05.09.2024

Answer to Referee 2:

The authors thank the reviewer for his/her comments. The point-by-point answers to the review are provided in blue in the following.

Main comments:

This manuscript focuses on the performance of NEMO and ADCIRC ocean models in simulating storm surges in tropical east Atlantic. It concludes that both ocean models can simulate storm surge in a similar way. It also concludes that ERA5 atmospheric reanalysis forcing gives better results than parametric wind models and also that inclusion of baroclinic processes in the simulation improves the result significantly. Different wind stress parametrizations, and the surge interaction with tide and mean sea level have shown little to minimal impact. Globally I would say that this study is well conducted, and gives some interesting results. However, I would suggest a general review to improve the flow and readability. Sometimes it gets hard to follow.

Thank you for the comment. The entire manuscript has been revised by the authors and by a professional editing service in scientific English. We believe that the new version provided has improved this issue.

Specific comments

- In lines 219-230 you describe how you investigated the impact of wind stress parameterizations. I find this section very hard to follow. I also would say that is poor in terms of content. I would re-write this part describing both equations in more detail, especially Eq.1, that has no description of the variables whatsoever.
- I appreciate the fact that you performed a different simulation with a variable Charnock parameter depending on wave parameters. You should explain why you performed this additional simulation, mentioning why sea roughness is dependent on wave parameters, explaining what variables have an impact, and cite the authors that investigated this process.

Thank you for your comments. We have modified the explanation of the wind stress parameterizations tested as follows (L221-230):

"The barotropic configuration of NEMO is also used to investigate the impact of wind stress parameterization on storm surges, taking advantage of the flexibility of NEMO in modifying the code. This study compares the S&B (Smith and Banke, 1975) scheme (Eq. (1)) with the Charnock formulation (Charnock, 1955) (Eq. (2)). In the S&B scheme, the wind stress τ is calculated using a simple formulation for the drag coefficient C_D, which represents the drag force exerted by the wind on the water surface, as follows:

$$(1)\quad \tau = \rho_a C_D U^2 \text{ with } C_D = (0.75 + 0.067|U|)e^{-3}$$

where ρ_a is the air density and U is the 10 m wind speed.

The Charnock relationship is a semiempirical formula that involves a more complex calculation accounting for changes in surface roughness with wind speed as follows:

$$(2)\quad \tau = \rho_a u_*^2 \text{ with } z_0 = \frac{\alpha u_*^2}{g}$$

where z_0 is the roughness length, α is the dimensionless Charnock parameter, u_* is the friction velocity and g is gravity. In general, the Charnock parameter α is generally assumed to be constant in the formulation of sea surface roughness (Eq. (2)). For example, in the standard NEMO code, it is kept constant in space and time, equal to 0.018. In reality, this parameter varies with sea surface roughness and is influenced by various wave parameters, such as wave age, wave steepness and the presence of sea foam, especially under high wind conditions, as suggested by numerous studies published in recent decades (Janssen, 1989; Moon et al., 2004; Pineau-Guillou et al., 2020; Wu et al., 2024). An additional simulation has therefore been performed using a variable Charnock parameter derived from ERA5 reanalysis outputs, which depend on wave conditions (Riverside Technology, 2015)."

- Also, I could not find (Smith and Banke, 1975) on your reference list. There could be others missing. I recommend to check the list very carefully.

Thank you. The reference Smith and Banke (1975) has been added and the whole reference list has been checked.

References

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Pineau-Guillou, L., Bouin, M.-N., Ardhuin, F., Lyard, F., Bidlot, J.-R., and Chapron, B.: Impact of wave-dependent stress on storm surge simulations in the North Sea: Ocean model evaluation against in situ and satellite observations, Ocean Modelling, 154, 101694, https://doi.org/10.1016/j.ocemod.2020.101694, 2020.

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