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The Cryosphere Discussions

Interactive comment on "Assessment of Arctic and Antarctic Sea Ice Predictability in CMIP5 Decadal Hindcasts" *by* C.-Y. Yang et al.

Anonymous Referee #2

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Review of the manuscript "Assessment of Arctic and Antarctic Sea Ice Predictability in CMIP5 Decadal Hindcasts" (tc-2016-97) by C.-Y. Yang et al., submitted to The Cryosphere.

This study analyzed decadal hindcasts/predictions of Arctic and Antarctic Sea Ice from 11 CMIP5 models. The manuscript suggests that the broader prediction skill for the Arctic sea ice at increasing time leads is mainly due to the predicted decline of Arctic sea ice induced by anthropogenic forcing. In contrast, the Antarctic sea ice decadal hindcasts do not show broad predictive skill at any time scales, and almost all models predict the decline in Antarctic sea ice, opposite to the observations. The subject of the manuscript is suitable for The Cryosphere, and the results are interesting and contribute to the understanding of decadal prediction of Arctic and Antarctic sea ice. Some clarifications/diagnoses as suggested below would be helpful to strengthen the

manuscript. I recommend the paper to be accepted for publications in The Cryosphere with minor revisions outlined below.

1, Page 6, Lines 126-128, as mentioned here, models tend to drift away quickly from the initialized states. Will the prediction results shown in this study change if the systematic model drift is removed (i.e. drift correction) before preforming the analyses?

2, The manuscript shows that the CMIP5 decadal prediction of sea ice extent is strongly affected by anthropogenic external forcing (i.e. decline in both Arctic and Antarctica sea ice extent). How is the CMIP5 decadal prediction of Arctic and Antarctic sea ice extent compared to uninitialized CMIP5 historical+RCP4.5 simulations? Is the predictive skill enhanced with initialization compared to uninitialized hindcasts?

3, Page 18, Lines 380-387, a very recent study (Zhang, 2015) suggested that to predict September Arctic sea ice extent variations, it is important to monitor internal variability associated with the three key contributors (Atlantic/Pacific heat transport into the Arctic, and Arctic Dipole), in addition to the focus on anthropogenic changes. The study also pointed out that the Atlantic heat transport is the prime driver for low-frequency variability of winter Arctic sea ice extent, while all three contributors (Atlantic/Pacific heat transport and AD) are important for summer Arctic sea ice extent variability at low frequency. Please add discussions on these related results.

Reference: Zhang, 2015, Mechanisms for low-frequency variability of summer Arctic sea ice extent. PNAS, 112, DOI:10.1073/pnas.1422296112.

4, Almost all models predict the decline in Antarctic sea ice, opposite to the observations. Please add more discussions on what caused such a discrepancy (internal variability, ozone depletion?).

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