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Discussions

Interactive comment on "The effect of vertical mixing on the horizontal drift of oil spills" *by* Johannes Röhrs et al.

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We would like to thank the reviewer for a thorough feedback on our manuscript. We will be happy to provide a more detailed discussion on why the two droplet size spectra give different results. While it is difficult to say something conclusive about the two parameterizations, we think that a key practical difference is that the Li et al. (2017) spectrum gives a more robust model system that is less sensitive to uncertainties in the emulsification rate and slick thickness (the latter is not a parameter in this parameterization). The Johansen et al. (2015) spectrum, on the other hand has a more explicit treatment of the oil slick properties. This may provide superior results if slick thickness and oil properties are well known, but is also more prone to errors when uncertainties are large, judging from our experience with the two methods (see e.g. Fig. 1).

We agree that the need for tuning the water content in the oil emulsion for the experiments in sec. 4 should receive more discussion in the paper. For operational purposes, our problem that we did not know how the pre-emulsified oil would behave after the spill, may not be a limitation if the initial oil spill is not emulsified from before. However, the same problem will arise when operational oil spill models are initialized from observed oil spills without knowledge of the time and location of the initial spill. In such cases, using the (Li et al. 2017) droplet size spectra can reduce uncertainties compared to other methods. In addition, we foresee a revision of the emulsification algorithm in future studies.

Considering section 5, it correct that we have not addressed inter-seasonal and inter-annual variations in the weather situations of our study region. For our study, an important requirement is that we cover a large range of different weather situations with regard to wind and wave forcing. The winter and spring season in the Norwegian Sea is charaterized by both stormy situations of passing lows (as during autumn) and calm weather with stable high pressures (as during summer). The simulations during January to May (one simulation starting every second day) did sample a large number of storms and calm situations, such that our set of experiments can be treated as Monte-Carlo simulations with random-like forcing. This allows us to map out most of the different possibilities for oil spill transport in the region, but we do not provide conclusions on inter-annual and seasonal variability of expected oil spill transport. This will be clarified in the revised paper.

A revised manuscript will include the discussion points above and we will also address all of the specific comments raised by the reviewer, particularly the suggestions on improving the style of the text in parts of the introduction.

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