Geoscientific
Model Development
Discussions

Interactive comment on "On the wind stress formulation over shallow waters in atmospheric models" *by* P. A. Jiménez and J. Dudhia

Anonymous Referee #1

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Review of GMD-2014-213

Title: On the wind stress formulation over shallow waters in atmospheric models
Authors: Jiménez, P. A. and Dudhia, J.
Date: January 2015

Recommendation:

Acceptable for publication following minor revisions

General comments:

The authors demonstrate that the agreement between observed and simulated low-level wind speeds at a research platform located in shallow seas can be improved by increasing the parameterized roughness of the ocean surface, relative to the roughness used over open oceans with deeper bathymetry. The authors hypothesize that their results will be relevant to many other models, since these models assume the same relationship between near-surface wind speed and ocean roughness regardless of the depth of the ocean. The authors recommend that atmospheric models include a bathymetric dataset as input, to allow for increased roughness in shallower seas. These results are highly relevant to the modelling community and have the potential to improve low-level wind forecasts in coastal regions, with obvious implications for the energy sector (e.g., oil platforms and wind turbines).

While I appreciate that the manuscript is brief and the authors state their conclusions clearly, I recommend that the authors take the time and space to include additional information on their simulations and analysis methods. As it stands, it would be impossible for another scientist to reproduce the authors' experiments and results. I also have some minor comments on the phrasing of several sentences, although overall the article is well-written.

Minor revisions recommended:

1. The authors claim that most models use the COARE algorithm to relate the low-level wind speed and the ocean roughness (e.g., page 9065, lines 23–24). However, they provide no evidence for this. I appreciate that it may be difficult to find published details for the details of individual model parameterizations, but even a few examples would be welcome. Can the authors provide some citations to back up their assertion?

2. Page 9066, lines 25–27: Please give the heights of the levels at which data were obtained from the platform. Also, please give the latitude and longitude coordinates of the platform, rather than the vague description of "48 km from the German coast".

3. The authors need to provide further detail on the design of their simulations and the data extracted from them, so that another scientist could reproduce their simulations exactly. Specifically:

   a. In regional models such as WRF, the results are often sensitive to the size of the domain. Therefore, it is important for the reader to know the boundaries of the domain that the authors used. Did the domain vary between the three horizontal resolutions tested (27 km, 9 km and 3 km)? Did the authors test the sensitivity of their results to the size of the domain?

   b. How long were the sensitivity experiments to horizontal resolution? Did the authors test the entire year (2009) or did they test only a fraction of it?

   c. Page 9067, line 3: What does "essentially the same" mean? If the WRF configuration is the same as in another paper, then please say so clearly. Otherwise, please state precisely how the WRF configuration in this study differs from those in the previous papers.

   c. When the authors compare data from their WRF experiments to the data from the research platform, do they use only the WRF data from the gridpoint closest to the platform?

4. Page 9067, lines 28–30: The meaning of this sentence was not immediately clear to me. How do timing errors mask systematic errors? I think the authors mean that they are compare only the frequency distributions of the observed and simulated wind speeds, rather than examining whether WRF predicts the correct wind speed at the time it was observed at the platform. That is fine, because

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this paper is not an assessment of prediction skill. Still, this comment should be clarified, particularly the part about systematic errors.

5. Section 4 and Figures 1 and 3: I am confused by the authors' references to "percentile–percentile comparisons" and "percentile–percentile plots" in Figures 1 and 3. The axes of these figures show raw values of wind speed for the platform observations and the WRF simulations; percentiles do not appear anywhere on either figure. How have percentiles been used to compute these figures? Further, does the shading represent the absolute range of the four WRF simulations, or the standard deviation? The authors need to explain exactly how they have produced these figures, so that someone else could use data and reproduce their plots.

6. Page 9068, line 24–25: How far is HEXOS from FINO1. "Relatively close proximity" is not particularly scientific language.

7. Figure 2: Please add an estimate of the goodness-of-fit between each of the coloured lines and the HEXOS data in panels (a) and (b), so that the reader has a quantification of how well each parameterization fits the observations.

8. Page 9070, lines 12–16: Please state exactly how you have defined stability in this analysis.

Sentence-level revisions recommended:

1. Page 9065, lines 9: Substitute "this is" for "this being".

2. Page 9066, lines 7–11: This is a long sentence that took me several attempts to parse. I suggest rewriting it as (starting from line 8): "...but it has been speculated to be either associated with (a) the effects of the ocean bathymetry, which slows the phase speed of the waves, which then become shorter and steeper in

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an effect known as shoaling (Foreman and Emeis, 2010); or (b) form drag due to short (young waves) (DeCosmo et al., 1996)."

3. Page 9066, line 15: At the end of the line, delete "and" and add "; we" to break up this long sentence.

4. Page 9067, line 16: "we used a total of 4 different PBL parameterizations" can be written as "we used four PBL parameterizations".

5. Figure 3, caption: "The data used for this each experiment corresponds with the average of the 4 simulations . . . ". I suspect that the data are the averages of the four simulations, not that they merely "correspond with the average". Please be precise.