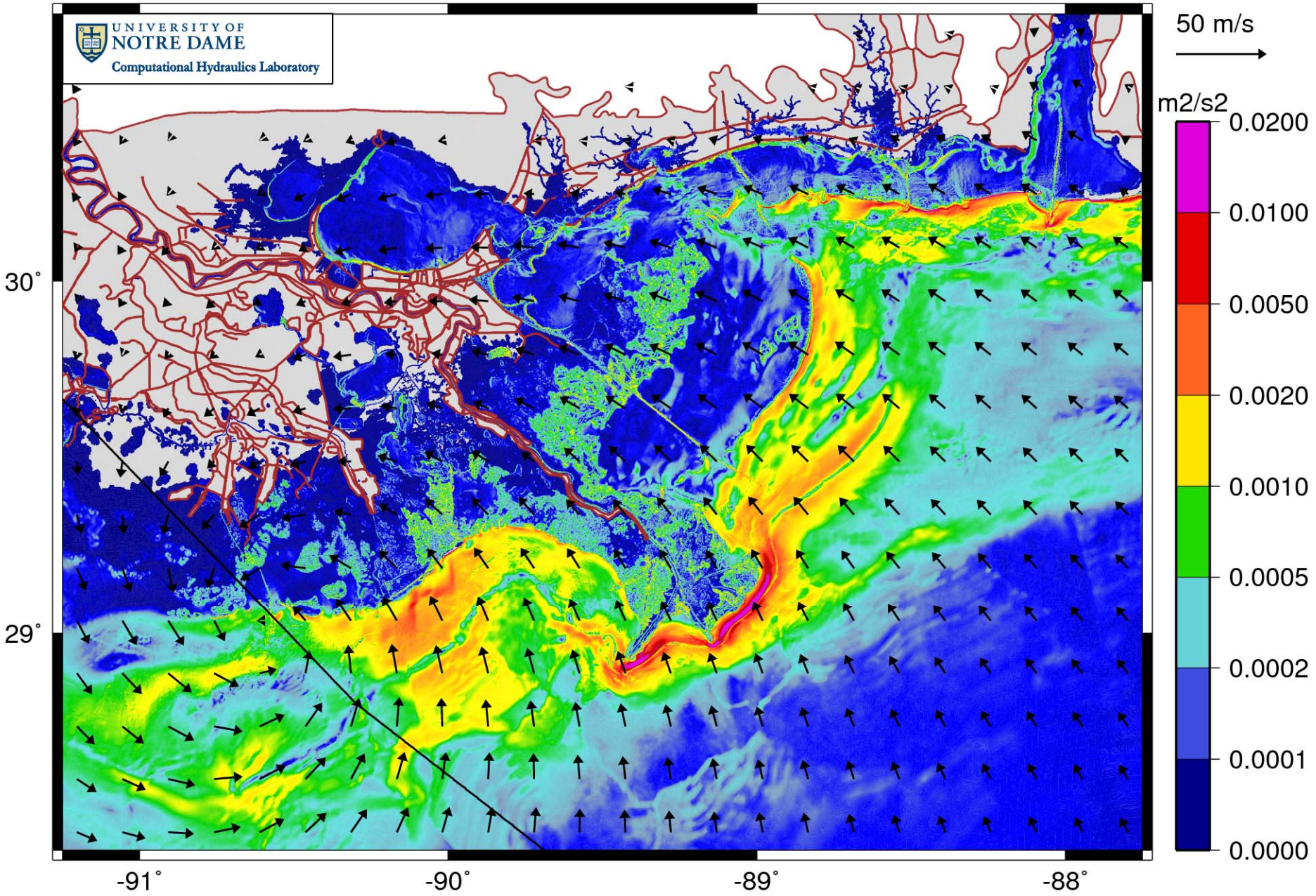
Gustav : Winds : 2008/09/01/1400Z



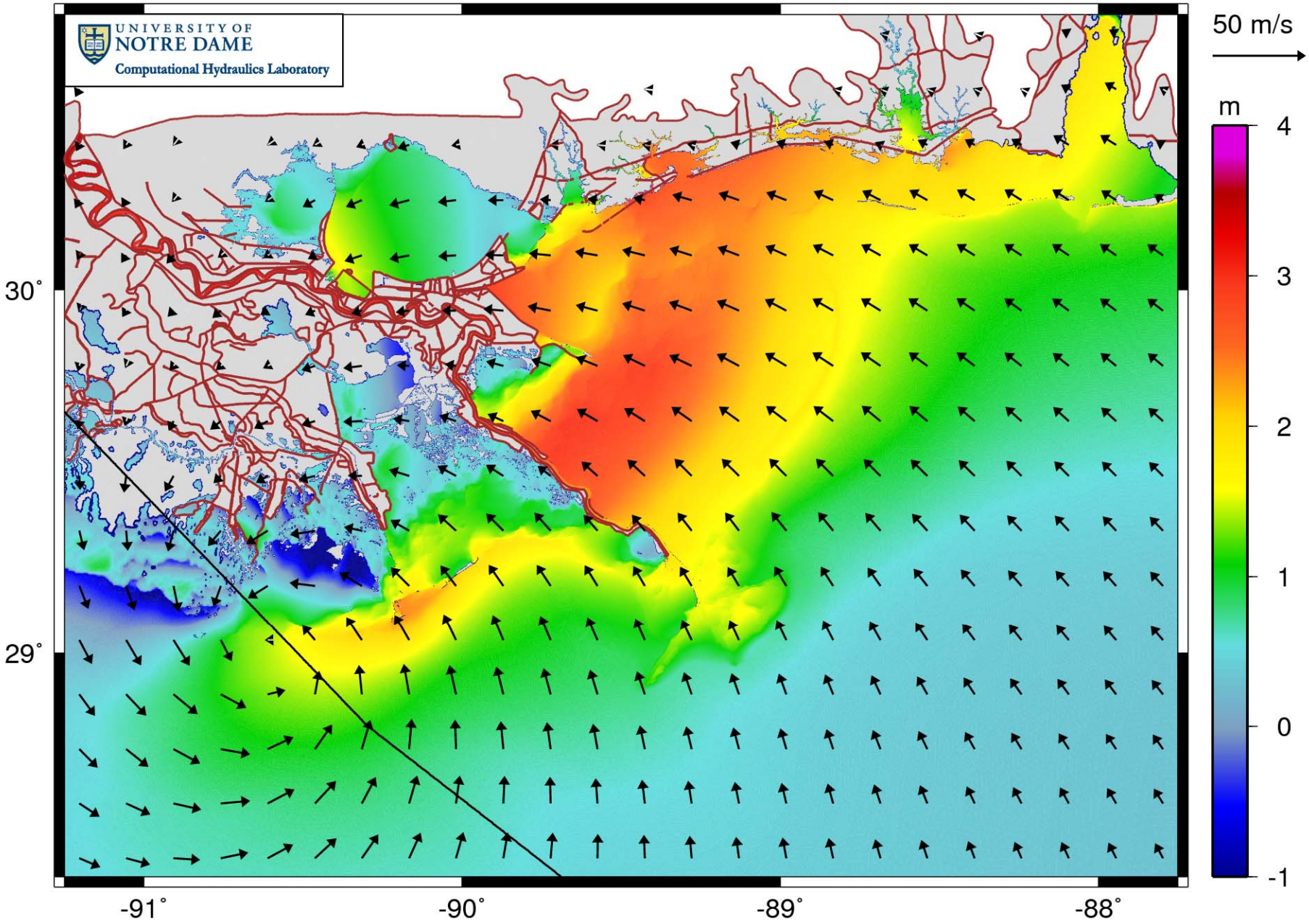
Gustav : Significant Wave Heights : 2008/09/01/1400Z



