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Interactive comment on "What can seabirds tell us about the tide?" *by* Matthew Cooper et al.

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Response to reviewer 1

I really enjoyed this article. It was well-written and showed how unexpected results of potentially great value can be extracted from data collected for entirely different purposes. There were a few minor things that, if addressed, could increase the value of the article, but it's already acceptable for publication. Here are my comments:

Thanks. Your comments are appreciated.

Introduction: the authors should cite Poulain (2013) as an example of mapping tidal currents with drifters. JGR Oceans 118, 1434-1444, doi: 10.1002/jgrc.20147.

Added

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Discussion paper

121-126: the caveats are well stated here, as well as later in the manuscript. Likely more could be done to statistically assess windage and Stokes drift in a follow-up, but this first study is sufficient to show convincingly that the tidal signal is extractable. 148: it would help a reader not familiar with the tides of the area to state what fraction of the tidal variance at Liverpool is explained by M2.

The Irish Sea is close to resonance with the semi-diurnal tide and diurnal tides are very small in comparison. The ratio of S2 to M2 is about 1/3, and so spring tidal currents (when M2 and S2 add) are about twice as great as neap currents. A note has been added to the text

246-247: later in the manuscript, this factor of 0.85 is called into question. Thus, it would add great value if the authors added at least a couple of sentences here summarizing how Pugh deduced this factor.

Pugh, on page 243 of his book, gives a 'rough' guide for estimating the tidal current profile. The calculation is based on a power law description of the current profile above the logarithmic layer, in which velocity increases as height above bed to the power 1/m. For experimentally determined values of m in the range 5 to 7 this gives the ratio of depth-mean current to surface current 0.83 to 0.85. A note has been added to the text

We have therefore used an empirical relationship in this calculation. Physical arguments suggest that as the current increases, eddy viscosity also increases and so the ratio of mean to surface current will increase. It is hard to imagine it increasing much above 0.9, however.

279-280: is there any evidence that the birds preferentially seek times when the tidal current is fastest? If so, there might also be a spatial bias toward higher-current regimes.

The birds appear to follow a diurnal routine, flying during the day and resting at night.

They may well seek out regions of fast currents however, if there is a benefit for feeding. We don't know this, although it has been suggested to us.

286-295: this is probably crazy, but is the M2 current signal in the model purely sinusoid? Could nonlinear effects alter this? The authors note that other, weaker constituents can also play a role in modifying this signal.

The model output is purely sinusoidal. The 'test' we refer to was adding a diurnal part to the curve fitted to the observations of bird speed. We should have made that clearer and have amended the text. **

General question: is there any evidence of a time-mean current superimposed on the tidal signal? This is likely much more contaminated by windage and Stokes drift that the tidal signal, but it would be fascinating to see what the residual velocities look like after fitting and removing the M2 signal.

There certainly is a time mean current which is generally towards the east. The prevailing wind direction is from the south-west and so this is consistent with the residual flow being partly surface drift and partly windage on the birds. We have not tried to tally this with observations of wind speed in this study, however. Something for the future perhaps?

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