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Ocean Science
Discussions

Interactive comment on "Constraining Uncertainties in CMIP5 Projections of Arctic Sea Ice Volume with Observations" *by* Wang Yangjun et al.

Anonymous Referee #1

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This paper, os-2020-35 Constraining Uncertainties in CMIP5 Projections of Arctic Sea Ice Volume with Observations by Wang Yangjun, Liu Kefeng, Shan Yulong, and Zhang Ren, represents a valuable contribution to climate research and risk assessment communities. I anticipate that this method will be applied on CMIP6 models, and some different domains and variables (besides sea-ice cover in the high north). I would like to see this paper published in Ocean Science after minor revisions that must address the following key issues:

1) SIC from PIOMAS is not "reality", but an estimate, so please justify your choice of using PIMOAS SIC by showing how close is PIOMAS SIC to one or more well-

established remote sensing SIC products.

2) Calculate PIOMAS SIV on PIOMAS grid and then re-grid PIOMAS SIV to 1x1 deg.

3) Again, since PIOMAS is just a reanalysis (that actually uses NCEP Re1 – more than 20 years old atmospheric reanalysis system with pronounced surface biases in the Arctic), how would your conclusions change if you would use some other reanalysis product that provides SIT over the same period, e.g., ECMWF ORAS5. No need to do entire procedure again with ORAS5 or some other comparable product, but the authors should compare SIT and SIV fields (perhaps PIOMAS and ORAS5 are very close, if not that should be clearly indicated in the paper).

Below are some additional points that should be addressed:

Line 8: ". . . emission scenarios from 2006 to 2018, . . ."

Line 10: "the genetic algorithm (GA)"? Could you briefly specify here (in few words or just a sentence) what is it.

Line 14: I would suggest: ".. possibility through the Arctic routes."

Line 20: The authors should also mention more updated, CMIP6 references for Arctic, e.g., SIMIP Community, 2020, Arctic sea ice in CMIP6, GRL, 46, e2019GL086749, https://doi.org/10.1029/2019GL086749.

Line 22: Perhaps you could cite here ("regional ecosystems (ref).") the following report: Chatman House, 2011, Arctic Opening: Opportunity and Risk in the High North (https://www.chathamhouse.org/publications/papers/view/182839).

Line 25: Now you can also mention CIMP6 results.

Line 26: I would suggest being more succinct here "available, showing a continued . . ."

Line 34: What is "seasonal cycles of the September"? September state is a part of seasonal cycle. This needs to be clarified and/or rephrased.

Line 39: Typo: “this study tries to further assess the model performance of ..”.

Line 43: It would be useful to put here some recent overview reference on multi-model benefits.

Line 47: I would suggest “. . . danger of overfitting and lead to . . .”.

Line 71: Unit issue: Do you mean “.. less than a 0.1 m mean difference . . .”?

Line 75: Using PIMOS SIC actually takes you further away from reality. Hence, be specific how much does PIOMAS SIC deviates from remote sensing products like NSIDC or OSI SAF SIC?

Line 106: You mean “.. the SIC times SIT of each ...”.

Related to equation (2), you should actually calculate SIV on the PIOMAS grid and then convert SIV to regular 1x1 deg grid. In general, it is best to perform as much as possible calculations on native grid before interpolation to some other grid.

Line 256: “well understood” is bit overconfident, perhaps I would suggest stating “.. have been adequately understood and represented . . .”

Line 258: You should add here: Notz, D., 2012, Challenges in simulating sea ice in Earth System Models. WIREs Clim Change, 3: 509-526. doi:10.1002/wcc.189

Acknowledgments: Are scripts used in this analysis publically available (and/or where they can be obtained)?

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