Geoscientific
Model Development
Discussions

Interactive comment on "The first Met Office Unified Model/JULES Regional Atmosphere and Land configuration, RAL1" *by* Mike Bush et al.

Mike Bush et al.

mike.bush@metoffice.gov.uk

Received and published: 24 October 2019

SpeciïňĄc comments

âĂć 1. It would be good to specify in section 1 that the Met OfïňĄce you're referring to is the UK Met OfïňĄce.

Response: "Met Office Unified Model" is the name of the model and "Met Office" is the correct name for the organization that was once known as the UK Met OfïňĄce. Whilst I understand (and have some sympathy) with the point the reviewer is making, I am unable to change this. I have slightly changed the word order at the beginning of the second paragraph of the Introduction to perhaps make this more obvious.

âĂć 2. In section 2.6 where you discussed the Smith cloud scheme you give

RHt=(qv+qcl)/qsat. Could you deïňĄne qv, qcl and qsat to make it unambiguous? Also, RHc is not deïňĄned, is it RHcrit?.

Response: I have amended the text to read: RHt=(qv+qcl)/qsat (where qv is the vapour, qcl is the liquid content and qsat is the saturation specific humidities) reaches 100% and that the grid-box only becomes overcast when RHt>=2-RHcrit.

âĂć 3. The tickets discussed in Section 3 aren't sequential. It is understood that only the most important tickets are discussed and arranged per topic, but it would be useful to have a complete list of the tickets that documents all the changes to the model.

Response: I have added Table 6.

âĂć 4. In section 3.5 "CCI" and "IGBP" is not deïňĄned. I like the description of the physical effects of the changes in the last paragraph of section 3.5 as it makes it more tangible.

Response: I have added a reference to table 4.

âĂć 5. The second paragraph in section 4 is a bit ambiguous. The ïňĄrst sentence on p15 talks about "several aspects" but then name two. Maybe the use of "such as" instead of "namely" would be better in that case? And in the following sentence about the differences in the representation of turbulence between RAL1-M and RAL1-T it would be good to speciïňĄcally note that the values given there is for RA1L-T, or state the opposing values for RAL1-M as well.

Response: I have amended the text to read: In order to cope with this, RAL1-M, has relatively weak turbulent mixing and stochastic perturbations to encourage the model fields to be less uniform and help convection initiate. If the model is run with these in the tropics the model initiates too early and convective cells tend to be too small.

Representation of turbulence (RMED tickets #12 and #26) and BL stochastic perturbations (RMED ticket #25)

There are two differences in the representation of turbulence between RAL1-M and RAL1-T, namely in the form of the stability functions and in the free-atmospheric mixing length. Both give enhanced turbulent mixing in RAL1-T compared to RAL1-M. RAL1-T uses the Brown (1999) "standard" model whilst RAL1-M uses the Brown (1999) "conventional" model. RAL1-T retains RAL0's interactive free-atmospheric mixing length, whilst RAL1-M uses a value of 40m. The other related change is that RAL1-T does not use the stochastic boundary layer perturbations. For more details and a summary of differences between RAL1-T and RAL1-M, see Table 2.

âĂć 6. GPM in section 4 and IMERG in section 5 is not deïňĄned in the text.

Response: There are references to these in sections 5 and 5.1

âĂć 7. When you explain the "scorecard" in section 5.1, you should also indicate which direction of arrows indicate improvement/decline. Something along the lines of "triangles pointing upward (green) are indicating that model A is better than B and downward "blue" triangles indicating model B is better" showing whether the model version being tested is better or worse than a previous incarnation.

Response: I have amended the text to read: Triangles pointing upward (green) indicate that the test model is better than the control and downward (purple) triangles indicate the control model is better.

âĂć 8. The legends in Figure 13 are not legible.

Response: Figure 13 has had its legends made legible.

âĂć 9. In section 5.5 it is stated that a total of 130 TC forecasts were produced, and only storm cases appearing in both RA1L-M and RAL1-T were kept. However, in Figure 19 the number of cases are up to 140 with a 0-hour lead time. Does that mean that some simulations had more than one TC at the same time?

Is the mean bias for model-obs?

Also, it would have been interesting to know how often storm cases appeared only in one of the experiments. Which conïňĄguration was more likely to form storms?

Response: The answer to the first two points is yes and I have slightly amended the text. 130 TC forecasts were run. When the storm sample was homogenised across the two experiments (RAL1M/T), there were 126 initialisation times remaining, i.e. some forecasts were discarded because either no storm was found in either experiment, or a storm was found in one experiment but not the other. This sort of thing can happen if the storm is weak and drops below one of the pre-defined thresholds used in the tracker code.Âă Âă In Fig 19 the number of cases at T+0 is 144. This is because there were 18 forecasts where two storms were present in the domain at the initialisation time (and 126 + 18 = 144). In 9 of these forecasts TCs Chan-Hom and Linfa were both present at T+0, and in the other 9 it was TCs Koppu and Champi.

Yes the mean bias is for model-obs.

The TC verification software we use (see Heming 2017 for details, reference below) only tracks and verifies storms that were observed to exist at the model analysis time so we do not have any statistics regarding TC genesis at present. In principle this is something we could look at in the future, but we suspect there would be little difference in genesis statistics between RAL1M/T. Âă Heming, J. T. (2017), Tropical cyclone tracking and verification techniques for Met Office numerical weather prediction models. Met. Apps, 24: 1-8. doi:10.1002/met.1599Âă Âă âĂć 10. Is there a reference for the Random Parameter scheme mentioned in section 5.6? Response: Added McCabe et al. (2016).

âĂć Technical corrections

P3 line 2: "added to the RAL0 base to deïňĄne RAL1-M" P7 line15: Maybe start "This represents" as a new sentence. P9 line 5: "Ri is less"? P10 line 9: Remove "Therefore" P14 line 29: There is an extra "reason" P16 line 18: "most" should be "must" P17 line 25: 3-hour or 3-hourly? P17 line 32: "can lead to difïňĄcult to interpret veriïňĄcation

scores" rather "can lead to veriïňĄcation scores that are difïňĄcult to interpret". P20 line 3: "reduces signiïňĄcantly the ability" change to "signiïňĄcantly reduces the ability" P23 line 5: "evaluate its performance"

Response: All technical corrections have been made.

Please also note the supplement to this comment: https://www.geosci-model-dev-discuss.net/gmd-2019-130/gmd-2019-130-AC2-supplement.pdf