

## *Interactive comment on* "A statistical and process oriented evaluation of cloud radiative effects in high resolution global models" *by* Manu Anna Thomas et al.

## Anonymous Referee #1

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## General comments

The paper investigated the cloud radiative effects in simulations with different spatial resolution for 4 climate models, which are part of the HighResMIP, compared to CERES observation. The results are presented for different seasons and modes of internal climate variability (ENSO and NAO) and show that an increased spatial resolution does not explain most differences to the observations. The paper is well written, comprehensible, and suitable for publication in GMD, but I have some minor issues (and technical corrections) that are listed below.

Specific comments

C1

Page 3, line 10/ page 4 line 31 - page 5, line 2 The division in high and low/standard resolution models should be explained already in section 2.1 (page 3 about line 10) instead of at the end of section 2.3 because it is use throughout the complete paper, not only for the ENSO analysis. It would also be better to introduce the abbreviations (Hi-res, Std-res or HR, LR) there and then only use one kind, not e.g. Hi-res (mainly used), high resolution (page 11, line 4), and HR (used in section 4.3 and 5.3).

Page 6, line 11 I think it is too early to draw the conclusion here that differences for zonally averaged hi-res and std-res models remain low, "mainly due to averaging out of over- and underestimation". At this point this should be rather written as assumption or question. Especially since it seems not to be true for all models according to page 6, line 26: "The impact of the resolution seems to be fairly negligible in the ECMWF model."?

Page 10 For the CREs at TOA there is a detailed discussion of the spatial (meridional) pattern (shown in Fig. 2 and 3), but these pattern are not at all mentioned for the CREs at the surface in Section 3.2. While it is probably not necessary to show similar figures like Fig. 2 and 3 also for the surface (such figures could be include in a supplement, though) it should be mentioned if the spatial pattern are in general similar to the ones at TOA or if there are any striking differences?

Page 11, line 8ff The calculation of the intermodel differences should be explained in more detail. What happens if not all models agree on the sign? Especially in Fig 13 and 14 there are some surprising low values in areas with high values (off the US East-coast), are these missing values/ values where the sign does not agree? If yes they should be marked by an easier to distinguish color.

Page 26, line 8 Here, it should be also mentioned, that the study is based on atmosphere only simulations as stated in the last sentence of the Abstract: "However, we note that these results are obtained from atmosphere-only simulations and the impact of changes in atmospheric resolution may be different in the presence of coupled climate feedbacks."

**Technical corrections** 

There are three different ways to write "setups" ("set ups", "set-ups") in the paper?

Page 2, line 22-25: The sentence is hard to understand, maybe there is something missing? Better split it in two sentences.

Page 3, line 8: Maybe better "... simulations. The forcing includes ..." instead of "... simulations that include ..." would be easier to understand?

Page 3, line 16: "The CREs ... are defined ..." instead of "The CREs ... is defined ..."

Table 1 and several places in the text: Shouldn't it be "MPI-ESM" instead of "MPIESM"?

Page 4, line 20: "... associated solely with ..." instead of "... associated solely by ..."?

Page 5, line 14-15: This explanation would not be necessary if the separation between Hi-res and Std-res would be introduced in section 2.1 as mentioned in the specific comments.

Page 6, line 21: "most notable" instead of "notable"

Page 6, line 34: "probability density function" is the more common?

Fig. 1 and 4: Add a y-label?

Fig. 2 and 3: Use only one color bar and try to enlarge the size of the panels?

Page 11, line 4-5: At the moment it is explained in section 2.3 (not 2.2) and I think it should be explained in section 2.1, see specific comments.

Page 12, line 34: The abbreviation "AMIP" is not explained.

Fig. 5 and 7, caption: There is no reason to explain the abbreviations Hi-res and Std-res again?

СЗ

Page 26, line 28-30: There is something wrong in this sentence, probably an extra "the" at "that the they are"?

Page 26, line 33: Following the discussion in section 5.3 it should be rather "variability" than "uncertainty"?

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