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Ocean Science
Discussions

Interactive comment on "Storm-driven across-shelf oceanic flows into coastal waters" *by* S. Jones et al.

Anonymous Referee #1

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General Comments

The authors present a range of observational and modelling evidence for a high salinity pulse (HSP) on the Malin shelf in December 2013, and further supporting evidence for HSPs in other winters, driven by persistent westerly gales generally associated with positive NAO states. These HSPs likely amount to a major oceanic flux into this sector of the northwest European shelf, with potentially wide-ranging consequences for nutrient levels and productivity in coastal waters.

In summary, the manuscript is well written and figures are of a high quality. It should be suitable for publication in Ocean Science, subject to minor revisions and/or appropriate responses, in regard to the specific comments listed below.

Specific Comments

1. p.4, lines 121-122: Regarding "Gaps in positional data were linearly interpolated with a maximum gap size of 20 hours" - can you provide information on the extent of this?

2. p.4, line 151: regarding the hindcast, in addition to citing Graham et al. (2018b), can you specify the period of hindcast, obviously covering August-December 2013.

3. 161-162: Regarding "The experiment was repeated 5 times resulting in a total of 200 unique particles being released from each location in Fig. 3a.", how was each experiment different? Was this simply sampling a range of 'random walks'?

4. p.5, line 167: A few more details on the Lagrangian method would be appropriate. How do you interpolate in latitude and longitude to obtain model velocity at an arbitrary particle location? You refer to the model timestep Delta_t in Equation 1. How long is this? To which model do you refer? Presumably the Lagrangian scheme? Noting previous reference to offline particle tracking and use of daily mean modelled velocities, does Delta_t = 1 day, or much shorter? If the latter, how do you interpolate in time?

5. p.5, line 170: What is Delta_T? Presumably Delta_t?

6. p.5: Given the complexity of your study region, does the Lagrangian scheme involve any issues near bathymetry or coasts? Do particles "crash" into coasts or seabed if the timestep is too long?

7. p.5, lines 181-182: "We use only tracks from drifters drogued at 70 m as this enables a comparison between the behaviours of the autumn and winter groups." It is not clear to me what you mean - can you elaborate?

8. p.6, lines 203-204: Regarding ". . . the peak drifter speeds of 60 cm/s observed in this study suggest that oceanic water import via the AIC may briefly reach 0.48 Sv", how did you estimate this transport? Presumably by associating the speed with a cross-sectional area? Can you provide some detail? Perhaps briefly reiterate the method of

9. p.7, line 231: As you introduce the particle statistics and Figure 6, can you briefly explain the particle origin (%) diagnostic in the text, as you have in the figure caption? Also, in addition to Figures 6 and 7, could you also show the mean particle salinity, as you have shown origin and age? Might this further confirm the pathway for high salinity water towards the Tiree Passage?

10. p.7, line 240: Regarding the statement “While a minority of 20 m particles originated in the abyssal ocean”, do you mean that these particles upwelled from off the shelf? The abyssal ocean seems an exaggeration in this context

11. p.7, lines 257-258: Regarding “the rapid (1-2 day) increase in currents in terms of the dynamic response to wind-induced pressure gradients”, I assume you mean geostrophic flows supported by a change in sea surface slope?

12. p.8, first paragraph: Continuing this theme, you suggest rapid setup on a short barotropic adjustment time, perhaps disrupted by inertial effects, but what about Ekman dynamics? Might one expect a strong westerly wind to drive Ekman drift towards Northern Ireland, setting up local downwelling and a geostrophic jet to the west, in the same sense as the AIC (or ICC in Fig. 1a)? Does this complement on-shelf oceanic flows?

13. p.9, lines 302-304: Regarding “between January and March coastal waters are cooler (6-8 °C) than the adjacent ocean (9-10 °C) so we would expect a similar event during this period to increase coastal water temperatures in western Scotland”, is there evidence for this in the TPM temperature record?

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