

Interactive
Comment

***Interactive comment on* “Technical Note: Description and assessment of a nudged version of the new dynamics Unified Model” by P. J. Telford et al.**

P. J. Telford et al.

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1. *The term "ERA-40 analysis data", which is used throughout the text is somehow misleading or inconsistent. Usually the dataset is called "ERA-40 reanalysis data", but simply "ERA-40 data" is also sufficient.*

We will make this change.

2. *p. 17263 line 2; p. 17275 lines 13 and 17: I recommend to replace "validate" by "evaluate" or "evaluation", since it will never be possible to validate a model.*

This is true, the correction will be made.

3. *p. 17264 lines 12-14, "The different orographies ... result in errors ...": Please*

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Discussion Paper



explain this statement in more detail for those readers who might not be experts in interpolation techniques.

We suggest replacing the sentences “The different orographies.... Andes and Antarctica” with

“The orographies in the UM and ECMWF models, although based on similar datasets are not the same due to different processing procedures for different grids. The differences can be as large as hundreds of metres in the Andes and Antarctica. They can produce errors in the interpolation from the ECMWF to the UM model levels due to the vertical structure of the model levels being represented differently in the two models.”

4. *Figure 1: most of the axes labels are unreadable; it would be nice to have a approximate altitude axis (as in Fig.2) which I think was intended anyway.*

There seems to be a technical issue with this figure, the axes have been corrupted. The plot does, as you suggest, have an approximate altitude axis on the right hand side. When the plot is corrected this will be visible.

5. *p. 17268 lines 24-26; "The increase below ... is a result of errors ...": Please explain this in more detail and/or provide an example.*

One example of errors produced by differences in orography can be seen in Figure 7, where the differences in the orography of the Antarctic causes differences in the surface pressure. The temperature is a slightly more complicated case as it is not as directly affected by the definition of ‘surface’ and errors require both differences in the orography and a pronounced temperature gradient. Some increase in the RMSE can be seen in Figure 3, especially over the Andes and the Himalayas and similar figures for January and July show this more prominently. The predominant feature in this figure is the high RMSE over Antarctica, which may be partially related to orography. However differences in the orography probably cannot explain all the high values of RMSE over Antarctica. When Figure 3

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is remade, but using the data from January, the RMSE over Antarctica is much smaller and there is high RMSE over Canada and Russia. When the RMSE is compared to the monthly mean snow cover in ECMWF they appear to have similar distributions. We will rewrite this to put the role of orographically induced errors into perspective.

6. *p. 17269 lines 3-5; "The low values of ... sea surface temperatures.": If I understand correctly you prescribe the same sst in both the nudged and the non-nudged simulation? Doesn't this low RMSE then simply imply that there is already a high consistency between the HADISST and the ERA-40 data? And that the influence of nudging is here negligible?*

The same ssts are used in both the adjusted and unadjusted simulations. Comparing the SSTs between the model and ERA-40 the differences are small, generally around 0.1%, implying that they are indeed not dissimilar. The influence of nudging is not negligible, which can be seen if Figure 5 is reproduced with theta instead of u, although the reduction is not as large.

7. *p. 17269 lines 7-9; "These differences probably ... between the UM and ECMWF models.": Please explain in more detail what you mean here.*

This statement is covered by the answer to the comment 5.

8. *p. 17269 lines 16-18; "The RMSE of ps shows a small decrease ... it is unaffected by nudging.": Either I do not understand this sentence at all, or it contains a contradiction; does it decrease or is it unaffected? Please reformulate this sentence.*

This has not been stated clearly, 'unaffected' would be better phrased as 'little affected' As shown in the answer to Referee 3 the RMSE, over the sea at least, is significantly reduced by adding nudging.

9. *p. 17270 lines 23-24; "In the stratosphere the unadjusted model is slightly better at reproducing the variability." Compared to what? Certainly not compared to the "nudged model" as would be a contradiction to the figure. Do you mean that in the stratosphere the unadjusted model is better than in the troposphere? Please clarify.*

This should be clarified to read "In the stratospherevariability than in the troposphere" . This is believed to be because the model is better able to reproduce the variability on the time-scales found in the stratosphere.

10. *Fig. 4: Should the isotherms (as mentioned in the caption) not be the same in both panels ?*

This is as a result of translating from a pressure level based model (ECMWF) to a height level based model (UM). When the pressure on the levels changes then the results of the interpolation change slightly. The turning point near the tropopause results in these small changes producing significantly different appearances, but as illustrated in the example below (Referee 2, comment 4) the changes are small.

11. *Fig. 10 and page 17272 lines 19 ff: Can you explain the zig-zag curvature between 8 and 46 km altitude, especially in October and January?*

This ratio is a lot noisier than other quantities. For instance the various quantities used to assess the performance of the model, mean, bias etc are fairly constant if you sample within a month. The ratio of the tendencies can fluctuate quite strongly, so it could just be noise. The point that we want to draw from this figure is that the nudging never predominates over the other forcings, at present it is difficult to draw more detailed conclusions from this quantity.

12. *page 17273 lines 25-27: For this statement - which is only partly true - the wrong reference has been chosen. In Lelieveld et al. (2007) the maximum altitude*

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of nudging was not varied (it was at 200 hPa), however, in Jöckel et al. (Atmos. Chem. Phys., 6, 5067-5104, 2006) the maximum nudging altitude has been changed from 100 hPa to 200 hPa.

The change was intended to refer to the altitude cut-off used in earlier versions of the model, such as that discussed in Van Aalst et al (2004) which implies that a higher cutoff is employed. The principle that we want to discuss is probably better illustrated by the reference to the paper of Jöckel et al as you suggest.

13. *Fig. 11: Just for completeness. What are the dotted lines in the figure?*

These are also isotherms. This will be added to the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 17261, 2007.

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