

# ***Interactive comment on “The Role of Sediment-induced Light Attenuation on Primary Production during Hurricane Gustav (2008)” by Zhengchen Zang et al.***

**Anonymous Referee #2**

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This paper describes a modeling study that investigate the impact of resuspension sediments on primary production and chlorophyll-a during hurricanes in the northern Gulf of Mexico. It is an interesting and relevant topic, but very challenging to perform. The authors formulated (enhanced) and tested a light attenuation equation to account for the impact of sediments on the light regime and how it impacts production and phytoplankton during hurricanes. They concluded that wind-induced resuspension caused the shelf to be a light limited over a short period of time which reduced primary production and chl-a and indirectly impact nitrate. They compared modeled chlorophyll-a to satellite data and concluded that their enhanced light attenuation formulation improved model predictions. They also performed sensitivity analysis using different sed-

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iment light attenuation coefficients. Overall the paper was written well; the Introduction placed their research in context, the method section was described in detail (or referenced), and the results and discussion were fairly sound. Here are the main points that I think the authors need to address to improve the quality of the paper:

- The authors need to do an extensive literature search to investigate how other models calculated light attenuation. I believe there are several levels of light attenuation sophistication in some of the other Gulf (and other coastal systems) models. Also, was their light attenuation formulation based on any previous equations – if so provide a reference.
- The authors reference the models (papers) which their model is based on (in some cases the same or very similar model), including a hydrodynamic, sediment transport and biogeochemical model. They need to give a short description of the models in the “Methods section”, especially the sediment transport and biogeochemical models.
- Authors should mention why they did not include nutrient river loadings (and show values), boundary conditions (and show values) and provide values of initial conditions. Values can be averages, ranges etc. - I am no expert with satellite data, but my understanding is that SeaWiFS is no longer in use? Regardless the authors need to provide information (reference) about the algorithms used to calculate satellite-based chlorophyll-a. Did they use an in-house algorithm? Perhaps also mention why newer satellite data were not used?
- It will be useful if the authors could compare model results with actual observations or ranges. E.g. Figure 5 show pre and post hurricane simulations – perhaps the authors can compare the pre-hurricane values to typical Gulf values and the post hurricane to highest values measured during “windy” times (if there are data available).
- So much is different in the shelf waters during a hurricane – sediments stirred up, high levels of solids and nutrients in the water (including the surface water), likely breakup of stratification, impact on river loadings and discharge into the shelf and more. I therefore do not think comparing model results, where only differences in sediment enhanced light attenuation is accounted, with satellite data prove that one light attenuation formulation is better than the other. I think it is fine to show the comparison and speculating that it might be better, but I do not think the satellite

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data prove it one way or another. I think the authors almost make this point themselves by pointing out the limitations and uncertainty of the model.

General comments Abstract: The abstract seems reasonable. I believe the authors can say a little more about model uncertainty since they make a good point in the paper about all the uncertainties in the model. The authors mention “episodic hurricanes” in line 57, but I do not think the authors should rather mention “wind events” or another term when discussing the impact of high winds including tropical storms etc. The abstract also need to be changed based once changes is made to the paper to reflect any changes in the paper.

Introduction: Line 44: Light is one of the primary agents for photosynthesis (also nutrients, temperature) Line 70: Since light attenuation is an important part of the paper, I think the authors should dig a bit deeper in what has been done, perhaps show their equations (or discuss conceptually) etc. I believe some models/papers have discussed CDOM and other influences on light attenuation.

Model Description: Line 115: Why nitrogen and silica and not phosphorus? I believe some studies in the Gulf have shown that phosphorus can be important at certain times of the year. Perhaps a sentence why it was not included? Line 116: Please expand on how chlorophyll-a was estimated. Fennel reference is fine, but perhaps add a sentence or two. Line 132: Expanding on my “main points”: Provide additional details in the Introduction or this section about the light attenuation formulation used in the paper, what others have done in terms of sediment attenuation, the section of the sediment attenuation coefficients (0.059, 0.025 and 0.075). Are these values based on some median/percentile values? How much faith should we have in these values? Line 171: Should this part not be the Results and Discussion section?

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