Response to Anonymous Referee #1

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 study uses an extensive data set in a dynamic interesting setting, and provides results that can serve as examplary 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.

We would like to thank Referee #1 for his or her constructive feedback on the manuscript

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 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.

We have adapted the figure showing the LAVA estimates (fig. 3 in original version) into 2 new figures (Figs. 6-7) showing the addition of AVISO SST maps plotted beneath the velocity fields. SST maps from AVISO are created every 24-hours centered on the 0th hour of each day. Two SST maps are shown with identical LAVA estimates to show that during and even after the window of analysis under high winds, the structures seen in the velocity fields appear consistent with AVISO observations throughout each high wind event. The SST maps show structures that are qualitatively similar to the velocity fields created with LAVA, even over the 24-hour product created after our analysis period.

Descriptions of these figures (6-7) and their implications can be found on:
Page 10, lines 12-28
Page 12, lines 9-23
Page 16, lines 17-24

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 redundandcies are made, suggesting that the paper could be shortened and sharpened to some extent.

Some of the paper has been reorganized based on the reviewer's suggestions.

The first paragraph of the introduction has been combined with a later paragraph of the introduction in order to reduce redundancy. (Page 3, lines 15-26).

The background information on Page 5 line 5-24, of the previous version of the paper, pertain specifically to the drifters used in this study, therefore the authors feel it appropriate to leave this description under the section titled 2.1 CARTHE drifter.

The authors also feel it appropriate to leave the description on what was formerly Page 13 line 19-31 in the previous version of the paper as is, as it acts a review of the significant body of work available on the topic. This lines act to help the reader remember specific details from the studies, we wish to reiterate in comparison to our results.

In the second to last paragraph no change was made. A brief description of the outcome from the subtraction of the regional circulation estimate, as well as a reference to a previous study, is presented to act as motivation for the method proposed.

Two paragraphs from the discussion section were moved to the results section, as requested by reviewer. They now reside on Pages 13, line 28 – page 14, line 11. As a result of this edit, we also rewrote part of the discussion, seen on page 15, lines 1-6.

Attempts were made to reduce redundancies in the discussion section, with the omission of Page 12, lines 2-6, in the original version.

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.

We have added more on motivation to the abstract.

Page 1. Lines 9-10.

- Page 2 line 17-21. Beside CODE and SVP drifters, undrouged SVP's and co-called iSpheres, and bamboo plates have been used to measure currents at the very surface.

These other types of drifters are mentioned elsewhere in the paper. This point was made to show other studies have missed the vertical shear in the top 1m.

- Page 2 line 22: It is quite possible to measure surface currents using ADCPs, for example using Nortek's Signature 1000 ADCP.

To our knowledge it is very difficult to measure surface currents at shallow depths, less than ~0.5m, in the presence of surface gravity waves due to side lobe contamination caused by the surface wave motion (Cole and Symonds 2015).

Cole, R., & Symonds, D.: A 25 year collaboration using ADCPs. In 2015 IEEE/OES 11th Current, Waves and Turbulence Measurement Workshop, St. Petersburg, FL, USA, March 2015, 1–10, 2015.

- 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. Geophy. 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).

These references have been noted and added to the manuscript and claims of novelty have been revised.

Page 2, lines 24-29

Page 3, lines 3-10 and lines 23-26

Page 15, lines 24-27

Page 16, lines 3-9

Page 17, lines 18-31

Page 18, line 23

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

lines have been rewritten in addition to extra explanation

Page 10, line2 – Page 11, line 6.

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

The exact windage on the drifters, especially for the undrogued drifter in the real ocean in not known to an extent in which we can apply a meaning correction. We have tried to be as transparent and straight forward to the extent to which possible errors pertaining to windage are expected.

Page 17, lines 24-26 and lines 10-13

Page 6, lines 7-10.