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Interactive comment on "Brief Communication: Does it matter exactly when the Arctic will become ice-free?" *by* J. K. Ridley et al.

Anonymous Referee #1

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In this very short contribution, the authors present results from 4 ensemble members of the HadGEM2-ES for the RCP8.5 and RCP4.5, and ask the question how different definitions of "first ice free year" affect the answer within this small ensemble, as well as the more general question as to how useful an answer to this question is. And while it is interesting to see a comparison of the impact of 4 different definitions of "first ice-free year" in a small ensemble of 4 simulations from one model, the result is not particularly surprising. The second point of the contribution, as reflected in the title, is the question whether we, as sea ice community, should focus on when the Arctic will be ice-free for the first time. And while I completely agree that the crossing of an arbitrary threshold (such as 1 million km2) has little real world meaning, it is a fact that the crossing of such thresholds (as the recent rise above 400 ppm CO2 in the atmosphere, discussions about avoiding more than 2 C global warming, etc) is

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something than captures attention in the media and the public. I do agree, however, that a common definition of how we define “first year of ice-free” as a community would be very worthwhile.

Finally, I disagree strongly with the final paragraph of the conclusion of the article (lines 75-82), which suggests that we have reliable seasonal forecasting systems that can predict year-to-year sea ice variability, so that we should focus our energy there, rather than on refining sea ice projections from climate models. There remains a large spread in seasonal forecasts of the sea ice extent (see the SIPN Sea ice Outlook for last year, https://www.arcus.org/sipn/sea-ice-outlook/2015/post-season), with so far limited skill. And with a range of over 100 years in the prediction of the “first ice-free year” in the CMIP5 models, and a large range in general in the projections of sea ice in CMIP5 (temporarily and spatially) I would argue that refining climate model projections of sea ice is still a top priority in order to allow more reliable adaptation planning, and narrow down when in the 21st century we can expect the Arctic to become ice-free. I would end after line 74, as that is really all that can be said based on the results presented.

Overall the article reads like a nice poster written up into an article, with some issues that could easily be fixed. However, I am concerned that this contribution is really below the “least-publishable unit” threshold, even for a “Brief communication”, but I will leave that decision up to the editor.

Specific minor comments: Line 17: this sentence reads strangely, seems like a “result of” is missing between the end of line 17 and the start of line 18. Otherwise it is unclear how line 18 links up with line 17 logically. Line 19: Completely unclear how the authors come up with this speculation that “the sea ice cover is more sensitive to fluctuations in temperature than previously thought”, as they even explicitly mention the impact of strong sea ice convergence in the line above. I would recommend removing this statement, also because the author do not come back to this at all, and it is not supported by any data or linked to any of the results or conclusions in the paper. Line 33-34: It is unclear to me what the “while particular ecosystems may be robust to short

term variations" mean here and what the purpose of this statement is. Please rephrase. Line 46: I would suggest rephrasing this definition of C, as it is confusing as it is. What is meant, I think, is the first time a 5 year running mean of September monthly mean extents is "ice-free". The "final year of" is confusing here, and not needed if we are looking at a running mean. Or maybe I misunderstood completely, but that also shows it should be rephrased or explained better.

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