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The Cryosphere Discussions

Interactive comment on "Assessment of Arctic sea ice simulations in CMIP5 models" *by* Liping Wu et al.

Anonymous Referee #2

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The current study aims to assess the ability of CMIP5 models to simulate past (1979-2014) evolution of sea ice. The authors construct a score that is supposed to capture the quality of the simulations. Based on this score they group the models and show that there are significant differences between the groups. Finally, they attempt to provide a physical explanation for the differences in performance. Unfortunately, the study is fundamentally flawed on various levels, and I cannot support the publication of this manuscript.

1) The score that is constructed by the authors (equation 4) is highly arbitrary and subjective. Additional weight is put on the Barents-Kara (BK) Seas. While a detailed assessment of the simulation quality of BK sea ice itself may be of interest, its combination with the simulation quality of sea ice outside the BK Seas makes the index

ambiguous and hard to interpret

2) The score combines a) a part that is related to the simulation of the trend in sea ice area and b) a part that is related to detrended sea ice concentration, based a a degree of agreement metric. Most of the detrended sea ice concentration is due to random year-to-year variations in sea ice concentration, which the CMIP5 models are not expected to capture (as they have not been initialized with observations). Therefore, it seems inappropriate to base the score on detrended sea ice concentration.

3) The HadISST1 data set used to score the model simulations is known to underestimate sea ice trends and is hence unsuitable. It would be better to use HadISST2 data.

4) The authors argue that some of the score differences can be explained by the stratospheric ozone data set used in the models. However, this is very hard to believe as there is no evidence in previous literature that stratospheric ozone variations and trends have a significant impact on Arctic sea ice. There is a lot of discussion on whether Antarctic sea ice is impacted by the Antarctic stratospheric ozone, but the potential impact of Arctic stratospheric ozone variations and trends (which are smaller than in the Antarctic) on Arctic sea ice (which has completely different drivers than Antarctic sea ice) is a completely different issue.

5) The authors group the models according to their score, and than show that the skill is different in different groups (e.g. Fig. 4 and Fig. 5). These are trivial results and the direct result of the way the score is constructed

6) The presentation of the paper is poor as it contains many grammatical errors.

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