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Climate of the Past Discussions

Interactive comment on "Explaining interdecadal salinity changes in the Baltic Sea in a 1850–2008 hindcast simulation" *by* Hagen Radtke et al.

Anonymous Referee #1

Received and published: 12 December 2019

The paper addresses a very topical and relevant issue for the Baltic Sea. Salinity dynamics is one of the key questions for the present and future state of this vulnerable sea.

The Authors have long time series from model simulations, which show good quality compared to the available measurements from the area. Although there are always some questions about the reliability of the model simulations for the period before measured data, it nevertheless gives possibility to study long-term changes and drivers in the system.

The estimations of the connections between the river discharge and the surface and bottom salinities is very interesting and an important finding is that the direct dilution effect only counts for the 25 percent of the salinity variations. Also understanding the

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uncertainties in our interpretations of the measured data and in the climate projections related to salinity dynamics is essential in evaluation of the future state of the Baltic Sea and the measures we have to take in its protection.

The use of the wavelet analysis allows to study the connections between different factors affecting the salinity dynamics and reveals interesting things. The 30-year time scale in surface and bottom salinity changes and river discharge is not directly connected to the time scale of the other factors. One wonders, whether a combination of different factors, e.g. NAO and AMO, which are not independent from one another, would actually lead to the time scale present in the surface and bottom salinities, some of the MBI's and runoff.

I have some comments/suggestion regarding the manuscript:

Title: Consider changing the title. I'm not sure if explaining is the right word. The study leaves many questions open, so maybe studying would be more appropriate word.

Introduction:

In the introduction, you could also introduce some literature related to the drivers of the salinity variation you are discussing later on; e.g. NAO, AMO and how their effects to the Baltic Sea dynamics have been studied earlier.

Please avoid introducing your results in the introduction (e.g. line 60)

Material and Methods:

In the dataset-section, consider using subtitles. It is easier to find, what you are looking for, when one is later on returning to this section to check what was said here.

Model validation:

Consider putting surface and bottom salinities to different figures or use larger image size. With the current size, scales and colours it is difficult to see the differences between the measurements and the model.

Results of the wavelet analysis:

The amount of stations and parameters studied is bit exhausting and it is not easy to form a consistent overview of the different effects and time scales. Would it be possible to summarize the main findings in a table?

Discussion:

In discussion of the things affecting the model accuracy in the beginning of the model period, you could also include the accuracy of the atmospheric forcing. I do not know the details of the forcing dataset used here, but typically the amount of data assimilated in the models increases the nearer we come to present and therefore typically also the accuracy improves. This would also affect the accuracy of the ocean model as the simulation of the MBI's are sensitive to the accuracy of the atmospheric forcing.

Drivers and variation:

I would like to see more discussion on the combined effect of the different drivers. Although it is now easy to study this, you could at least discuss the possible joint effects of the different drivers, as they are not independent from one another.

Conclusions and outlook:

I would avoid using the world realistic, when talking about hindcast simulation. Maybe some other term related to quality?

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