

Interactive comment on “Sea Ice Model Intercomparison Project (SIMIP): Understanding sea ice through climate-model simulations” by Dirk Notz et al.

Anonymous Referee #2

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This paper summarizes the goals and design of the CMIP6-endorsed Sea Ice Model Intercomparison (SIMIP) project, which is a diagnostic MIP that requests specific sea-ice related outputs to be saved so that a detailed assessment of sea ice variability, its response to external forcing and its influence on climate can be made.

The questions that can be addressed with the suggested outputs are fundamental, not only for sea ice scientists but for a wide range of climate scientists and stakeholders. Indeed previous analysis of climate simulations highlighted large differences between model simulations of past sea ice evolution and observations. They also indicated a large model spread and hence a large uncertainty in future projections of sea ice. The diagnostics that will be possible with the outputs requested by SIMIP will allow

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to better identify whether model differences arise from internal variability, from different tuning approaches, or/and from missing processes. It will also allow an improved understanding of the processes that govern sea ice evolution and its interaction with the atmosphere above and the ocean below. Very few sea-ice variables were saved in previous CMIP experiments and a rigorous analysis of the heat budget of sea ice was not possible. The data request detailed in this document includes new variables so that such budgets can be computed in upcoming CMIP6 simulations. An interesting suggestion is also to request that modeling centers provide a detailed documentation of their sea ice model and of the tuning approach they follow. This information is currently missing for many sea ice models and I think it is very important to better understand the differences between models and to help young scientists who start in this field.

The expected outcome of this project is hence a better understanding of the drivers of sea ice internal variability, more reliable projections of sea ice changes and sea ice related climate changes, a better estimate of models uncertainty and eventually possible improvement of systematic biases in climate models.

The authors made an outstanding effort to come up with such a detailed description of the requested variables. The document gives a detailed description of the requested data by dividing them into 5 groups, each describing a specific aspect of sea ice evolution and associated with a priority 1 to 3. The document is very clear even for a non-expert in sea ice modeling. Detailed guidance is given on every requested variable, including its definition and what type of analysis it can be used for. Thus, I strongly recommend the publication of this paper and I only have few minor changes to suggest as detailed below.

Detailed comments:

-Appendix E. p.20. I.3: I find it confusing to put “downward always positive” in the title here and have fluxes defined positive upward I.15, I.20 and in the following page. I am fine with this convention but I suggest phrasing it differently in the title I.3 e.g. “usually

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positive downward except when the term upward appears in the name description”

-Appendix F p.22 l.4: To me the request of sea ice speed is redundant with the x and y components of sea ice velocity. Why can't we estimate sea ice speed only from u and v ? In addition, I don't understand what is meant by “ to account for back-and-forth movement of sea ice”. Isn't the speed an absolute value that is positive by definition and hence does not provide any information about the direction? Please clarify the explanation and remove u from the requested variables if it can be estimated from u and v .

-p.23, l.10: P , h , C and A are not defined. I guess that sea-ice experts who use a Hibler model would understand but it would be useful to add at least a reference where this term is clearly defined.

Typos: -p.10, l.12, I guess the authors meant to use the word “even” instead of “ever”

-p.17, l.15: “refrozen” should be replaced by “refrozen” -p.18, l.16 : the parenthesis should be closed after “advection...”

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