Geoscientific
Model Development
Discussions

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Interactive comment on "Understanding the development of systematic errors in the Asian Summer Monsoon" *by* Gill M. Martin et al.

Anonymous Referee #1

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Summary

This paper describes systematic modelling errors for the Asian Summer Monsoon on both weather and climate scales using a suite of tools including different model configurations within the MetUM, Unified modelling framework, including global, regional, nudged, and initialized prediction/hindcast techniques. It highlights the utility of the methods and tools employed, reports on various errors, and proposes sources of those errors.

Overall Comments

Using the MetUM unified modelling framework to decompose systematic modelling errors for the Asian Summer Monsoon is a wonderful example of the great utility of apply-

ing one framework to a science problem, in this case, quantifying systematic modelling errors in a monsoon system. The paper contains an enormous amount of information that will be useful to modellers to improve skill for prediction (and projections) for the EASM. Although I appreciate the challenge of presenting this work in a concise and digestible way, I feel some improvements can be made, primarily to figure organization and better descriptions in the manuscript. To help guide the reader and improve the readability, I suggest the following:

1. To help guide the reader on experimental design, I recommend use of flowcharts for modelling tools and experiment description. 2. To help summarize the regional climate modelling results in Section 3.2, consider summary table (see specific comments). 3. To help digest and follow discussion on the initialized hindcasts in Section 3.3., consider reorganizing your figure suite such that specific locations (or errors foci in the text) are highlighted (see specific comments). If this is not possible, perhaps sub-heading per error topic, and better labelling on the figures will help.

Specific Comments

Line 95: An explanation of N is needed for this grid system beyond what you have here. This will also help define the reader interpret "768" from N768 on Line 129, and N96 on Line 134.

Figure 1: What is the reference vector?

Line 115: This isn't clear to me: Did you originally run RCM with GA6.0 physics? Or is your statement on a better Indian subcontinent simulation based on the GA6 vs GA7 comparison? I am not suggesting re-running anything, just a clarification on the justification for using GA7.0 configuration rather than that what was used for the global simulations. Also, to be clear, you used GA7.0 to force RCM (and not simply using the same model configuration)?

Line 169 and Figure 2: The mean JJA cold bias of GloSea5 for parts of the Indian

Ocean, around Malaysia, and perhaps Western Pacific look larger than the individual months?

Figure 3: The caption should note where domains overlap and also describe what N1 represents.

Line 222 and Figure 4: It is hard to compare the GA7 GCM with Figure 1 top left with different color contours, scales, and vector arrows. It might be helpful to add a panel in this figure to truly compare the two. Also, it might be a good opportunity to discuss the improvements moving from GA6 to GA7 which would be interesting to readers of GMD.

Line 239: The westward extension in ChinaW seems to have a rather large impact over the Indian subcontinent. Explanation?

Section 3.2: To elucidate the local/remote implications of each domain, one suggestion would be to make a summary table, i.e. something like, one row per domain; one column for remote influence notations; one column for local influence notations.

Figure 6: What is the reference vector?

Paragraph 259 and Figure 6: Comments on the dry biases in the Bay of Bengal?

Figure 7: What are your thoughts on what is going on in the Bay of Bengal. This cannot be explained by SSTs.

Line 280: The N/S dipole seems weak.

Section 3.3: It is hard to follow specific locations for much of the discussion. I recommend picking a few key areas and designing your figures (6-9) around specific locations/error sources (i.e. one location/error per figure but include the information contained across 6 – 9 but also 10-13) This might help to clearly show the progressions and biases. For example, the South China sea area, or the Bay of Bengal, or EEIO. Full plots as shown here can be supplemental for readers interested in some-

thing the authors do not highlight, but for the discussion explicitly called out in the text, there needs to be better organization of figures.

Figures 7 and 9: Please define all components of the figures in the captions or note them in the text. I don't see an explanation of the red dashed box?

Line 306: Define SCSSM.

Figure 11d: I feel like there is much to unpack from this panel beyond the few paragraphs in the text. I see that the dashed/dashed-dotted lines are defined in the caption, but some attention to these should be paid in the text with further explanation as to interpretation.

Figure 12: Shading = color contours? What is the reference vector?

Lines 351,357,370 and Figure 13: CPLDNW, UNCPLD, and FOAM, although we can guess, should be explicitly defined.

Figure 14: Labelling and boxes should be cleaned up and consistent.

Figure 16: What is the reference vector?