

***Interactive comment on “Floodwater Impact on Galveston Bay Phytoplankton Taxonomy, Pigment Composition and Photo-Physiological State following Hurricane Harvey from Field and Ocean Color (Sentinel-3A OLCI) Observations” by Bingqing Liu, Eurico J. D’Sa and Ishan D. Joshi***

The authors would like to thank Reviewer #1 for the thoughtful and constructive comments that will improve the quality and clarity of the paper. The author’s responses are given below in italic font.

**Response to Anonymous Reviewer #1**

“This paper presents two things: (1) the evolution of the Galveston Bay system following Hurricane Harvey in 2017 drawing on satellite data to do this and (2) the description of the algorithms and their subsequent validation against in situ data.”

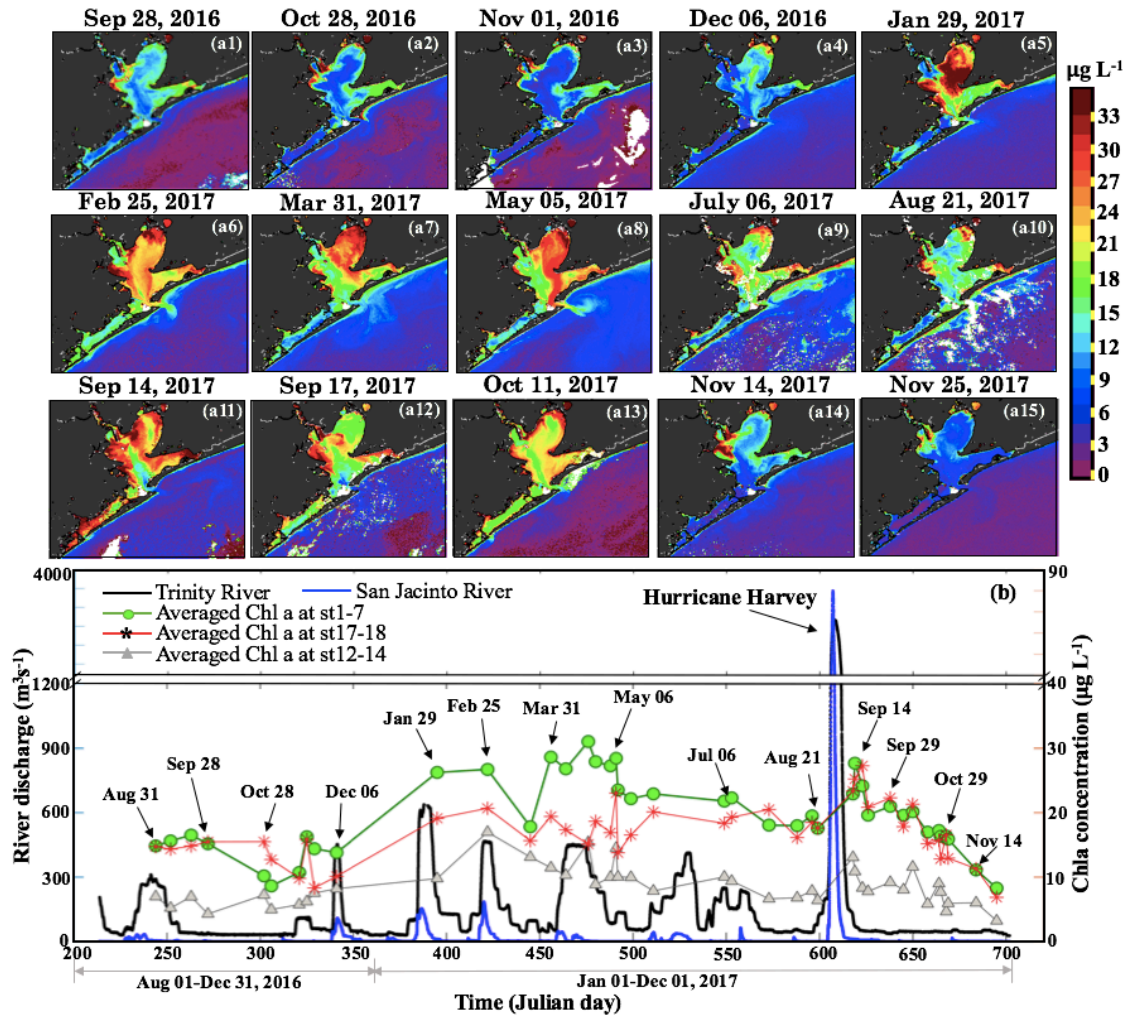
**Response:** *We thank the reviewer for recognizing our efforts in this.*