Gustav : Radiation Stress Gradients : 2008/09/01/1400Z



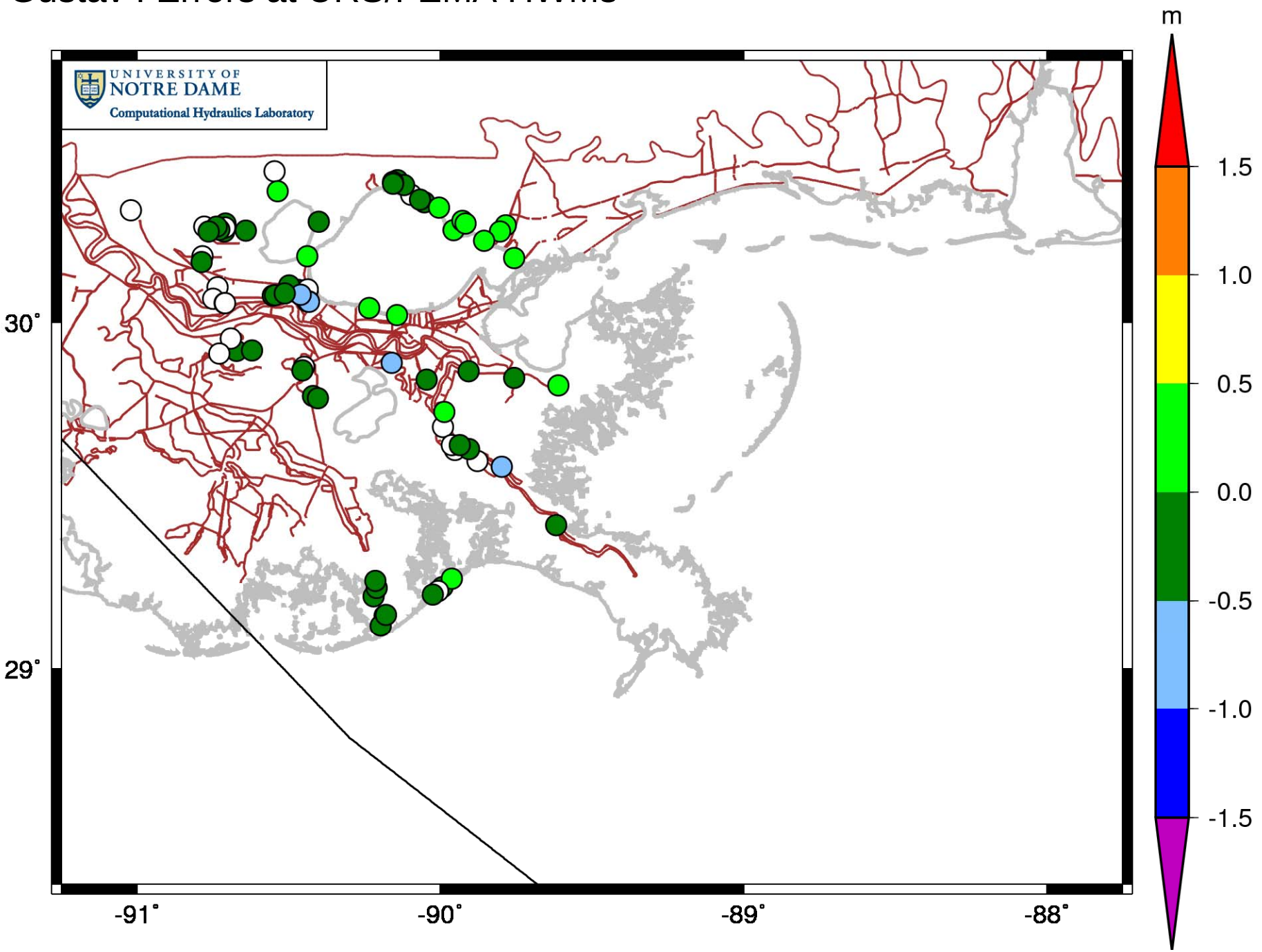
Gustav : Water Levels : 2008/09/01/1400Z



Increased Availability of Measurement Data

	Katrina (2005)		Gustav (2008)	
High-Water Marks	**Total:**	**399**	**Total:**	**82**
	URS/FEMA	193	URS/FEMA	82
	USACE	206		
Time Series	**Water Levels:**	**9**	**Water Levels:**	**184**
	NOAA	3	NOAA	26
	USGS (Permanent)	6	USGS (Permanent)	44
			USGS (Deployable)	42
			USACE	46
			ND (Kennedy)	16
			USACE (Smith)	6
	Wave Parameters:	**14**	**Wave Parameters:**	**39**
	NDBC	12	NDBC	12
	CSI	2	CSI	5
			ND (Kennedy)	16
			USACE (Smith)	6

