

Response to Reviewer #1 Document for GMD-2021-243 by Almudena García-García, Francisco José Cuesta-Valero, Hugo Beltrami, Fidel González-Rouco and Elena García-Bustamante.

We are grateful for the thoughtful and constructive feedback of the reviewer.

This document provides a complete description of the changes that have been made in response to each individual reviewer comment. Reviewer comments are shown in plain text. Author responses are shown in bold blue text. All line numbers in the author responses refer to locations in the revised manuscript with changes marked.

Referee #1

This manuscript explores the effect of horizontal resolution and land surface model (LSM) choice on the simulation of WRF surface energy fluxes and conditions. This is a very well written paper on a topic that is not a focus for WRF. Most WRF sensitivity tests deal with the various combinations of the atmospheric parameterizations. I like that they analyze not just mean air temperature and precipitation but also minimum and maximum temperature and convective and non-convective precipitation as well. The authors find that CLM4 is the best LSM to use with WRF. They find that model horizontal resolution most affects precipitation.

I think the description of the WRF sensitivity tests in this manuscript is a perfect fit for GMD. Practically speaking, this is very helpful for WRF users who want to run regional climate simulations. Scientifically, it lends no information to what aspects of the LSMs beyond just simply model complexity causes the improved simulations with CLM4, but that would require a deeper dive into offline LSM simulations that would go beyond the scope of GMD. It is interesting that the authors suggest that further sensitivity tests should be performed at convective-permitting resolutions. What would be the horizontal resolution for that? Are such resolutions computationally achievable for continental-scale simulations as is done here at this time?

We thank the reviewer for the positive feedback. A convective-permitting simulation would require much finer horizontal resolutions (< 5 km). Indeed, climate simulations at continental scales would require large computational resources at those resolutions. For example, around 1000 Tb would be required just to store the outputs of four WRF experiments of 30 years over North America with a resolution of 5 km. Hence a reduction in the area of interest or in the period of the simulation may be necessary to perform a sensitivity analysis including convective permitting simulations. We have included a small discussion on this topic in the new version of the manuscript (see lines 492-498).

Additionally, I would suggest one minor change to the manuscript: The authors use the abbreviation RAIN for total precipitation (rainfall + snowfall). I would suggest using PRECIP (or something similar) instead to avoid confusion for the casual reader.

We agree with the reviewer that the term “RAIN” can be confusing, so we have changed the text and the figures accordingly.