Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-99

Anonymous Referee #1

Referee comment on "SITool (v1.0) – a new evaluation tool for large-scale sea ice simulations: application to CMIP6 OMIP" by Xia Lin et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-99-RC1, 2021

General comments

This manuscript describes the creation and application of a new Python-based software, called "SITool", for evaluating Arctic and Antarctic sea ice in global climate models. The authors utilize SITool to analyze models from the CMIP6 OMIP in terms of their sea ice concentration, thickness, snow depth and ice drift. The authors find that model biases exceed observational uncertainties and note improved model performance using the JRA-55 atmospheric forcing versus the CORE-II atmospheric forcing. No single model performs best in all metrics as there is no link found between performance in one variable and performance in another.

This manuscript is thorough and well-organized. The figures and tables support the discussion well and the analysis clearly demonstrates the utility of SITool. My main comment is that, while discussion of model ranking is distributed through the manuscript, there is no section devoted to synthesizing the cross-metric analysis or a figure documenting the rankings (mentioned in the Conclusions on Page 20, Line 468). I recommend the addition of a short paragraph to the Results section summarizing the findings and implications of the cross-metric analysis. While model ranking may not be the primary goal of the tool, it is mentioned enough in the manuscript to warrant further discussion and context prior to the Conclusions. The authors may consider moving the text on Page 20, Lines 470-473 to the added paragraph and/or including a table of the best and worst performing models for each metric to the main text or Appendix.

Overall I recommend minor revisions to address the cross-metric analysis and the specific comments below.

Specific Comments

Page 1, Line 11: I recommend replacing the phrase “bi-polar” with “Arctic and Antarctic” throughout the manuscript for clarity.

Page 2, Line 49: I recommend expanding briefly on what is meant by “rather limited” to describe which sea ice diagnostics are provided in ESMValTool and which are unique to SITool.

Page 2, Line 52: Can you please clarify what is meant by SITool providing “qualitative” information? The tool seems to be used primarily for calculating model biases and related metrics, which I would consider primarily quantitative.

Page 3, Line 92: Can you please clarify here if the interpolation is a component of the SITool workflow or is a preprocessing step that needs to be completed before using SITool?

Page 4, Line 117: It would be helpful to have a brief sentence explaining why February and September were chosen (for example, why February instead of March).

Page 6, Line 184: Please list here the respective resolutions of CMCC-CM2-HR4 and CMCC-CM2-SR5 or provide a reference to Table 1.

Page 9, Line 259 (and page 14, line 359): Throughout the manuscript, I recommend using “finer” or “higher” spatial resolution versus “increased”.

Page 10, Figure 2 (as well as Figures 5, 7, 10): It would be helpful to remind the reader in each of these figure captions that lower values indicate better skill.

Page 14, Line 355: “…the ice edge location simulations in the Arctic are much better than that in the Antarctic.” This is an interesting and logical point that you’ve quantified. Perhaps this has also been shown elsewhere? If so, reference(s) would be helpful.

Page 16, Line 420: Can you please clarify what is meant by “different observational references” in this sentence? Different from what?

Page 17, Figure 8 (and page 18, Figure 9): I recommend a new color map for these figures as the chosen color map may present challenges for readers with red-green color

blindness.

Page 19, Line 446: On page 6, line 144 the authors write that two observational references are used for each variable, but here the phrase "at least two" is used. Can you please clarify if you mean that SITool is equipped to handle more than two sets of observational references?

Page 21, Line 488: "While it is running, SITool (v1.0) produces ancillary maps and time series that can be consulted by the expert to understand the origin of one particular metric value." I believe this means that SITool automatically creates the kinds of maps provided in Appendix A, and if that's true, please reference Appendix A here. It would also be useful to note in Section 2 that SITool automatically outputs the differences (which may be just as useful to some users) in addition to the scaled metrics.

Technical corrections

Page 2, Line 60: I recommend rephrasing the grammar of the final sentence to something such as:

"The SITool is written in the open-source language Python and distributed under the Nucleus for European Modelling of the Ocean (NEMO) standard tools. SITool is provided with the reference code and documentation to make sure the final results are traceable and reproducible."