Gustav : Errors at URS/FEMA HWMs



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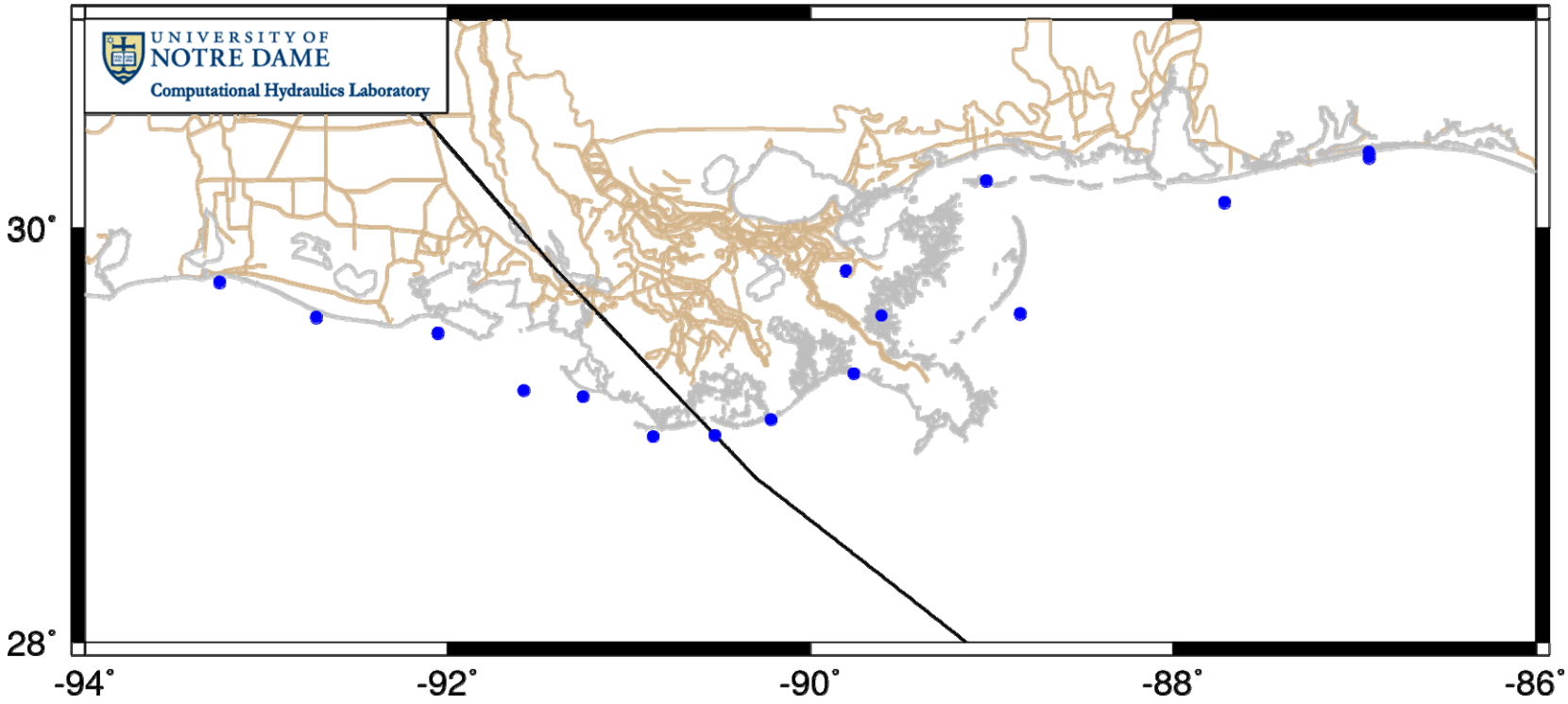
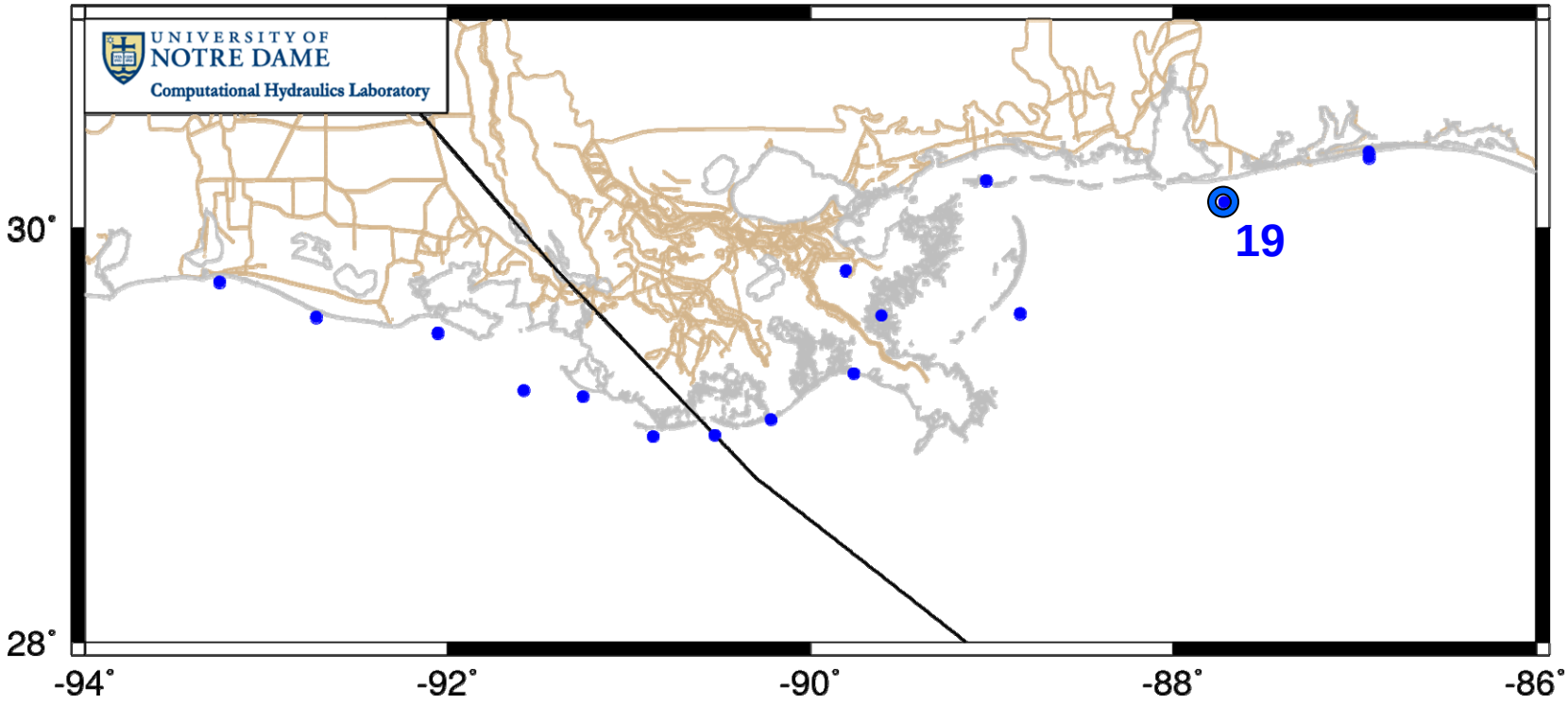
Gustav : Validation of Wave Parameters : AK