“Papers like this are always difficult to judge as there is a highly technical aspect of algorithm description, justification and validation on the one hand and then the (more interesting to the general readership) description of the evolution of the GB system on the other. On balance, the authors have done a good job of algorithm description, justification and validation. However, in terms of the evolution of the GB system following the hurricane it would be good to draw on actual datasets of river discharge during the event, as well as any other supporting data that could be obtained. There are some statements within the manuscript, such as nutrient loading, which are not substantiated by any data for example. It would also be useful to put a few paragraphs in describing the phytoplankton succession and reasons for it - it would also be worthwhile looking to contrast this event with the background "mean state" i.e. what are the anomalies from other years in the satellite record (this may only be possible for 10 - 20 years for a small subset of variables, such as chlorophyll).”

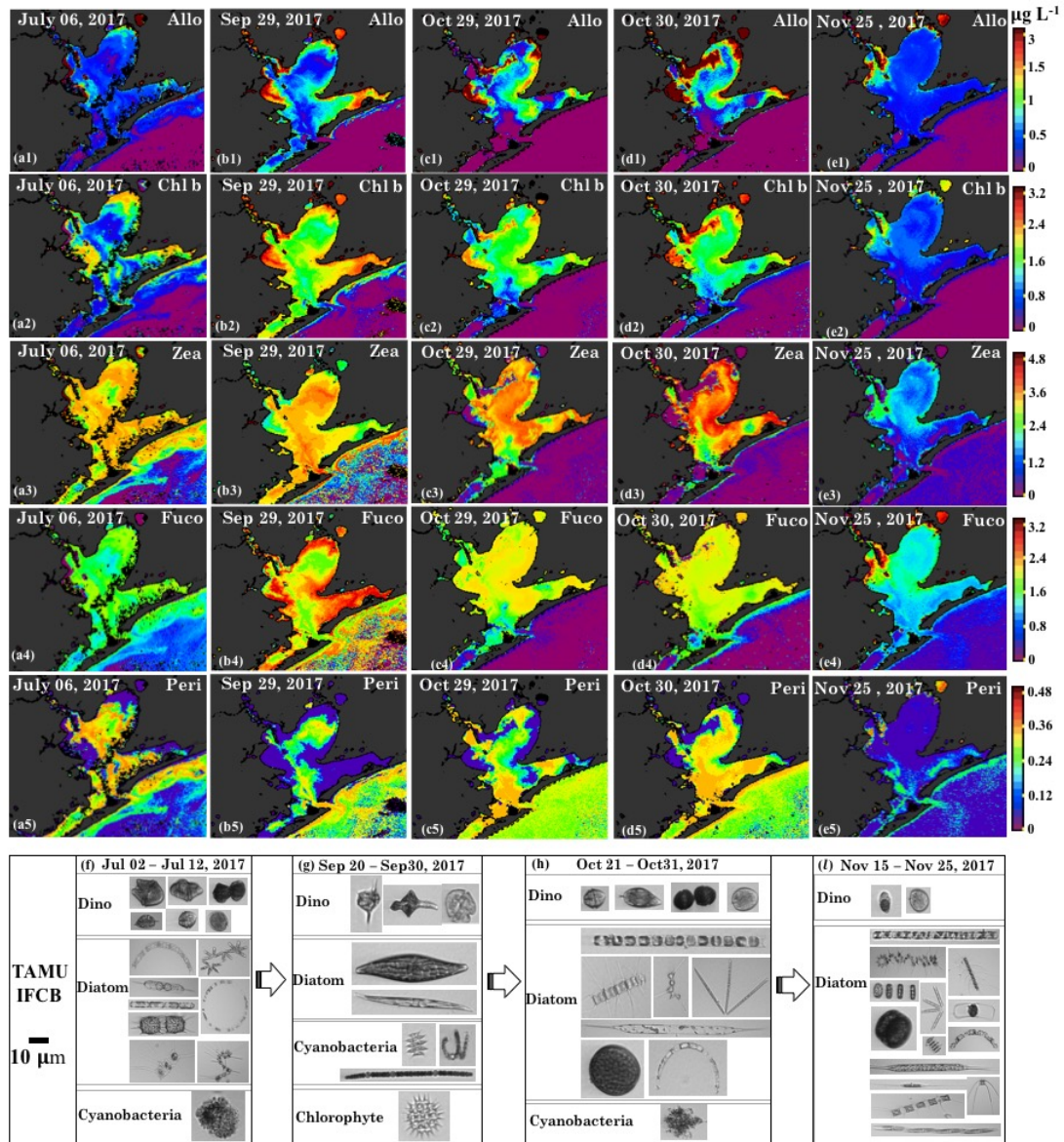
**Response:** *Thanks for noting this deficiency. We carefully followed the reviewer’s comments to improve the manuscript by providing greater context surrounding the variations before and after hurricane event, which might be more interesting to the general public. We also added more data including river discharge information, OLCI-derived chlorophyll and Imaging FlowCytobot data to support hurricane-induced variations described in this study; these are now shown in Figures 11 and 14. We also appreciate the positive comment on our algorithm description, justification and validation. The corresponding improvements are shown as below:*

