Response to Anonymous Referee #1

Thank you for your comments. The response to the Reviewer's comments are in black while the original comments are in blue.

This paper details a sensitivity analysis of aquatic vegetation in the COAWST model using a novel Effective Quadratures method. The model uses a three-dimensional drag term and generates TKE in the presence of vegetation. The paper does not detail the implementation details of the vegetation module (though equations are given in Table 1), but evaluates the sensitivity of the model via novel Effective Quadratures method. The outcome of this paper is guidance on setting parameters in similar modules.

Major corrections ——————
The paper is not focused in its current state. The details of the EQ methods are not given and neither are details of the vegetation model. In order to properly judge the conclusions more details on the EQ methodology are required. The paper therefore lacks a clear aim: is it detailing the EQ method (no - this is cited as Seshadri et al, 2017b, although as a paper in JOSS it lacks detail), the coupling of vegetation to COAWST (no - this is Beudin et al 2017). The paper should therefore be refocused along the lines of: "new methods for assessment of models, including work on developing new metrics for assessing model performance and novel ways of comparing model results with observational data" as to my knowledge EQ has not been used in a coastal model and as such this would represent an advance. More details of the implementation would greatly improve the paper.

The paper does not detail the implementation details of the vegetation module because a reference paper also published by the part of the same group of authors (Beudin et al., 2017) contains the details of the implementation of the vegetation model. We have attempted to summarize the physical processes and related equations in Table 1 of the paper. The goal of the current paper is to provide guidance to the setting up of the parameters for the vegetation model by performing the sensitivity analysis.

The Reviewer states that the JOSS paper (Seshadri et al., 2017b) lacks details of the EQ method. This is true, however, the JOSS paper is simply for the software release. The underlying methodology is cited in the SIAM paper (Seshadri et al., 2017a) in Section 2.2, where more details as to what the subsampling strategy entails are provided. The computation of the Sobol' indices is outlined in Surdet et al., but is also provided in the appendix of the SIAM paper (Seshadri et al., 2017a). The purpose of the present paper is to demonstrate the computation of sensitivity metrics using an approach that is amenable to multi-physics simulations that are not computationally cheap. The EQ method has not been developed as a part of this study and we are not comparing the model results with observational data as well.

In the final version of the manuscript we will modify the introduction and conclusions to clarify the focus following the Reviewer's suggestions. Specific additions to the text include:

Line 25-29 Page 2 in introduction: These tools are implemented in the open source package, Effective Quadratures method (EQ) (Seshadri et al., 2017b) and the current work provides one of the first applications of this methodology to quantify sensitivity of input parameters in coastal models.

Therefore, the goal of this work is to use the EQ method to estimate Sobol' indices to estimate the sensitivity of the flow and wave dynamics to vegetation parameters in COAWST model.

Line 23 Page 10 in conclusions: We use an existing tool comprising of polynomial quadrature method to investigate the sensitivity of plant input properties for the vegetation module in COAWST model.

Minor Corrections:

1. Title: Change as requested by Editor
   Changed the title of the paper upon Editor's suggestion to include the version of EQ method "Sensitivity Analysis of a Coupled Hydrodynamic-Vegetation Model Using the Effectively Subsampled Quadratures Method (ESQM v5.2) "

2. Line 4 fixed the typo

3. Line 15, Yes it is 40 CPU hours for 24 cores. Alternatively, we can use the word "Core hours". So the current simulations required 24*40 core hours.

4. Color scheme in Figures 4-7 is now using a continuous color scheme "viridis" from the matplotlib tool kit options. As an example, Figure 4 is shown on Page 3 of this document:

5. Figure now contains the individual legend on the line. Also, replaced the lines with different colors with symbols and markers for clarity. Please see the new figure at the end of this response document.