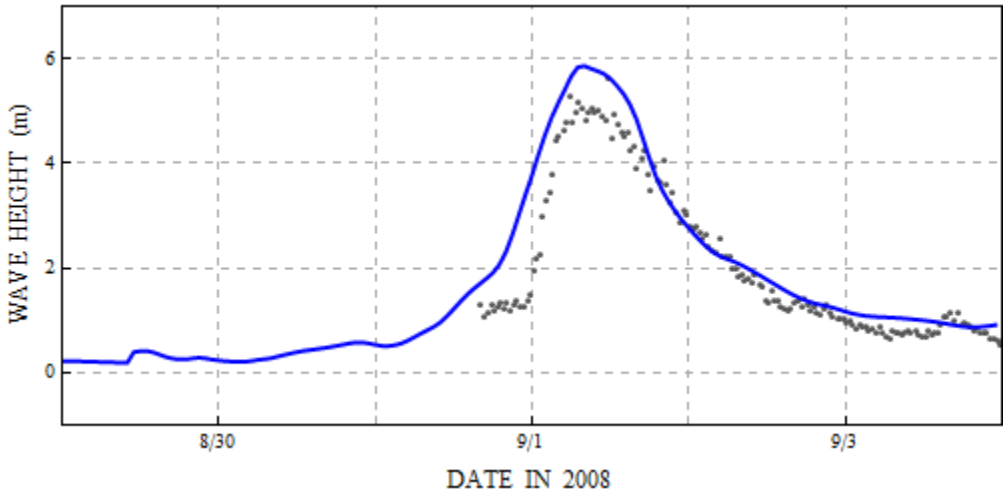


Gustav : Validation of Wave Parameters : AK 19

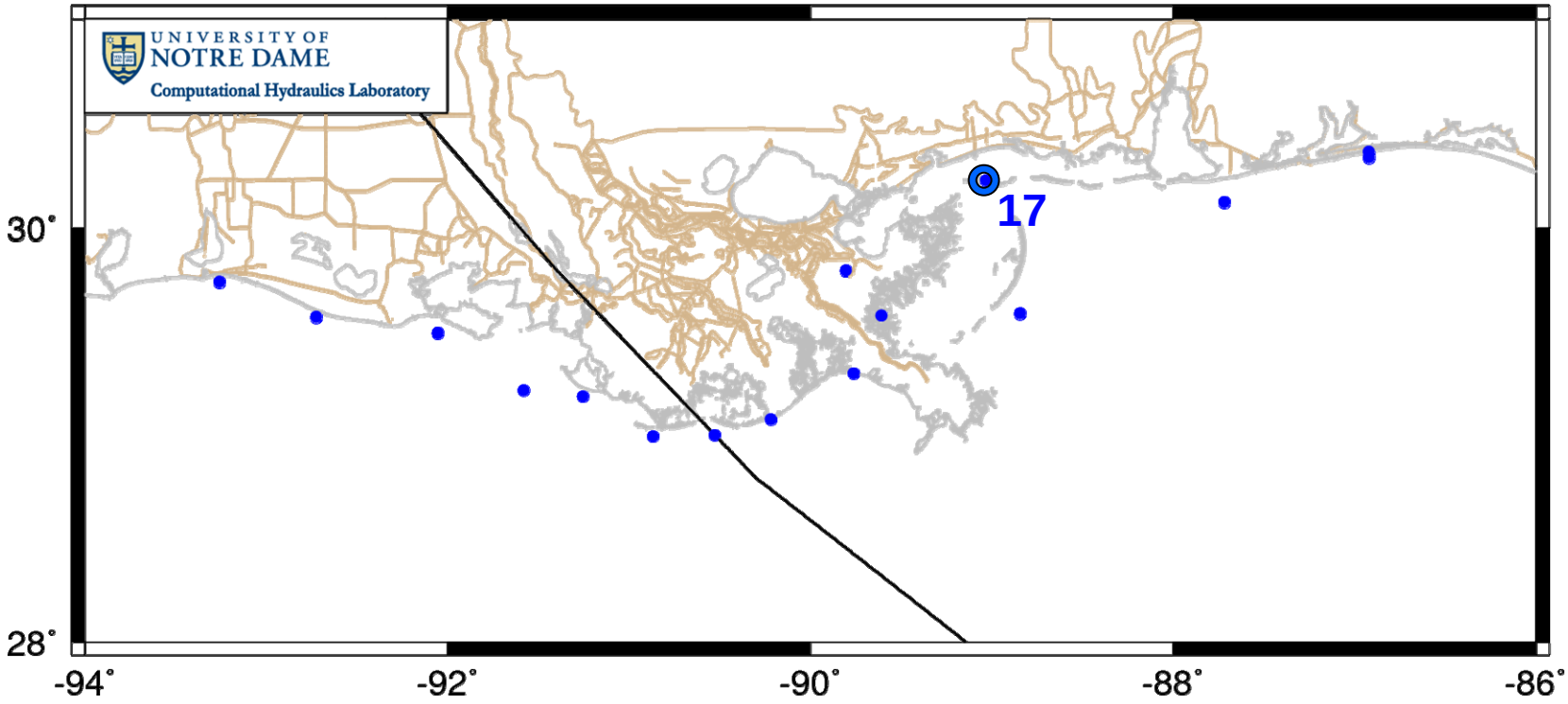


Bathymetry at Gage:

Kennedy:	15.4
ADCIRC:	14.8

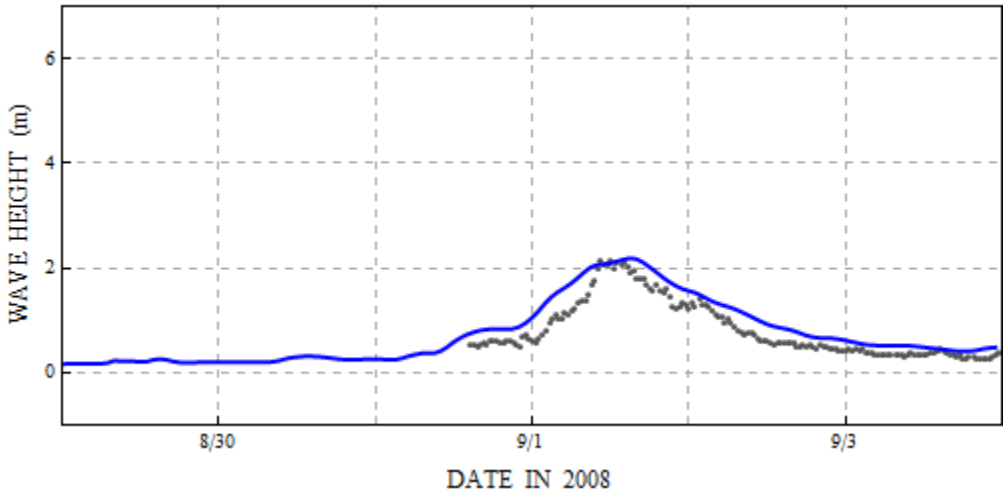


Gustav : Validation of Wave Parameters : AK 17

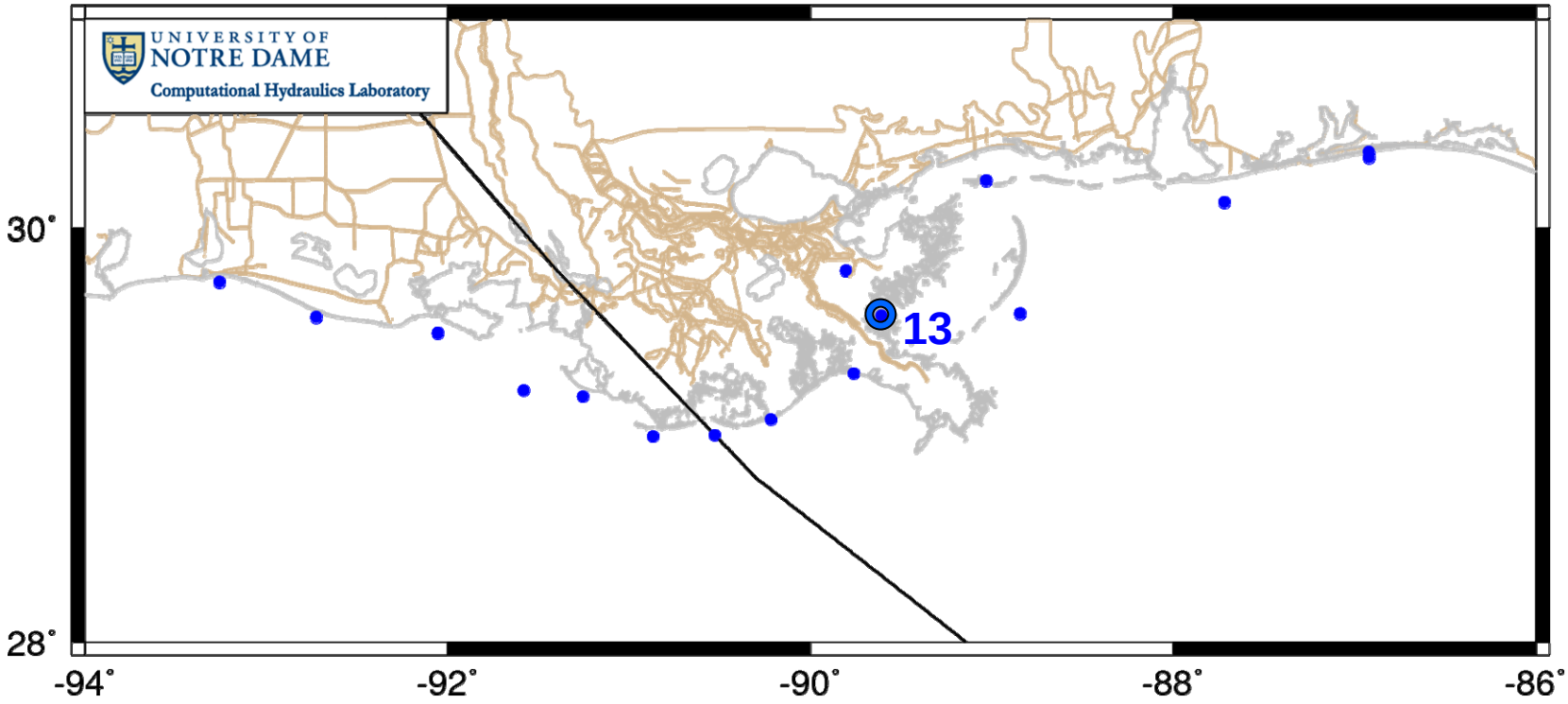


Bathymetry at Gage:

Kennedy:	4.6
ADCIRC:	3.2

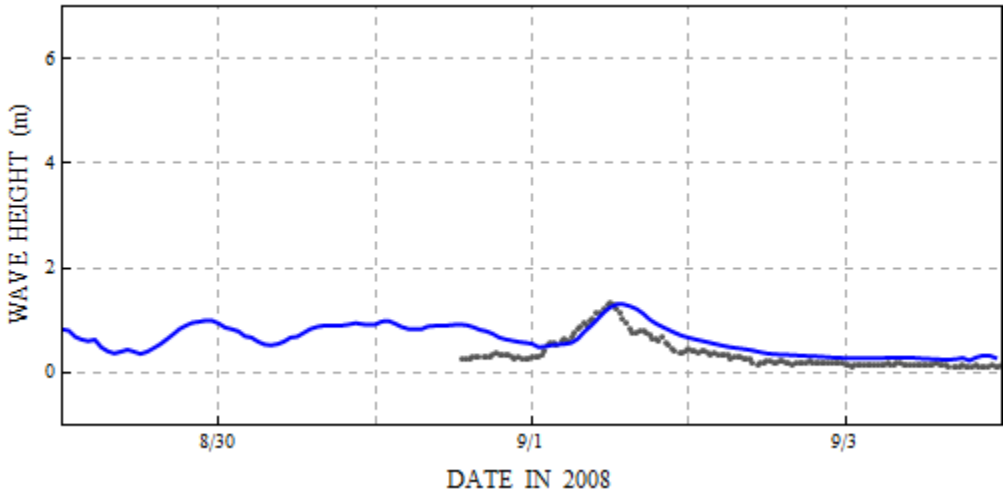


Gustav : Validation of Wave Parameters : AK 13

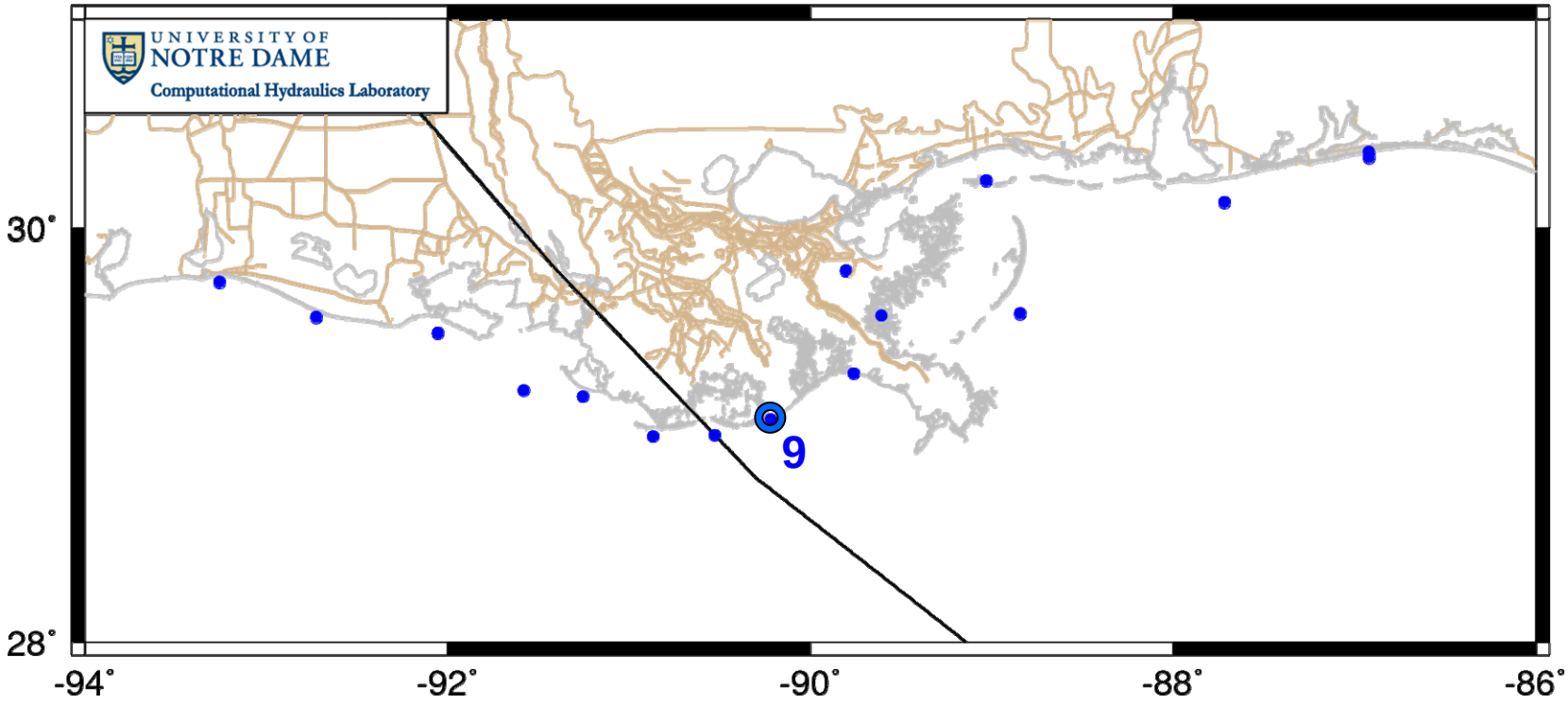


Bathymetry at Gage:

Kennedy:	1.8
ADCIRC:	1.2

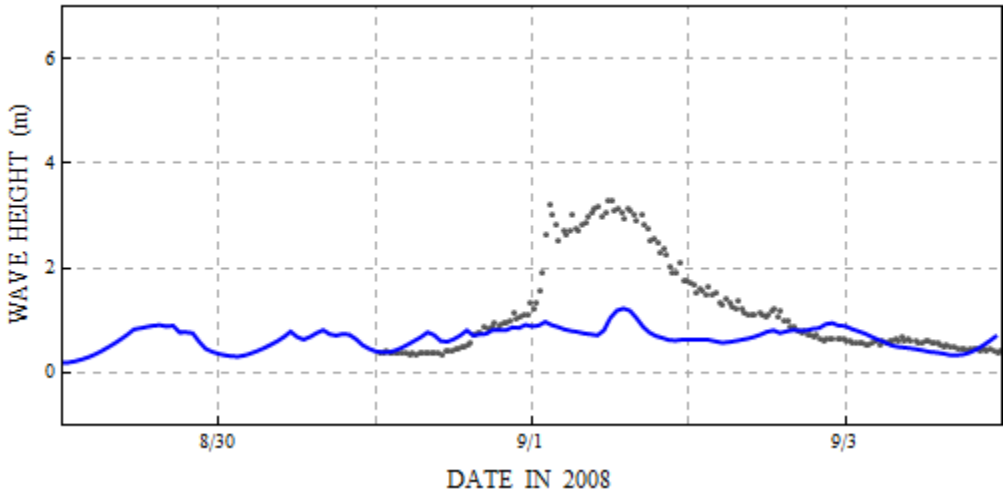


Gustav : Validation of Wave Parameters : AK 9

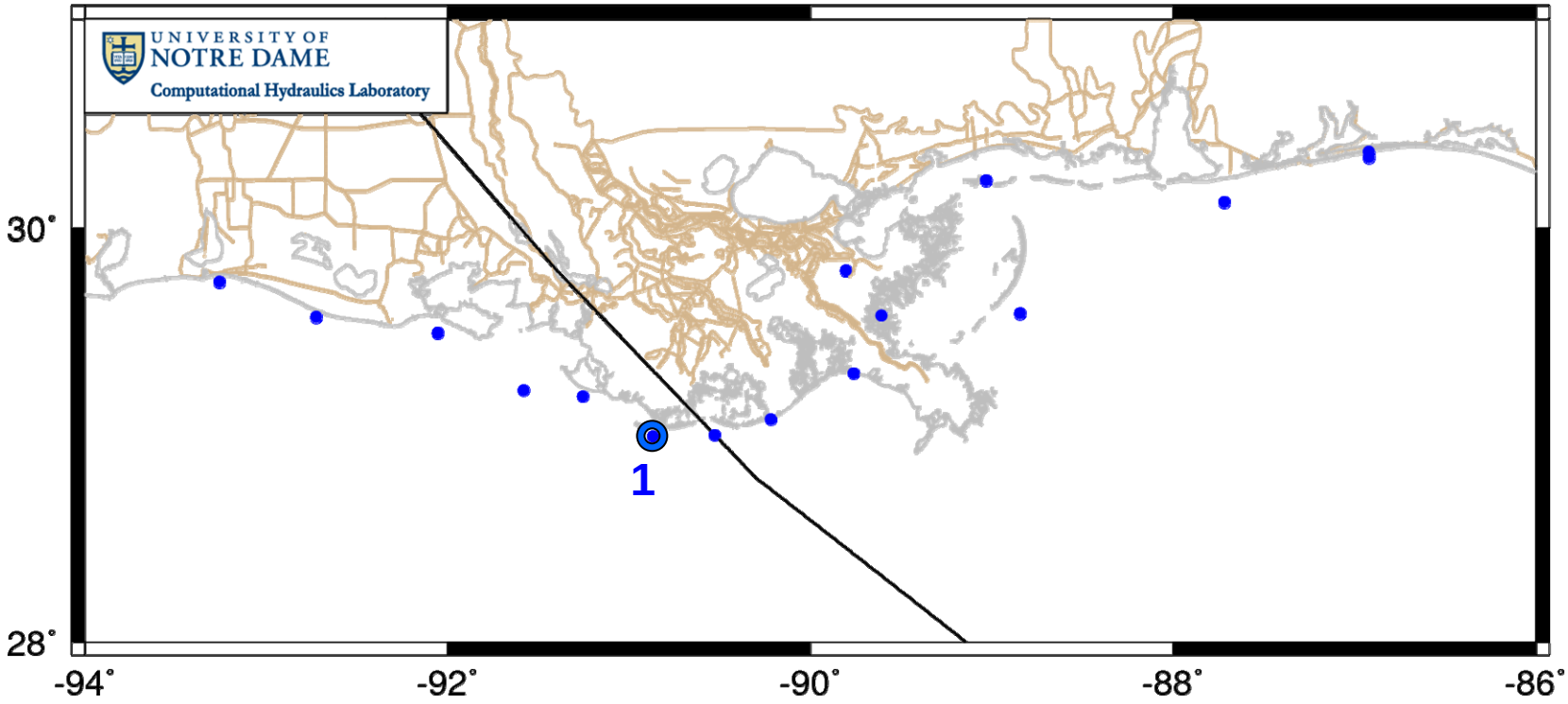


Bathymetry at Gage:

Kennedy:	6.9
ADCIRC:	1.0

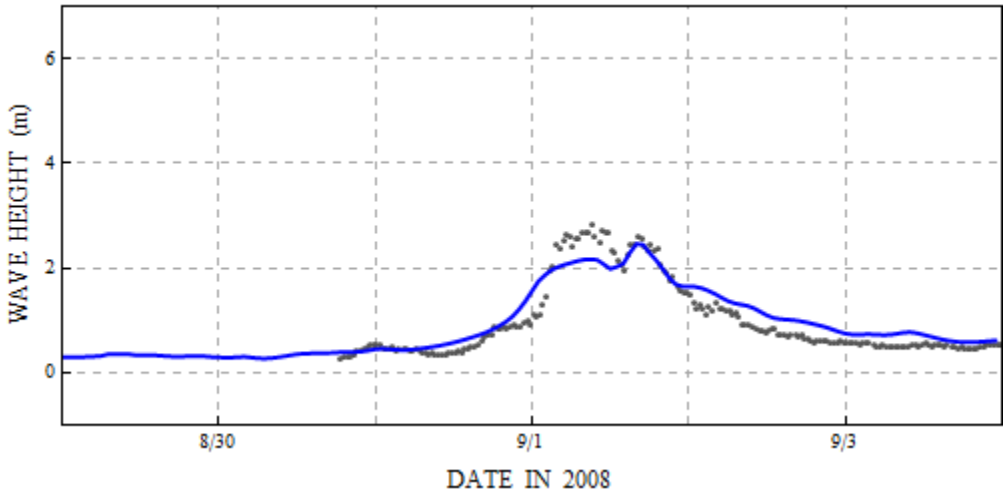


Gustav : Validation of Wave Parameters : AK 1

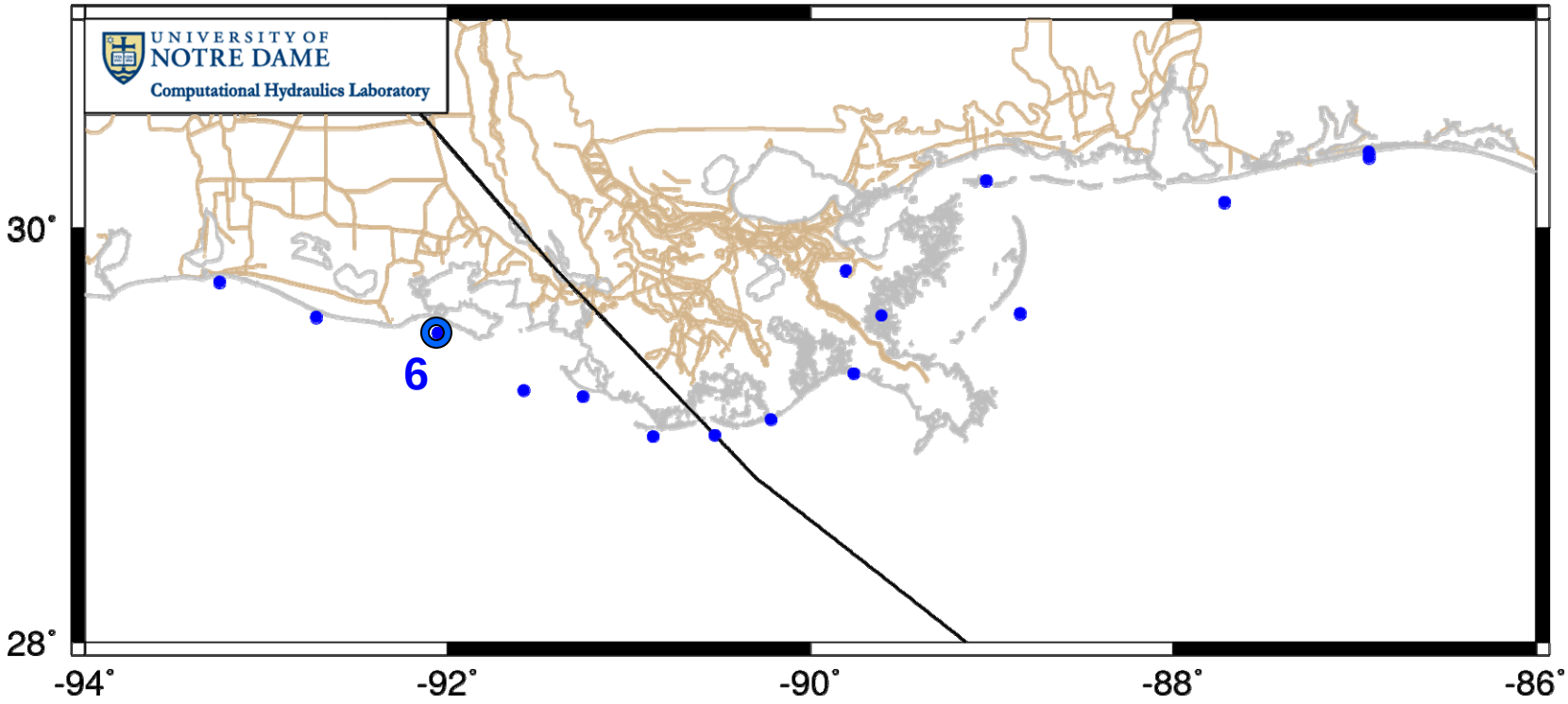


Bathymetry at Gage:

Kennedy:	7.0
ADCIRC:	5.5

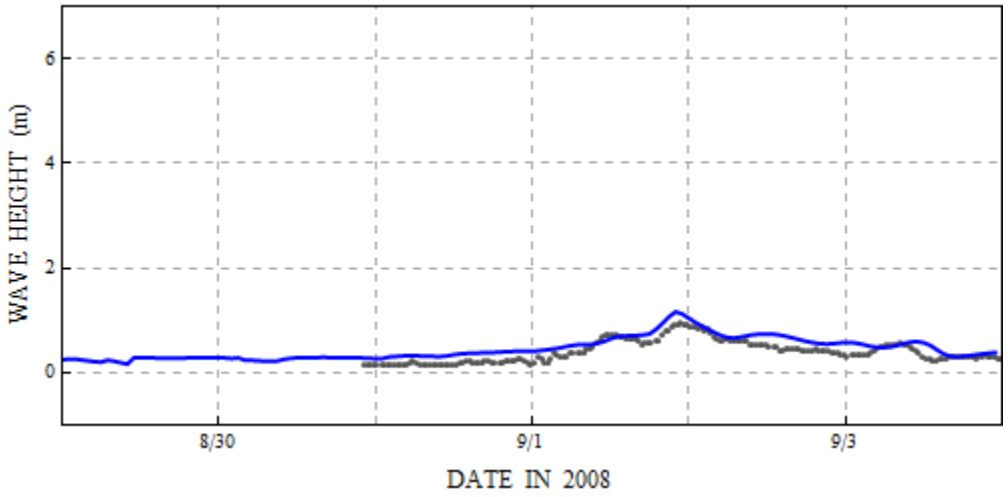


Gustav : Validation of Wave Parameters : AK 6



Bathymetry at Gage:

Kennedy:	3.2
ADCIRC:	2.9



Conclusions and Future Work

Next Generation of Tools

- SL16 mesh improves resolution in southern Louisiana
- ‘Tight’ coupling of SWAN+ADCIRC
- Wealth of measurement data, especially nearshore

SWAN+ADCIRC Hindcast of Gustav

- Weak in intensity, but large in size
- Steady winds pushed water over marshes, into channels
- Good match to measured HWMs
- Must create meshes with both models in mind