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Ocean Science
Discussions

Interactive comment on "A multi-decadal meridional displacement of the Subpolar Front in the Newfoundland Basin" *by* I. Núñez-Riboni et al.

Anonymous Referee #1

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The authors study the multidecadal variability of the Subpolar Front in the Newfoundland basin. This manuscript gives interesting results on the link between the variations of the front and the Meridional overturning circulation, and meridional heat transport. However, the analysis of the causes of the variations of the SPF position is not totally convincing, and additional sensitivity experiments could be run to clarify this point. Therefore, I recommend publication after a major revision.

Major Comments:

The authors state that "the modelled mean position of the Subpolar Front in the Newfoundland Basin is roughly in phase with the observed one". However it does not seem so obvious when comparing both curves on the lower middle panel of figure 1. What is the correlation between these two curves? As the authors are interested in low fre-

quency variability, they should plot the low pass filtered mean latitude of the observed SPF in figure 3d.

In order to obtain the contribution of the wind stress curl to the barotropic stream function, the authors compute a Sverdrup balance, using, I suppose, a flat bottom. However to take into account the influence of the topography and the stratification of the model on the contribution of the wind stress, they should perform a numerical sensitivity experiment forced with variable wind and constant heat fluxes (e.g Eden and Willebrandt, 2001).

The contribution of the heat fluxes to the barotropic stream function is computed as a residual between the "WSC contribution and the total stream function". The authors considered that this contribution is mainly related to LSW changes. On one hand, the authors supposed that the oceanic response to the forcing is linear at multidecadal timescale. Could they prove it with a sensitivity experiment or give some references? On the other hand, the WSC is crudely estimated, so is the "LSW contribution". Therefore, the comparison of these two contributions is questionable.

Specific comments:

Section 2: The authors should specify the time evolution of the data density in the Newfoundland basin.

Sections 3: The section 3 should be divided in two subsections: 3.1 Model set-up and analysis methods; 3.2 Model evaluation.

p. 458: The domain of the model and the frequency of the atmospheric forcing should be mentioned.

p.458, l.9: The model resolution is 0.4°, but the model outputs have been interpolated on 1°x1° grid. I supposed that this interpolation was done to match the observations resolution. However, except for this comparison the interpolation does not seem to be useful all the more that the variations of the mean latitude of the SPF rarely exceeds 1°

(fig 3d). A computation of the SPF index done on the original grid would allow to better resolve the variations of the front.

p.458, l. 21: The box to compute the SPF index encompasses the Northwest Corner. However, according to the authors, this loop is not present in the model. Can this explain the discrepancy between the observed and the modelled SPF index? Is the observed SPF index sensitive to an eastward shift of the box?

p. 460, l. 8: The authors compare the gyre index of their model and Hatun et al. model (fig 1, upper middle panel). However, the two indices are not defined in the same way. In Hatun et al. paper, the gyre index is defined as the first principal component of the sea surface height, whereas in this study the index is an average of the barotropic stream function between 45 and 65°N and 20 to 60°W.

p. 460: A more quantitative comparison of the model variability could be done by giving correlations between the time series displayed in figure 1.

Section 5 P 462, (l.14-16): To illustrate the variation of the salinity in the Newfoundland Basin a panel of the mean salinity at 500 m depth in the NFB could be added to figure 3 below the panel describing the SPF index . This will stress the link between these two indices.

p.467, l. 2-5: The authors could compute the SPG intensity index, the DBWC transport at 53°N and the subpolar SST in their model and compare these indices with the SPF index.

The authors suggest the SPF index as an indicator of intensity changes of the MOC in the subtropics. However, relationship between the MOC variability and the Greenland Scotland overflow have been proposed (e.g:). Thus have the authors investigated a possible connection between the SPF position and the Greenland-Scotland overflow?

p.467, l. 15. What does “additional” refer to? The northward propagation is not clear on the plot, neither the 15 year time scale.

P; 467, l. 19 replace “an” by “a”.

Interactive comment on Ocean Sci. Discuss., 8, 453, 2011.