

Interactive comment on “Vertical Structure of Ocean Surface Currents Under High Winds from Massive Arrays of Drifters” by John Lodise et al.

Anonymous Referee #1

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The paper addresses the magnitude and direction of surface currents under the presence of strong wind forcing, assessed using drogued and undrogued surface drifters. Given the large uncertainties of today's theoretical and numerical models with respect to surface currents and their vertical variation, this is an urgent topic. The presented studies uses an extensive data set in a dynamic interesting setting, and provides results that can serve as exemplary quantification of surface currents under strong wind forcing. The work therefore has a potential to become a useful reference for such dynamics. There are a few shortcomings in the analysis and the presentation of the work, requiring major revision before the work should be published.

A potential flaw in the analysis lies in the determination of a pre-existing circulation field that is supposed to be constant throughout the remainder of the experiment. As

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justification, the authors refer to very general descriptions of circulation in the region and to a sudden increase in wind-speed, but Fig. 2 rather shows that there is a steady increase of winds over one day. In addition, any pre-existing current is subject to further development and changes typically occur within one inertial period. For example, previous wind or buoyancy forcing events could have set up near-inertial oscillations that continue to change throughout the next wind event. This has to be addressed in a revised paper, potentially involving another method to identify background currents that are allowed to be time-variable. A snapshot at one arbitrary time step is not convincing enough, even if subtraction of that current field helps to collapse scatter in wind- versus current comparison.

A second shortcoming of the study that is straightforward to address is the structure and organisation of the paper. Introductory material, methods, result and discussion is often mixed up in the paper and it would help to re-organize or re-write some parts. For example, A description of the applied method is given in the first paragraph of the introduction, which should be given in section 3 or in the abstract. Some background information and literature reviews are given in later parts of the paper, that should have better fitted in the introduction, e.g. page 5 line 5-24 and page 13 line 19-31. In the second-last paragraph of the introduction, results are given. A major part of the results is provided in the discussion section. These jumps in the paper make it very difficult to read. At the same time, a lot of needless redundancies are made, suggesting that the paper could be shortened and sharpened to some extent.

Specific comments:

- A motivation for the study should be given in the abstract. I first realized what the overall motive was when I read the discussion.
- Page 2 line 17-21. Beside CODE and SVP drifters, undrogued SVP's and co-called iSpheres, and bamboo plates have been used to measure currents at the very surface.
- Page 2 line 22: It is quite possible to measure surface currents using ADCPs, for

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example using Nortek's Signature 1000 ADCP.

- Page 3 line 9-1 and page 15, line 12-15: The authors claim novelty with regard to estimating vertical shear between the 0-5cm and 0-60cm layers. Notice that the difference between undrogued drifters and drifters with drogue at ~1m depth has been quantified in Röhrs, J. & Christensen, K. H. Drift in the uppermost part of the ocean. *Geophys. Res. Lett.* 42, 1–8 (2015), and in Morey, S. L., Wienders, N., Dukhovskoy, D. S. & Bourassa, M. A. Measurement Characteristics of Near-Surface Currents from Ultra-Thin Drifters, Drogued Drifters, and HF Radar. *Remote Sens.-Basel* 10, 1633 (2018).

- page 9, line 1-8 should be re-written

- Possible windage of the used surface drifters should be addressed.

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