- (1) We have included river discharge data from the Trinity and San Jacinto Rivers, for the period August 01, 2016-December 01, 2017 (downloaded from USGS) to understand seasonal patterns of river discharge and the Hurricane Harvey flooding event. Nutrient data for the basin area, is not readily available for GB. We have thus referenced Santschi 1995, who using an extensive set of field observations showed nitrate to be inversely correlated with salinity in GB. Thus, during the flooding event induced by Hurricane Harvey and the extremely high river discharge, nutrients were most likely elevated in GB.*
- (2) A paragraph has been added in **Section 4.3** between line 719-735 in the manuscript to describe the phytoplankton succession and reasons for the variations in phytoplankton abundance and taxonomy.*
- (3) We have not considered using Chl a over the suggested 10-20 year period as the standard MODIS Chl a product is of coarser resolution (1 km) than OLCI (350 m) and likely inaccurate in the optically complex bay waters. Sentinel 3A-OLCI Level 1B data which are only available after June, 2016 were therefore downloaded and processed for Chl a between August 01, 2016-December 01, 2017. Thus, a year-long OLCI-derived Chl a has been used to examine both seasonal and regional variations in Chl*

a in conjunction with river discharge (Fig. 11). We have also added a section in the revised manuscript: Section 3.2.2 “Long-term Chl a Observations in Comparison with Hurricane Harvey Event”.



- (4) **Figure 11.** (a<sub>1-15</sub>) OLCI-derived Chl a shown for the period of August 31, 2016–November 25, 2017. (b) Trinity River discharge at Romayor, Texas (USGS 08066500, black line) and the west flank of the San Jacinto River (USGS 08067650; blue line); the green, red and gray lines/symbols represent the mean of Chl a at stations 1–7 in Trinity Bay, at stations 17–18 in East Bay and at stations 12–14 close to the entrance of GB corresponding 43 cloud free Sentinel 3A-OLCI images (colored symbols; dated values corresponding to images a<sub>1-15</sub>).
- (5) NNLS pigment algorithm has been applied to Chl a maps of July 06, 2017, and November 25, 2017 to further assess the variations of biomarker pigments pre- and post-hurricane. In addition, freely available data of microplankton (10 to 150  $\mu\text{m}$ ) recorded by an Imaging FlowCytobot (IFCB) located at the entrance of GB (<http://dq-cytobot-pc.tamug.edu/tamugifcb>) have been added to Figure 14 to support pigment retrievals.



**Figure 14.** Sentinel-3 OLCI derived maps of diagnostic pigments for Galveston Bay. Simulated **a<sub>1</sub>-e<sub>1</sub>**) alloxanthin, **a<sub>2</sub>-e<sub>2</sub>**) Chl b, **a<sub>3</sub>-e<sub>3</sub>**) zeaxanthin, **a<sub>4</sub>-e<sub>4</sub>**) fucoxanthin, and **a<sub>5</sub>-e<sub>5</sub>**) peridinin concentrations. a, b, c, d and e represent columns (maps for July 06, September 29, October 29-30 and November 25, 2017) and 1-5 represent rows (pigments), respectively; **(f)**, **(g)**, **(h)** and **(l)** are the corresponding IFCB data for July 06, September 29, October 29-30 and November 25, 2017, respectively; note that IFCB pictures of fresh water species including chlorophyte and cyanobacteria that appeared on September 29, 2017 have been zoomed in for better clarity.

“Overall though, a well written manuscript and worthy of publication.”

**Response:** *We appreciate that the reviewer found this work interesting and worthy of publication.*

Reference:

Santschi, P. H.: Seasonality in nutrient concentrations in Galveston Bay, *Mar. Environ. Res.*, 40, 337-362, 1995.