6. Code availability link has been modified to contain the right information.
   https://coawstmodel-trac.sourcerepo.com/coawstmodel_COAWST

References

- Beudin, A., Kalra, T. S., Ganju, N., K., and Warner, J.C.: Development of a Coupled Wave-Current-Vegetation Interaction, Computers & Geosciences, 100, 76-86, 2017.
- Seshadri, P., Narayan, A., and Mahadevan, S.: Effectively Subsampled Quadratures for Least Squares Polynomial Approximations, arXiv: 1601.05470, 2017a.
- Seshadri, P., Parks, G. T.: Effective Quadratures (EQ): Polynomials for Computational Engineering Studies, Journal of Open Source Software, 2(11), DOI: 10.21105/joss.00166, 2017b.
- Sudret, B.: Global sensitivity analyzing using polynomial chaos expansions, Reliability Engineering and System Safety, 93, pp. 964-979, 2008.

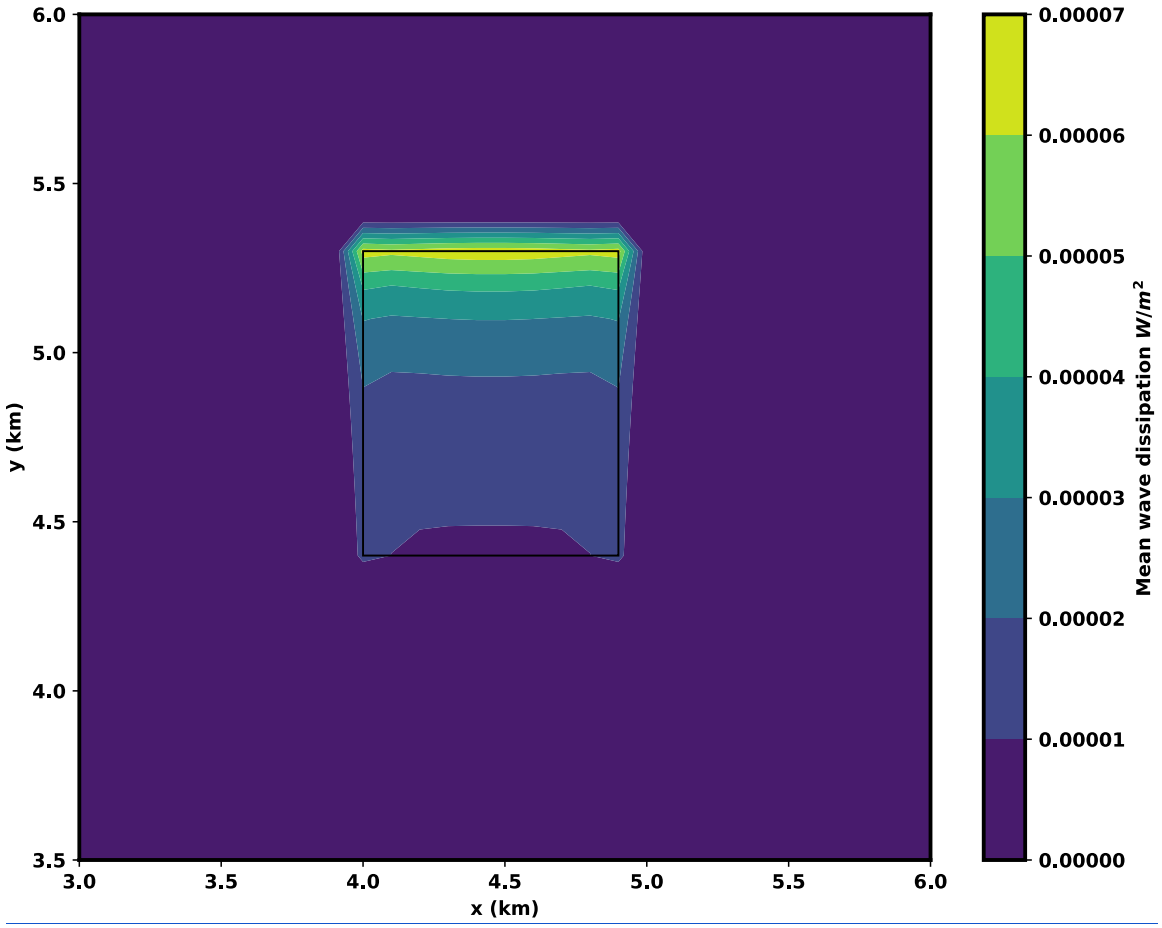

Figure 4: Standard deviation from wave dissipation (W m^{-2}) in presence of vegetation (Plan view). The area of the vegetation patch is highlighted in the middle of the domain.

