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Interactive comment on “Biased thermohaline exchanges with the arctic across the Iceland-Faroe Ridge in ocean climate models” by S. M. Olsen et al.

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Anonymous Referee #2

The manuscript investigates climate model representation of baroclinic exchanges between the North Atlantic and the Nordic Seas across the Iceland-Faroe Ridge. These exchanges are critical for heat and salt budgets of the Nordic Seas and for climate prediction. The paper nicely hypothesizes resolution-derived bias in the model and test the hypothesis using a case study from a long term observational record. The model is not able to accurately represent fluctuations in the inflow of Atlantic across the IFR seen in the observational record. The authors postulate that this discrepancy is due to

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the lack of a resolved IFR overflow in the model. This hypothesis is plausibly defended, despite the lack of an observational time series of the IFR overflow.

I believe this is a solid paper and deserves to be published. My slight reservation is that the authors look to describe a single model/observation discrepancy in a time series that is not super highly correlated. But as the authors point out, the 2003 event is large and makes a good case study. It's too bad that the timeseries of IFR overflow has to be reconstructed so indirectly, but I believe there is a solid dynamical underpinning in the analysis leading to the best proxy for overflow possible given the data.

Author comment: We fully agree with the reviewer and will take initiative to a new observational monitoring program for the Western Valley Overflow (proposal submitted).

The paper is very nice coupling of model and observational data. It was great to see such long term observational records used to diagnose bias in climate models.

I think the paper should be published in Ocean Science. I only have a few minor comments, listed below.

The authors introduce the three main branches of Atlantic inflow to the Nordic Seas in the abstract and early in the paper. The first description of what those three branches are doesn't come until page 1486. It might be nice to have the branches west of Iceland, the IFR and the FSC introduced earlier (maybe around page 1473 line 17).

Author comment: We thank the reviewer for this suggestion and will reorder the manuscript so the two branches are described initially as suggested 1473-19 "This includes the Iceland branch, the Iceland-Faroe Ridge inflow and the Faroe Shetland Atlantic inflow."

Some grammatical comments are listed below by page # - line #

1472-5: " : : ocean heat is in critical regions: : ." is an awkward construct. Consider rephrasing.

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Author comment: We rephrase the sentence: “and ocean heat is directly available for sea-ice melt”

1472-6: “Hereby: : :” wrong word choice.

Author comment: We rephrase the sentence:”Through these mechanisms,. . .”, also at 1492 5

1472-10: “have shown: : :” should be “have been shown to be: : :” or something like that

Author comment: We rephrase the sentence: “have been shown to be”

1473-26 “has shown: : :” should be ‘has been shown to be: : :”

Author comment: We follow the suggestions and rephrase the sentence.

1484-18: I was initially a bit confused by the title of section 4.3. The overflow is generally referred to as overflowing the IFR, not the Iceland slope. I might change the section header here to “Overflow AT the southeastern Iceland slope” Or “Overflow at the northwestern IFR (or Western Valley)”. Just a preference.

Author comment: We replace the section title:”Overflow at the Western Valley”

1489-10 “Thus, only here: : :” awkward construction

Author comment: We find the sentence is redundant and remove it.

1491-13 “has been shown plausible” ->“shown to be plausible “

Author comment: We rephrase the sentence:”shown to be plausible”

Interactive comment on Ocean Sci. Discuss., 12, 1471, 2015.

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