

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 for a constructive review. Addressing the first point raised by the reviewer, we agree that a quantitative comparison of the model simulation with the measured oil spill contours would be better than a purely visual inspection of the results. We are therefore working on a way to subjectively evaluate the model simulations with the various droplet size spectra and emulsion rates. This additional analysis will be presented in the revised manuscript.

The reviewer also addresses a weakness in section 4 that we end up tuning the model by selecting the water content in the oil emulsion that provides the best match with observations – and we do not see a way to overcome this issue in the present study.

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The need for tuning the water content arises because the oil in the experiment was pre-emulsified before spilling the oil, and we do not know how the oil then continues to emulsify in the open ocean. The used algorithm for emulsification does not account for this situation. Nevertheless, using realistic droplet size spectra has greatly reduced the need for model tuning compared to the previous model implementation used in Jones et al. (2016). We will clarify this in the revised manuscript and add to the discussion.

Considering point two, we should clarify that Stokes drift transport is relevant for both surface and subsurface oil, but for the subsurface oil the effect is much smaller and dependent on the depth. Below the Stokes layer, it should be negligible. This leads to the explanation that parts of the surface slick, which consists of resurfaced oil, lags behind the part of the surface slick that has experienced continuous transport by wind and waves.

While the UAVSAR underestimates the total extension of the downward slick, the parts that are not seen are expected to be very thin, such that they do not provide sufficient alteration of wind ripples to be detected by the image processing. For the total mass budget of the spill, this part may be less relevant than the bulk of the oil in the trailing part of the oil slick. However, this may be different for light and heavy oil which is submerged to a different degree. We will include this consideration in our discussion of results.

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