Supplement on Wave Modeling New Orleans (Gautier, 2008)

To: Ivor van Heerden
From: Caroline Gautier (Svašek Hydraulics)
Date: November 13th, 2008
Ref: 08417/1474

1 Introduction

This supplement presents the data of the study "Wave Modeling New Orleans - Mississippi River Gulf Outlet, Hurricane Katrina August 2005" by Gautier et al, July 9th, 2008 in such a way that the scenarios can be better compared with each other. No additional data is considered.

We focus on three scenarios:

Scenario 1: Katrina real run (situation just prior to hurricane Katrina's landfall)
Scenario 2C: Neutral MRGO (levees present, MRGO absent, original vegetation)
Scenario 3: MRGO-as-designed (levees present, MRGO with original dimensions, original vegetation)

In order to better manage the amount of data contained in the SWAN report we concentrate the discussion on three locations, Bayou Bienvenue (ray 1), Bayou Dupre (ray 6) and halfway in between (ray 3).

2 Wave parameters on cross sections

In Figures 2.1 - 2.3, the wave parameters at 8:00 am (the peak of the storm) on rays 1, 3 and 6 are given. These figures give much more information than the tables (2.1 and 2.2) which only give the results on the blue ("deep"), green ("toe") and red ("levee") location. In each figure, all three scenarios are present. The green lines show the water depth, defined as the sum of surge and bottom level. The three scenarios can be easily recognized in the green lines.

Everywhere along the rays, the continuous lines representing wave parameters for scenario 1 is higher than the other scenarios. The exact difference between the scenarios depends strongly on the considered location. In scenario 1 the high wind speeds and the large water depth of the MRGO result in large wave heights up to almost 10 feet. At the toe of the levee (at the green dot) the wave height has reduced to circa 8 à 9 feet.

In scenario 2C the MRGO is absent and therefore the variation in wave parameters along the rays is almost zero. Significant wave height is about 5 feet, peak wave period about 3.5 seconds.

The dashed line of scenario 3 also indicates wave growth across the MRGO, but since its dimensions are smaller than in scenario 1, the wave growth is less. Furthermore, the vegetation in scenario 3 reduces the waves compared to scenario 1. If Katrina would have hit the area just after construction of the MRGO, so with its original channel dimensions and with the surrounding vegetation present, the significant deep water wave height would be about 25-50% less than what it was in the real Katrina situation.