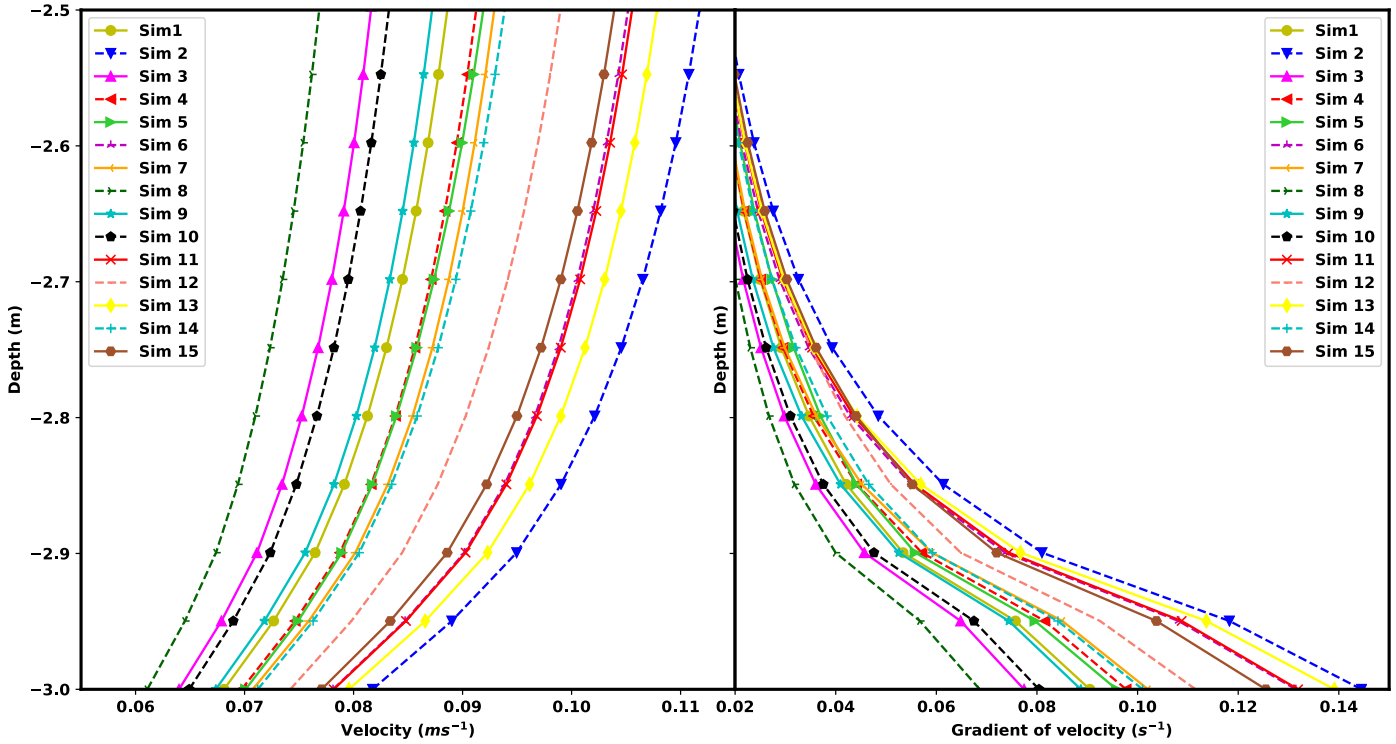

Figure 8: (a) Velocity (m s^{-1}) profile and (b) Vertical gradient (s^{-1}) of velocity profile varying with depth in front of the vegetation patch at a particular time instance during flood for different simulations.