

## ***Interactive comment on “Atlantic Water advection vs glacier dynamics in northern Spitsbergen since early deglaciation” by Martin Bartels et al.***

**Anonymous Referee #2**

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This paper looks at the evolution of the Woodfjorden system over the last ~15,000 years. This system was chosen because of how it interacts (and is impacted) by the warm Atlantic Water that enters the Arctic near Svalbard through Fram Strait. The authors carry out a detailed reconstruction of marine environmental conditions in the area around the fjord to look at temporal evolution in the region and the role of AW (vs glacier dynamics) in driving the observed changes.

This is a well written paper, easy to read and follow. The data is clearly presented, and the conclusions drawn from it make sense. The figure quality is good, and the figures provided are appropriate. So it will definitely make a good and interesting contribution to the literature. That said, there are some small ways that the manuscript could be improved. Most importantly is adding to and strengthening the discussion of Atlantic

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Water in the region, as well as something on the processes that could allow it to enter fjord system (like Woodfjorden in this work). As well, at times I find the authors use older references when there are newer papers that would be better to refer to. Thus I would recommend minor revisions.

Given the importance of Atlantic Water to the manuscript, I find section 2 a bit short and incomplete. How much Atlantic Water enters the region, and how does it vary? What drives that variability, i.e. the North Atlantic Oscillation? What depth is it found at today and what sets it? What drives there to be more or less Atlantic Water transport through Fram Strait vs the Barents Sea Opening? How can it be exchanged from the open ocean across a fjord sill (at the very least, there is some discussion of this for Greenland, if not Svalbard)? All of these items are important for the reader to understand so that the authors can link what happens today to their paleoscenarios. The references in section can be brought more up to date as well.

Also, the introduction has old references. I.e. for Fram export, there are newer works than Serreze et al., 2006, for example.

Section 4.2: How would the results change if that one radiocarbon age had not been excluded?

Section 5.1: What does the topography of the fjord system look like with the sea level drop at this time? What does the oceanic Atlantic Water circulation potentially look like at this time?

Section 5.2: Not sure about the forced to submerge comment. If the Atlantic Water is cooled in winter, it will have its density increase and it will sink, irregardless.

Also, if the Ekman transport is northward, that is away from the fjord, so am not sure how that allows the Atlantic Water to flood the fjord.

Figure A1: What are the units of the vertical axis? Shouldn't they be m or dbar? Also, I'd like to see this figure as a panel in the actual paper, not just supplementary material.

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Having an understanding of the vertical structure and where the Atlantic Water sits would be useful to the reader.

Finally, it would be good in the discussion section to try to take the results, which are focussed locally on the Svalbard area, and speculate on the wider significance.

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