

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

### **Anonymous Referee #2**

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In this manuscript, the authors make use of an image-processing methodology for comparing Arctic sea ice properties (sea ice concentration, sea ice thickness, and sea ice volume) provided by several CMIP5 model outputs against the PIOMAS reanalyses. I am sorry for not being more positive at this stage, but in my opinion, the paper lacks scientific rigor. So, I do not see this manuscript ready for publication as a scientific paper. Please, see my arguments below:

1. First, I think the paper is out of the context of Ocean Science (OS). As shown in the journal’s “Aims and scope” ([https://www.ocean-science.net/about/aims\\_and\\_scope.html](https://www.ocean-science.net/about/aims_and_scope.html)), OS covers the following fields:

- ocean physics (i.e. ocean structure, circulation, tides, and internal waves); - ocean chemistry; - biological oceanography; - air–sea interactions; - ocean models – physical, chemical, biological, and biochemical; - coastal and shelf edge processes; - pale-oceanography.

It seems that the paper’s subject (comparison of sea ice properties between model outputs and a reference reanalyses) matches better with another Copernicus journal, The Cryosphere ([https://www.the-cryosphere.net/about/aims\\_and\\_scope.html](https://www.the-cryosphere.net/about/aims_and_scope.html)) which cover the following aspects:

- ice sheets and glaciers; - planetary ice bodies; - permafrost and seasonally frozen ground; - seasonal snow cover; - sea ice; - river and lake ice; - remote sensing, numerical modeling, in situ and laboratory studies of the above and including studies of the interaction of the cryosphere with the rest of the climate system.

2, Besides what is claimed in the title (and throughout the text), the manuscript is not using “observations”. Indeed PIOMAS has been largely used by the scientific community, but still, it is not an observational data set.

3, The text is sometimes confusing and it contains many vague statements. It needs to be substantially improved before publication. See just a few examples (non-exhaustive) below:

pg. 2, l33–35: “Wang & Overland, (2015) have reduced GCMs to 12 models by taking both the mean trends and seasonal cycles of the September sea ice extent (SSIE) projections from 1981 to 2005 into consideration.” → How and why?

pg. 2, l42–43: “Generally, there are two ways to improve the precision of projections; one is to find the model that best fits reality, while the other is to combine estimates with multi-models.” → Selecting the best performing model is not a way “to improve the precision of the projection” itself.

pg. 2, l51–53: “Additionally, the error method (e.g. relative error, root mean square

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error), widely used in previous literature (Wang and Overland 2015a, 2009, 2012; Massonnet et al. 2011; Stroeve et al. 2012; Liu et al. 2013), cannot suitably fit the difference in spatial distribution (Zhou et al. 2004)”—→ this sentence is a bit confusing. Does a work from 2004 say that the methodology used by papers published in the 2010s is not adequate?

pg. 2, l51–53:—→ “sea ice thickness is also taken into account in the calculations.” → Why “also”? What is the other variable that is taken into account? At this stage, the text referred only to sea ice thickness.

Sec. 2.1: The description of PIOMAS is very poor. What model is used? Is there data assimilation? How does it work? Which atmosphere forcing is used?

Etc.

I recommend that the authors make a careful review, sentence by sentence, of the manuscript.

4. The methodology is hard to follow. If I understood well, the methodology takes only into account the trivial trend and seasonal cycle(?) What about the interannual/decadal variability? Is it possible to predict “the possibility of navigability” without taking into account this important component of the sea ice variability?

5. Figures need to be substantially improved:

Fig. 1: It seems that the first panels are not needed at all. The authors didn’t refer to them in the text. Also, the colormap doesn’t make it easy to compare the plots.

Fig. 2: Very hard to distinguish the dates in the upper x-tick label; what does it mean “Year (o)”?. The y-label is wrong ( $10^3$  not  $10^2$ ); What the authors call by “monthly change” was plotted only in the blue line but not in the red.

Fig. 3: y-ticklabel is missing; y-ticks are overlapping each other; the colormap and color bar range is not adequate.

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These are comments only for the three first ones.

6, I am wondering why the authors didn't use the updated CMIP6 data since the files already available?

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