

Author comments in response to Reviewer 2's comments on “The Met Office Unified Model and JULES Global Atmosphere and Land 9.0 configuration” by Willett et al.

The reviewers' comments are copied below and our response to them included after each individual comment in red.

General comments:

This manuscript systematically describes the latest scientific configuration GAL9/GAL9.1 of the Met Office Unified Model (UM) and JULES land surface model, which is an important milestone in the development of this series of models. The manuscript is well structured and detailed. It clearly explains each key scientific improvement from GA8GL9 to GAL9 and provides evaluation evidence of NWP and climate performance. Overall, this is a high-quality technical paper that meets the publication standards of the Geoscientific Model Development journal.

I believe my comments/suggestions are not very critical and do not require hard work, and this manuscript would be suitable for publication after following revision comments.

RESPONSE: The Authors would like to thank the reviewer for taking the time to review the manuscript and providing valuable comments. We believe that their contribution has resulted in a much-improved manuscript.

Minor comments:

Section 4.8.3 - The authors completely disabled the original deep convection scheme, assigning all non-shallow convection to the mid-level scheme. While this modification improved the diurnal cycle of convection, the authors did not sufficiently demonstrate the reliability of this approach. It is recommended to include at least one case study of a strong convective event or to cite relevant research validating the reliability of the mid-level scheme under strong convection conditions.

RESPONSE: We agree that more evidence is needed on this point. To that end, we have added two figures and accompanying text. One figure shows that in an example NWP case study, the convective precipitation is not substantially changed by switching off the deep convection scheme. The other demonstrates that increased mid-level convection compensates for the removal of the deep scheme, and that the total updraught mass flux is very similar between GA8GL9 and GAL9.

Section 4.12 - Model tuning is the most critical yet most difficult aspect of model development to clarify clearly. How are the tuning sequence (or strategy) for these parameters determined? Given the potential lack of independence when adjusting multiple parameters simultaneously, how are the interaction effects between parameters addressed? It is recommended to include a brief overview of parameter sensitivity analysis, specifying at least the ranges tested for key parameters prior to their final selection.

RESPONSE: This section has been slightly expanded to include some brief discussion of how the parameters were selected and the choice of values. It has also been noted that the sensitivity tests included combinations of parameters. The range of values tested as part of the tuning has been added to Table 10.

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