Comment on gmd-2022-209

Anonymous Referee #2

Referee comment on "The second Met Office Unified Model/JULES Regional Atmosphere and Land configuration, RAL2" by Mike Bush et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-209-RC2, 2022

General Comments

This manuscript describes a new regional atmospheric and land-surface modeling configuration of the UK Met Office's weather forecasting system. The paper is well structured and provides an excellent summary of the new configuration. I believe it will be of significant interest to the wider NWP modeling community and vital for users of the UM/Jules. I recommend this be published with minor corrections as laid out below.

Specific Comments

Where case studies and trials of the complete RAL2 configuration are described for the UK (Sec 3.3, 3.4, 3.5) these have been related back to the one or more of the individual changes (i.e. the performance described in Sec 3.2). However, the other cases are not so well linked. For example:

a) in the MCS case it is not clear whether the improvement in fractional coverage shown in Fig 12 is to be expected, nor which of the science changes might have caused this.

b) in the South East Asia cases, what might be causing the degradation in FSS during spinup, or rather, why does RAL2-T take longer to spinup than RAL1-T. Is it due to the BL stochastic perturbations (Table 2) or was there no change in this from RAL1 to RAL2?

c) for the Indian lightning cases, I assume the changes seen here are partly/mainly?? due to the liquid and ice phases in the cloud scheme (Sec 2.6). There is mention of a reduction

in graupel and ice water paths, but it's not obvious what is causing this. Also, I assume the results shown are after the reduction in GWP threshold was applied to the RAL2-M configuration; if so it would be helpful to see what the results from the 'standard' configuration looked like. This threshold adjustment seems arbitrary, why tune RAL2 to RAL1 output? From Fig 14 & 15, it looks like both RAL1 and RAL2 are producing higher flash counts than the obs (albeit with lower spatial coverage) so its not clear why they should be increased.

Technical Corrections

(Apologies, but some of these get rather pedantic...)

Pg2, Ln 5: The 'regional model' you refer to here has not been defined yet (except in the abstract). It needs to be defined as UM/JULES or similar. (Also 'trhe world' sp.)

Pg2, Para 3/4: I think it would make sense to introduce RMED at this point (rather than just as a prefix when introducing the toolbox). Or if not here, then around line 7 on page 7 where the regional model evaluation process is introduced.

Pg3, Ln2: When introducing section 2 I think it is implied that when not stated explicitly, then the definitions given haven't changed from RAL1 to RAL2 (e.g. Sec 2.2, 2.3, 2.4). It would be helpful to make this explicit.

Pg3, Ln6: The SOCRATES url in the footnote is not accessible (I assume this is an internal website). Remove.

Pg3, Ln 19: Delete 'basic underlying'.

Pg6, Ln25: Thin snow albedo bugfix: this should either be expanded on or removed. Did the bug have a noticeable effect?

Pg6, Ln26: Similarly the snow grain growth. Is there a reference for this? Why was the treatment revised?

Pg8, Ln4: Delete "simple"

Pg8, Sec 3.2: Can you confirm that all the scorecards and results (Fig 4, 5, 6, 7 & 8) are based on all 100 UK cases? And do they include the Darwin cases? How many Darwin cases are included?

Pg9, Ln1: Clarify that "performance" in winter is not necessarily better than summer. "... by season reveals that the IMPROVEMENT IN performance in winter is LARGER than in summer..."

Pg9, Ln6-8: "04th" shouldn't have the "0"

Pg10, Ln7: I think "though" is meant to be "through"

Pg11, Ln22/Ln25: "RAL2 Science" and "Data Assimilation" don't need capitals

Pg11, Ln25: "(the latter we refer to as case studies)" This is probably not necessary. But if it is important should be pointed out in the relevant earlier section, not in the conclusion.

Pg12, Ln7: change "RAL2-M science is running 24/7 in" to "where RAL2-M science is used in"

Pg12, Ln6-8: "Operationally" doesn't need capitals and '04th' should be '4th'

Pg12, Ln13: change "the partnership" to "the UM Partnership"

Acronyms not defined:
Pg2, Ln4: UM (except in abstract where an acronym isn't needed, should be defined in main text)
Pg6, Ln20: LES & PBL
Pg7, Ln18: GPM
Pg11, Ln4: GWP

Seasons shouldn't be capitalised (e.g. winter and summer throughout page 9, and Fig 9-11 captions)

Captions to Fig 3-6 have unnecessary capitals. I don't think they need to match the 'Description' field in table A3. Also too many capitals in caption of Fig 14.