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Interactive comment on "The digital terrain model in the computational modelling of the flow over the Perdigão site: the appropriate grid size" *by* José M. L. M. Palma et al.

Anonymous Referee #2

Received and published: 30 March 2020

The paper addresses the important problem of the numerical model setup for simulations of the wind over two parallel ridges at the Perdigao site, the area of interest during the intensive observational campaign of the New European Wind Atlas project.

The introduction is too long, given that the problem is quite a straightforward one: the numerical model resolution is sufficient when further refinement no longer affects the results. This is often ignored by necessity due to computational cost, and compromises are generally accepted if the results are still applicable after validation. So the goal of this interesting and relevant paper could be elegantly achieved by presenting a clear and comprehensive overview of the resolution requirements, so that future simulations

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of this highly studied area can easily be set up and evaluated with respect to the terrain and grid resolution.

I would recommend that the paper is published after revision, addressing the specific comments below.

Specific comments:

L23: It is unclear what is meant with the resolution of the measuring equipment. Perhaps density would be a better word.

L24: Please provide the geographic coordinates in WGS84 at this stage, and the equivalent in UTM. It is acceptable to use UTM later in the text.

L33: The SRTM terrain resolution is 1" (24 m) but in the conclusions it is considered inadequate, in spite that the 40 m resolution is recommended as a minimum. Please comment.

L58: The threshold resolution is not a concept, but a requirement in numerical modelling. It is often ignored by necessity due to computation cost.

L80: 22 square km would be easier to understand than 22 million square meters.

L79,84: What is BlomTopEye? TPDS? Please supply a reference or description.

L81: This is an impressive number of points in the cloud, but does it have any relevance? Please remove.

L83-89: This paragraph is very hard to comprehend. Please reformulate.

L94, Figure 1: please display the two images in the same projection

L96: Table ?? ?

L135: It is important to remember that the concept of two-dimensionality quickly breaks in the case of atmospheric flows, i.e. as soon as not all the forces acting on an air parcel are aligned with the 2D plane.

L146: It is inappropriate to use anything more precise than integer meters when describing terrain altitude with regard to atmospheric modelling. The same for geographic coordinates, for example in Table 1, especially since the highest data resolution is 2 m.

L228-233, Section 5: It is unlikely that the atmospheric conditions at 22 UTC are neutral and stationary, as the simulation setup assumes. It is also unclear whether the authors are aware that the conditions might not be neutral and stationary, yet they proceed with the analysis because the referred publications have established the opposite? Please clarify by including the measurements of relevant parameters.

L246-250: Is it justifiable to use uniform roughness for this simulation? Have you performed any sensitivity analyses if the sufficient resolution threshold changes when non-uniform roughness is used?

L250: Does the impact of the first node height show any convergence, like it is the case for the horizontal resolution? You state that this is worthy of further studies, whereas this is the very study where this should be evaluated.

L278, Figures 12,13: It is not clear what in these figures exactly illustrates the impact of mesh resolution. Are we supposed to see the differences in the insets? Please provide more information in the captions and some discussion about the figures in the text.

L282: The statement how too high z0 and u* "yield a high loss of momentum" is probably badly formulated.

L291, Figures 14, 15, 16: There are several revealing features in the figures, but only the absolute wind speed, and to some extent the TKE, receive any discussion. The diverging wind speed in the higher altitudes in Figure 15a is particularly interesting. The legend is hard to read.

L294: Please clarify what is meant by "... where a pattern similar to the slope (Table 4) can be observed."

L294: Is the RMSE calculated over all the points in the vertical where the measure-

ments are available? The relevance of this statistical measure in a situation where the basic characteristics of the two datasets disagree quite fundamentally (e.g. the TKE at the tower 20/tse04, Figure 14) is probably questionable.

L304: This conclusion 1. is very categorical, while not entirely based on presented facts. At the resolution of 40 m, which is suggested as sufficient for Perdigao, the RMSE for the SRTM-based simulation is not systematically larger than of the other two datasets; in fact, it can be seen that in terms of RMSE for the 40 m resolution the SRTM-based simulations often have the lowest RMSE (Tables 6, 7, 8).

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