

Interactive comment on “Evaluating the Met Office Unified Model Global Atmosphere/Land 3.1 (GA/L3.1) and Global Atmosphere/Land 6.1 (GA/L6.1) land surface temperature. Outcomes of the SALSTICE campaign” by Jennifer K. Brooke et al.

Anonymous Referee #2

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The manuscript “Evaluating the Met Office Unified Model Global Atmosphere/Land 3.1 (GA/L3.1) and Global Atmosphere/Land 6.1 (GA/L6.1) land surface temperature. Outcomes of the SALSTICE campaign” by Brooke et al. describes an investigation of land surface temperature biases using the Met Office Unified Model. Overall, the results are interesting and show aspects of the errors in simulated land surface temperature for a number of different model configurations, and would be of interest to the scientific community. The simulated temperature biases are related to a number of different

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parameters in the model. For the most part, the manuscript is well written, although some parts could provide more motivation and be made clearer to the reader. Most of my concerns are relatively minor and should be straight forward to address and the manuscript should be acceptable for publication in Geoscientific Model Development after these concerns are addressed.

Major comments: 1. The title is a bit misleading, given that it only mentions two model configurations while limited area models are also applied in the study. In addition, the title mentions SALSTICE, but it is not clear to me if any SALSTICE data is included. Was the deployment of the eddy-covariance systems considered part of that study, or was SALSTIC only the airborne deployment that is not used at all. 2. The application of cloud screening applied in the study needs to be described better. It is mentioned in a couple of places, but I think that it has an important impact on the interpretation of the satellite derived LSTs and should be presented in a consistent way, perhaps in the Methodology section. 3. A little more background is needed to help the reader understand the need for all of the model configurations that are presented. I believe that one reason is related to changes in model configurations with time, while other differences are related to parameter values. 4. The authors should add a few notes regarding some of the calculations. For example, how is the bias computed? Is the correlation coefficient Person's correlation coefficient or something different?

Minor comments: 1. Page 1, line 12: Should “greater than 2 K”, be “greater than 2 K in magnitude”? 2. Page 1, line 13: This is related to my major comment 3 and minor comment 13. A number of different model configurations are used in the study, and it is hard to see the reason why in the abstract. If there is space (given the word limit of the abstract) some reasons for application of different model configurations would be helpful. 3. Page 1, line 18. Please define “Terra” on first usage. 4. Page 2, line 7-9. The sentence describing the IASI was confusing as written. It seems to imply that the data is never assimilated, but other part of the manuscript seem to describe that these observations are not used only when the errors are large. 5. Page 2 lines 10-17.

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Could this paragraph be adjusted for those that are not completely up-to-date with the UM and other models used by the Met Office? The second sentence says that LST is not assimilated into the UM, but the next sentence talks about LSTs being applied in the Met Office operational model. 6. Page 2, line 18. What is meant by "background" in this context? 7. Page 2, line 31-33. The surface albedo plays an important role in the surface energy budget. Should albedo also be mentioned in this paragraph? 8. Page 4, line 4-6. Why are two different time periods used in this study? I recognize that it is, at least in part, due to the timing of the SALSTICE study. Are the eddy-covariance measurements only available for the shorter time? 9. Page 4, line 31-33. Could there also be errors associated with the representativeness of the soil heat flux? You mention this later, but it would also fit here. 10. Page 5, line 4. Is there any need to consider clouds in the IRT measurements in order to ensure that they are consistent with the satellite observations? I see something mentioned in section 2.3, but should it also be mentioned here? 11. Page 5, line 18-22. Is there a reason why you would expect the nighttime values to be unreliable, but not the daytime values? 12. Page 6, line 8-9. I can understand why you wanted to include information about the cloud clearing here, but would it make more sense in the modeling section? 13. Page 6, line 19. Section 2.4 could be improved with additional background information regarding the selection of the various model configurations. Why are so many model configurations used? Why are both global and regional models used? I believe that one reason are new versions of the operational model. 14. Table 1 helps, but probably isn't sufficient. 14. Page 8, line 19-21. Is the sign convention the same in Figure 1 and the text? 15. Based on the figure it looks like nearly all of the biases are positive, not negative. 15. Page 9, line 11-14. I agree that the field of view of the IRTs is much smaller than the size of the model grid cell, yet the color shading still shows good agreement between the simulations and the IRT. 16. Page 9, line 21-22. I agree that high resolution data sets are likely important, but could other factors also lead to improved performance at higher resolution? For example, better resolution could lead to better simulations of the boundary-layer in areas of complex terrain. I see it is touched on in more detail in

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a later paragraph. Should the order of the paragraphs be switched? 17. Page 10, line 1-2. I don't quite get the sentence "... however worsen the representation...". How can you say that the representation is worse? Shouldn't the higher resolution still be a benefit to the simulations? What data is being used to make this argument? Is it just inferred from the changes in temperature bias? 18. Page 11, line 20-21. What is meant by "both collections"? 19. Page 11, line 29-32. I am not sure that I get the point of this paragraph. As it is written it seems almost circular to me. 20. Page 13, line 1. Is "pattern" missing after spatial? 21. Page 13, line 17. The text states "...increases night-time biases ...". Is this really fair to say? What is the meaning of the MODIS LST when clouds are present? Shouldn't the cloudy cases be left out of the analysis completely? 22. Page 14, line 6. What is meant by "in runs"? 23. Page 14, line 13-14. Is it fair to say "under representation"? Do you have a measure of the bare-soil fraction? 24. Could you say sensitivity? 24. Page 15, line 1. The text states "...represents the available energy..." Is the data shown in Figure 7 only for cloud free conditions? 25. Page 15, line 15-19. The text describes biases in the latent heat flux. Could the results also be explained in the context of soil moisture? Could the soil be too moist or the atmosphere too dry (or some combination of both)? Would this have an impact on your results? 26. Page 15, line 31. The text about the location of the radiometers could be rephrased. I assume that the radiometers are mounted above the canopy top or in a fashion that gives a clear view of the sky. 27. Page 17, line 3-5. I commented on this earlier, but I think that one needs to be careful about the use of "better" and "worsen" describing the surface fractions when there isn't a data set that can be used to evaluate the values used in the model. 28. Figure 1. What does O-B mean? 29. Figure 2. Could the caption be augmented to state the meaning of the shading for the red and blue curves? It would be helpful to indicate the relevant years somewhere on the panels. 30. Figure 4 (and others). In a number of the figures, the authors may want to consider more descriptive headings on some of the plots. That can orient readers without having to read all of the caption, and I often find it helpful when flipping between the text and figures. 30.

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