fig 2.1

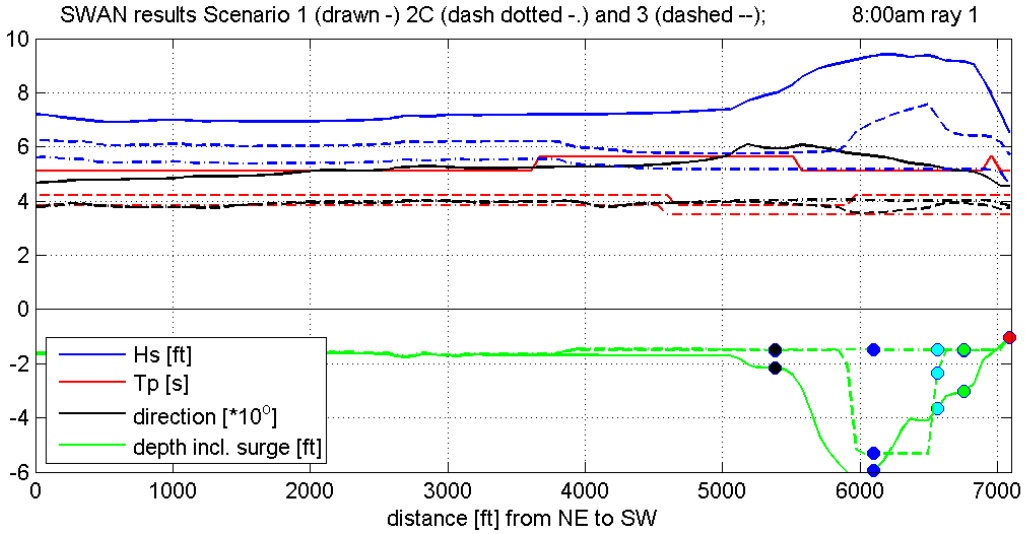


fig 2.2

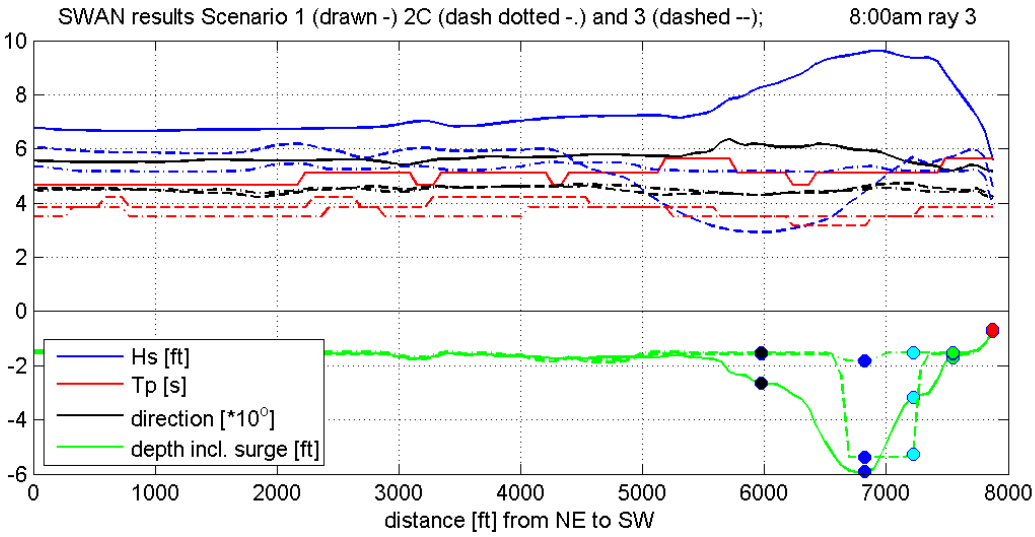
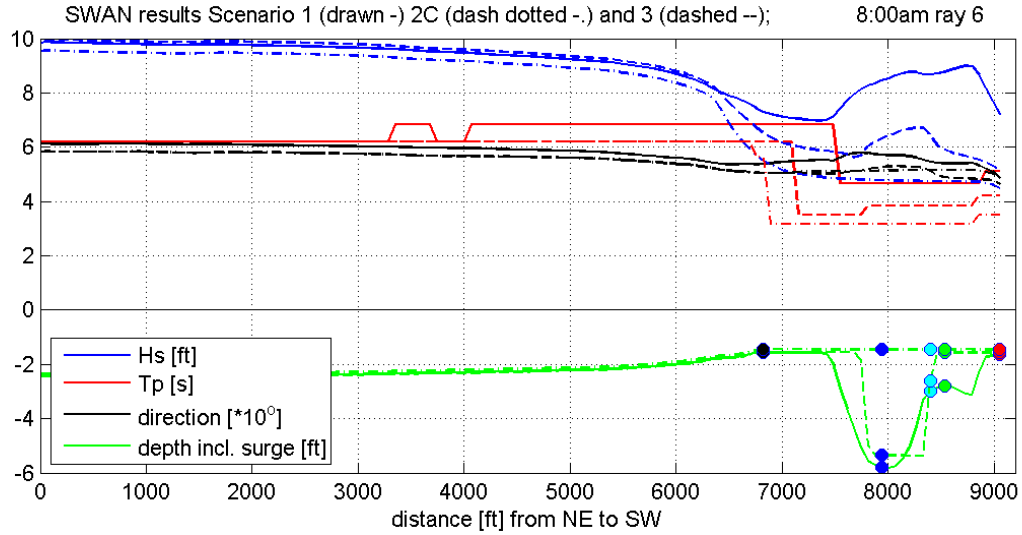


fig 2.3



Hs [ft]	6 am						7 am						8 am						9 am					
	Levee		Toe		Deep		Levee		Toe		Deep		Levee		Toe		Deep		Levee		Toe		Deep	
	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3
ray 1	4.5	-	6.8	4.3	6.9	4.7	5.7	-	8.3	5.5	8.4	6.0	6.8	6.0	9.1	6.4	9.4	6.9	4.3	-	5.3	3.9	5.4	3.9
ray 3	3.3	2.9	6.0	4.0	7.1	3.1	4.9	4.1	7.4	5.0	8.6	3.9	6.0	5.0	8.4	5.7	9.6	4.4	3.6	2.6	4.7	2.7	5.1	2.2
ray 6	5.5	3.6	6.9	4.2	6.8	4.7	6.8	4.7	8.5	5.4	8.3	6.0	7.3	5.2	8.8	5.9	8.7	6.4	3.2	2.0	4.1	2.2	4.1	2.4

Table 2.1: SWAN results Hs [ft]; S1=Scenario 1, S3=Scenario 3

Tp [s]	6 am						7 am						8 am						9 am					
	Levee		Toe		Deep		Levee		Toe		Deep		Levee		Toe		Deep		Levee		Toe		Deep	
	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3	S1	S3
ray 1	4.7	-	4.7	3.5	4.2	3.5	4.7	-	4.7	3.8	4.7	3.8	5.1	4.2	5.1	4.2	5.1	4.2	4.2	-	4.2	3.5	4.2	3.5
ray 3	4.7	3.2	4.7	3.2	4.2	2.6	5.1	3.5	5.1	3.5	4.7	3.2	5.6	3.8	5.6	3.8	5.1	3.2	4.7	3.2	4.7	3.2	4.7	2.9
ray 6	4.2	3.5	4.2	3.2	4.2	3.5	4.7	3.8	4.7	3.8	4.7	3.8	5.1	4.2	4.7	3.8	4.7	3.8	42	2.9	4.2	2.9	4.2	2.9

Table 2.2: SWAN results Tp [s]; S1=Scenario 1, S3=Scenario 3

3 Conclusions

All through the storm the wave heights are lower for the well maintained case as versus the as-is situation. For instance at the peak of storm at 08h00 local time the wave heights in the MRGO channel with the Katrina-as-is the wave heights vary from 8.7 to 9.6 ft, and for the properly maintained scenario (#3) the wave heights vary from 4.4 to 6.9.

Waves have shorter periods with Scenario 3, therefore less run up erosion potential.

What is important is how the wave energy changes, which is related to the square of the wave height. So wave energy increase due to the unmaintained nature of the channel is by a factor of $9.6^2/4.4^2$ which equals 92.16/19.36 which means almost a 5-fold increase in wave energy due to the unmaintained nature of channel.

It is evident that allowing the MRGO to expand and destroy the wetlands significantly increased the fetch of the channel itself and as a result the wave striking the EBSB's was much more powerful.