

# Comments on “Statistical characterization of erosion and sediment transport mechanics in shallow tidal environments Part 2: suspended sediment dynamics”

## 1 Summary

This work is part 2 of the study that introduces the idea of using random processes to model the wave-tidal-induced events along the coastal area. The Venice Lagoon, Italy is chosen as the study site due to the availability of multiple bathymetry surveys over the past centuries. The WWTM model coupled with STABEM sediment transport model is used to simulate morphodynamics. Statistics are extracted from simulation results. The author found that over-the-threshold suspended sediment concentration (SSC) events follows can be modeled as marked Poisson process. As Part 1 paper, this work paved a new way to upscale short-term simulations in a wave-tidal environment to long-term, while following the statistical characteristics. This paper has a very similar structure to the Part 1 paper, as well as employed identical analysis using morphodynamics results. However, different from hydrodynamics simulations, simulating the dynamics of SSC is much more complicated which means more uncertainties. Hence, I recommend the author show more validation of the modeling results. Maybe some changes also need to be adapted in the analysis to address the differences. Secondly, although I understand the idea behind the “threshold of SSC”, in my opinion, the author did not show the physical meaning or mathematical definition of it, which makes it not well-defined, I recommend the author add more work to its definition. Thirdly, I believe when dealing with a time scale over 4 centuries, the climate can play an important role, and the analysis should take into consideration of it. As the revision in Part 1 paper, I recommend the author add more model details, and the choice of constants. There are more things that need to be addressed, which are listed below. Overall, I think this work has good potential, but still needs more work.

## 2 Major comments

1. As the first paper, the knowledge gap in this work is not clear from the literature reviews. The Poisson process is commonly used in describing the occurrence of events. The author needs to show that people have not used this technique in sediment transport events. For example, in Line 201, the author said that there are studies using Poisson processes to describe geophysical processes. Compare to those studies, the author should explicitly point out the new knowledge that the readers can gain from this work.
2. Line 137. Please introduce the equations that are used in the sediment transport model, particularly, the choice of entrainment relations for cohesive and non-cohesive materials, as well as the choice of parameters in the equations.

3. Line 144, the initial bed composition is very important in the simulation of suspended sediment concentration. More details are needed to show how the local bed composition is determined. Furthermore, it will be helpful to show data such as grain size distributions, and show how the sediment properties in this 2-sediment-class model are determined.
4. Line 151. The author mentioned that bottom shear stress and critical shear stress are determined using a stochastic approach from Grass (1970). Please give more details on how it is implemented. Is the implementation validated using benchmark tests? How do the results look like compared to the classic deterministic approach?
5. Line 182. In the first paper, the critical shear stress is a well-defined concept. While in Part 2, it is not clear what is the physical meaning of the “minimum-intensity threshold  $C_0$ ” of SSC.
6. Line 201. The choice of  $C_0 = 40$  mg/L needs to be justified.
7. Line 343. When talking about the comparison in the past centuries, it might be important to consider the impact of climate change.
8. In the introduction, the author stated that there exists field-measured data and remote sensing data for SSC. I think it is necessary to show the comparison between the simulated results and those datasets as model validation.

### 3 Other comments

1. In the captions in Figure 2, 3, 4, 5, 7, 8, 9 The description of subfigures is confusing. Recommend switching the order of the year and sub-figure numbering. For example, use “(a) 1611; (b) 1810; ...” instead.