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# *Interactive comment on* "Carbon cycle uncertainty in the Alaskan Arctic" *by* J. B. Fisher et al.

**Anonymous Referee #1**

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General Comments: This analysis of carbon cycle uncertainty for Alaska is an extension of previous research. Its strength lies in bringing together 40 models that contributed to earlier NACP, TRENDY, and WETCHIMP analyses, and to a more limited extent subjecting a few of those models to site-specific comparisons against flux tower data from sites at Barrow and elsewhere. As a result there are two useful lessons to be learned. First, the sensitivity of NEE to CO2 fertilization and climate is compared with the conclusion reached that climate is the more uncertain of the two. It is not clear, however, what component of climate might be dominating this dynamic. Second, is that mean annual NEE shows no consistent spatial pattern among the various models evaluated. It was surprising not to see this mentioned in the Abstract. My preference would be to see this result described in the Abstract and not the site-specific comparisons to AmeriFlux. This is especially true since the Discussion section concludes with an observation that these analyses could be used to guide future field data collection



efforts. This would be a valuable contribution, but it must be mentioned how this could be done and/or what the recommendations might be coming from that analysis. Specific Comments: Abstract: Although it is mentioned that an analysis of "structural and parametric uncertainty" was conducted, this is not how results are presented in this section. It is possible that the multi-model standard deviation against the mean is a measure of total uncertainty for a given quantity and not structural and parametric separately. Also, it is unclear whether these flux and stock estimates are the only sources of uncertainty evaluated or where there others. It should also be emphasized that baseline means results from a transient simulation from 1991 to 2009, not uncertainty estimate for 2100 or beyond. The title and Abstract will lead readers to believe this is a new and unique analysis. Rather, while it is interesting, it is a future compilation and analysis of previous (NACP, TRENDY, and WETCHIMP) model inter-comparisons. Introduction: This is a reasonable presentation of previous research and results that come from other model inter-comparisons. Thus, this section sets a good stage for readers. It does seem to capture uncertainty in broad terms, but hesitates to dip into the details of sensitivity analyses, uncertainty quantification, etc. Materials: Rather than a new community coming together for this model inter-comparison, it appears that it compiles previous results from NACP, TRENDY, and WETCHIMP. The rationale for this is not exactly given, but should be stated in the Introduction. It will be interesting to see if and where the larger analysis differs from the three individual NACP, TRENDY, and WETCHIMP efforts. Results: Although expectations were otherwise, the breadth of the uncertainty analysis conducted here is rather limited to carbon flux and stocks. Some interesting results were presented that were not emphasized or mentioned in the Abstract. Discussion: Good discussion of soil carbon stocks, their uncertainties, and comparison to field measurements and previous summaries. These differences do seem to be striking leaving it an open question as to the explanation. It is interesting in that given all the directions that this analysis could go, the emphasis was placed on the relevance of these data to future field campaigns. Not sure what exactly motivates that decision especially given the poor agreement among models in spatial

representation of processes. However, assuming that the analysis of spatial patterns of carbon flux and stock uncertainties would yield useful information for field studies, the question becomes why are those maps not presented and where are those recommendations? Those alone could be quite valuable. Conclusion: Good summary of the major objectives of this project and its findings.

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