

Geosci. Model Dev. Discuss., referee comment RC2  
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## Comment on gmd-2021-242

Anonymous Referee #2

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Referee comment on "Determining the sensitive parameters of the Weather Research and Forecasting (WRF) model for the simulation of tropical cyclones in the Bay of Bengal using global sensitivity analysis and machine learning" by Harish Baki et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-242-RC2>, 2021

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The study investigates the sensitivity of 8 meteorological variables to 24 WRF model parameters. Three methods are being used for the sensitivity analysis, with very similar results, indicating that the results are robust. Most variables are only sensitive to a few parameters, and some parameters don't introduce any obvious sensitivity. The results can help to improve forecasting by finding optimal tuning parameters in numerical models.

The study is well-constructed and generally well written. I don't see any major flaws that would prohibit publication. In fact, I think this is a nice systematic study that can tell us a lot about how to improve forecast models, and how to find optimum value for the myriad of tunable model parameters. I do have some concerns, but they don't really apply to the methodology or interpretation of results. Please see below.

Major comments:

- I feel there is a contradiction between the title and motivation of this study versus the presented results. The title and motivation of the study explicitly refer to TCs, but most of the results are not TC specific. Rather, the results presented in Figs. 3–15 seem to be derived from the entire domain 2, of which TCs only cover a small fraction of. So, to me it seems the results are general rather than specific to TCs (note that I don't think this is a bad thing). Only Figs. 16–18 specifically refer to TCs. This contradiction could be removed by either focusing the analysis to parts of the domain that include the TC (like the panels in Figs. 16 and 17) or by rewording and restructuring the title and text.
- Somewhat related to the first comment, the authors seem to treat all variables with the same importance. Again, I don't think this is a bad thing, but if this study is about TCs, I'd put TC-specific variables, such as 10-m winds and rainfall (and maybe pressure), in the focus. Again this could be done by restructuring the text.
- How did you decide on the ranges in Table 1?

- L87: Unless there's a technical reason for not doing so, to me it makes more sense to say "The objective of the present study is to assess the sensitivity of meteorological variables such as surface pressure, temperature, wind speed, precipitation, to WRF model parameters..." instead of "The objective of the present study is to assess the sensitivity of the WRF model parameters to various meteorological variables such as surface pressure, temperature, wind speed, precipitation, ...". I think what we're interested in is the response of the output to the input, and the latter sounds to me as the opposite.
- Fig. 18: I wonder if we're losing some information by showing boxplot aggregates and the average wind speed of all TCs. Often the average is something non-physical, and often does not tell us much. Would it be possible to show 10 timeseries, one for each TC? Also, how do the box plots relate to the colored lines? Shouldn't the green or blue line go right through the orange lines in the box plots?

#### Specific comments:

- L. 21: "which alone contributed to an overall increase in the NIO." – Increase of what? Activity or destructiveness?
- L 59: It would be interesting to know which two parameters were found to significantly affect the intensity and structure.
- L194: "spin-up time" instead of "spin-off time" (also L215)
- L444: Taylor statistics **are...**
- L446: can be plotted in one Taylor **diagram...**
- To me there is a discrepancy between Figs. 14 and 15. In Fig 14, it doesn't look like the optimal parameters are any better than the default parameters when looking at WS10. But when looking at Figs. 15a and 15b, it looks like the optimal parameters are quite a bit better (smaller bias). How do you explain this discrepancy?