

consultants architects engineers

The influence of Lower Plaquemines Parish Mississippi River levees on storm surge in Southern Louisiana

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Motivation



Observations during Hurricane Katrina:

- Surge reached levels up to 6 meters along the lower Plaquemines Parish levee system;
- Huge volumes of water propagated upriver, the water level in the Mississippi River at New Orleans did rise to 4 meter.

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Motivation



Hurricane Katrina made clear that:

- Surge reached levels up to 6 meter along the lower Plaquemines Parish levee system;
- Huge volumes of water propagated upriver, the water level in the Mississippi River at New Orleans did rise to 4 meter.

Objective:

 Study the influence of the Lower Plaquemines levee system on storm surge levels during major hurricane events.

Methodology

thinking in

all dimensions



- Integrated modeling system: ADCIRC and STWAVE;
- 3 different configurations computational grid (SL15):
 - 2007 base condition;
 - Three spillways;
 - No Lower Plaquemines levee system (upper limit).
- Suite of 18 selected storms;
- JPM-OS method to determine 1/100 year levels;
- Analyze the influence of the levee system on:
 - maximum surge levels;
 - surge propagation;
 - 1/100 year flood levels.

In actual situation:

- At Pointe a la Hache surge propagates upriver;
- There is no hydraulic connectivity between the eastand westbank of the delta;

Situation without levees (upper limit):

- 1/100 year flood levels along Lower Plaquemines reduce by 1-2 m;
- Average level in Mississippi River reduces by 1 m;
- The hydraulic connectivity between the east- and westbank allows surge to propagate across the river.

Lower Plaquemines levee system









Lower Plaquemines levee system



- Length Mississippi River from Jesuit Bend: 130 km
- Length levees on eastbank: 39 km
- Length levees on westbank: 92 km
- Crown height levees: 4.8 5.4 meter
- Natural floodplains: 1.0 2.5 meter



Selected storm suite



track

[-]

2

Radius

[km]

32.8

47.8

27.6

40.4

32.8

pressure

[mbar]

930

930

900

900

930

- 18 different storms out of 152 storms, selected by
 - Return level
 - Location (track close to Mississippi delta)

Storm nr.

14

15

17

18

wind

[m/s]

52.4

51.7

58.3

57.8

52.3



thinking in

all dimensions

	24	51.7	930	47.8	2
	26	58.1	900	27.6	2
	27	57.7	900	40.4	2
	32	52.6	930	32.8	3
	35	58.1	900	27.6	3
	52	58.2	900	23.2	4
	53	58	900	34.1	4
	56	58	900	23.2	5
	57	57.5	900	34.1	5
	69	58.3	900	34.1	6
	73	58.2	900	34.1	7
	77	58.2	900	34.1	8
	500	54.8	902	30-35	9

Surge propagation, Actual situation



 No hydraulic connectivity between east- (blue) and westbank (red).



Maximum surge levels for 18 storms

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2007 base condition



Maximum surge levels for 18 storms

ROYAL HASKONING

Impact of removing levees



Surge propagation storm 027, base case





Surge propagation storm 027, no levees



thinking in all dimensi<u>ons</u>

Storm 073, no levees



Hydraulic capacity of Mississippi River to drain propagating surge is remarkable





In actual situation:

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- There is no hydraulic connectivity between the eastand westbank of the delta;

Situation without levees (upper limit):

- 1/100 year flood levels along Lower Plaquemines reduce by 1-2 m;
- Average level in Mississippi River reduces by 1 m;
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To study the impact of:

- different spillway alternatives;
- ring levees around townships;
- removing (parts of) the levee system on other subjects like navigation, restoration of the wetlands, river morphology etc;
- a storm event together with high river discharges.