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The Cryosphere Discussions

Interactive comment on "The Arctic Sea ice in the CMIP3 climate model ensemble – variability and anthropogenic change" *by* L. K. Behrens et al.

Anonymous Referee #1

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General comments:

Behrens et al examine the Arctic sea ice in the CMIP3 model ensemble. Similar to previous studies, they report changes in summer and winter sea ice areas, as well as trends in the amplitude and phase of the sea ice seasonal cycle between pre-industrial and future simulations. To my knowledge, their particular focus on the Barents Sea and Central Arctic regions is novel.

While the results are clearly presented in general, I cannot recommend this paper for publication. My first major concern is that the main findings do not add to the existing literature that already examines the sea ice in the CMIP3 models, and compares to the observations. If the authors had considered the CMIP5 ensemble, perhaps the argument could be made that simply reporting model results (and comparing to CMIP3

and observations) would be a useful exercise. Of greater concern is that no attempt is made to take into account sea ice cover biases across the models, and thus conclusions about regional changes may not be valid.

Major comments:

- It must be considered that the regional findings (comparing different models and models to observations) may come from differences in the timing of when the seasonal sea ice edge begins to change within a region under hemispheric warming. For example, a model with a far too extensive summer sea ice cover will not show Central Arctic sea ice area changes until much later than other models or observations. Without taking such biases into account, it is difficult to learn much from regional analyses.

- Without a more careful analysis of regional sea ice changes, many of the major conclusions cannot be supported. For example, neither the large variability (page 5326) or intermodal spread (page 5330) in the Barents Sea region, nor the magnitude (page 5229) or nonlinearity (page 5325) of the Barents sea ice area trends with hemispheric temperature, necessarily imply that ocean dynamical feedbacks are at work (though this may be the case).

Minor comments:

- Why switch from September to JAS, and from March to JFM in section 3.2?

- The observations in Fig. 1 are shown on a different scale, making it difficult to see some of the results from this figure.

- I am not sure we can trust Arctic sea ice area observations from before the satellite era, and regional observations are particularly suspect.

- page 5325, Lines 2-8: the reported regression lines suggest that the whole Arctic is more sensitive to hemispheric temperature than is the Central Arctic, right? Then why do you state otherwise?

- page 5328, Lines 12-13: The relationship between March thickness and September variability doesn't appear at all in the late 21st century, so another mechanism must be at work here.

Interactive comment on The Cryosphere Discuss., 6, 5317, 2012.