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Interactive comment on "A Surface KInematics Buoy (SKIB) for wave-current interactions studies" *by* Pedro Veras Guimarães et al.

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Dear colleagues, we appreciate the effort of the editor and reviewers. The reviewers comments were particularly useful for improving the text and clarify some missing information. You will find attached a detailed point-by-point answer to all the comments and questions. We are looking forward to your opinion on the possible publication in Ocean Science. Although most comments gave rise to corrections, the few on which we did not agree with the reviewers have led to a more detailed rewriting of the corresponding section of the paper, as detailed in the attached rebuttal.

A detail response to the reviewers are described below. The comments from the reviewer are reproduced in bold, and our answer is in normal font.

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Discussion paper

1 Author's response

Overview This paper describes the design of a drifting buoy, to measure directional waves using a low-cost accelerometer to obtain 'heave' spectra and the Global Navigation Satellite Systems (GNSS) signal to obtain the directional components of the wave spectra and the ambient current. The paper describes the design of the SKIB system in some detail, then analyses results from an experiment where several buoys are deployed in the Chenal du Four, with strong tidal currents and current gradients, adjacent to a moored Datawell Directional Waverider buoy. The SKIB buoy performance is validated against a SWIFT buoy and stereo-video as well as the Waverider. Then there is a discussion about the high-frequency interaction of waves and currents. General Remarks There is a lot of interesting information in this paper but there is a need for clarification of its aims. Is it about presenting a new instrument or an application in the Chenal du Four (this seems to be an afterthought), a lot more of the content is about the buoy and other wave measurement systems. The summary and conclusion are very cursory and there are a lot of errors and typos (mainly annotated on the m/s). The paper does not appear to be ideally-suited to publication in Ocean Science, although it falls within the topics described, there are not many papers published on waves and instrumentation. It might be better submitted to Ocean Engineering or to Continental Shelf Research as a follow-up to the Pearman et al. (2014) paper. In order to be accepted it needs major revision. Detailed Corrections

1.In the Introduction, please make clear what the motivation and aims of the study are. It is not clear whether the main aim is to design and test the instrument or gather data on wave-current interaction. The stated intention is 'to capture the response of surface gravity waves to horizontal current gradients, in order to better interpret airborne and satellite imagery of waves and current

features'. After listing previous instrument developments, please clarify why it is necessary to develop another buoy. What is the novelty in the work presented in this paper?

We have clarified that the objective of measuring shorter wave components and wave-current interactions require a relatively small buoy which was not available. We have now written on page 3, line 4: In this context, existing wave buoys are generally too large to properly respond to short gravity waves. We have thus developed a low cost drifting buoy, the "surface kinematics buoy" (SKIB), specially developed for wave-current interaction studies

2. Section 2 presents standard directional analysis of wave spectra from combined vertical plus horizontal motion, using FFT and co- and quad-spectra. There is some confusion about the nomenclature at the bottom of page 3 (lines 23 onwards). What are termed the 'moments of the directional distribution' are usually referred to as the angular harmonics, which can be derived only for the first 4 terms (Longuet-Higgins et al., 1963). This section needs correction. A good reference is the COST 714 book (2005) which shows the various ways of deriving a directional distribution and the limitations due to observation systems. It is usual to separate the 2D frequency-direction spectrum into two parts multiplied together: a frequency distribution and a directional distribution (frequency-dependent) based on some simple pattern such as cos2s. However none of this is new.

We beg to disagree. Because buoys do not measure the directional spectrum but only "moments", we prefer to only work with measured parameters, or parameters that are derived by simple manipulations of the moments, e.g. the mean direction and spread. This is most useful for validation (e.g. O'Reilly et al. 1996). We have thus added, The spectra and co-spectra of these time series can provide the first five Fourier coefficients of the angular distribution, also known as angular moments, a0(fr), a1(fr), b1(fr), a2(fr) and b2(fr)...

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Check also lines 13-18 on p 10. 3. In section 3.2 there are a lot of acronyms for the electronic components which should be defined or identified as trade names.

We have simplified the buoy electronics description by removing unnecessary description of standard electronics equipment (e.g. Zigbee), and giving the full name of parts that were only refered to by their acronyms. For example, Micro Secure Digital High Capacity (SDHC) memory card

4. In section 3.2 can the authors clarify the cost of the basic SKIB-STM system.

We have added the following in section 3.2, Standard prices for all the parts in the year 2015 was about 1100 euros for all electronics, half of which is for the Iridium and GPS equipment, and another 1100 euros for the hull and mounts inside of the hull. That expensive choice of the hull was, in our case, justified by a possible re-use for other oceanographic applications.

Is this system accurate enough - later it is clear that SKIB-SBG is better There is of course always a trade-off between cost and accuracy. The accuracy limit is mostly due to the relative high noise floor of the STM accelerometer chosen. Indeed the SBG sensor is necessary for measuring small amplitude long waves, but in the case of the short waves that we focus on, the STM is good enough. This was clarified in the text and we add more information about it in the conclusions.

(NB please standardise how this is referred to – SKIB IMU is also used).

We verified and standardised the use of SKIB-STM and SKIB-SBG.

5. In section 3.3 the upper limit of the useful frequency range is 0.8Hz, this is not really extending the frequency range to high frequency as claimed but rather similar, especially since the frequency range for directional parameters is limited to 0.5Hz. As clarified in section 3.3 and in the conclusion, this statement on the limitations in only for the directions due to our choice of GPS antenna and processing.

The heave spectrum is still valid up to 1 Hz. This may seem like a modest increase from the 0.6 Hz of Datawell Waveriders, but this is still a factor 2.8 in wavelengths.

6. Section 4 describes the results from a short deployment in October 2015. Figs 4 and 5 refer to September 2016 and should appear in section 3. 7. The figure had been misplaced. This is now corrected.

Section 5 'Summary and conclusions' is far too short and superficial. We have now expanded section 5, in particular adding some comments on the costs and the performance of the two SKIB models, as well as a reference to the recent paper by Sutherland and Dumont (2018), who used a SKIB-SBG.

8. Standardise the way of referring to the Datawell Directional Waverider – it is variously referred to as Datawell, Waverider etc. This has been corrected to "Datawell", which implicitly refers to the Mark III Directional Waverider model from Datawell.

9. In Figure 7 the colours would be more usefully applied to identify different buoys – this would require changing Fig 6 also. We have kept the colors to better identify that it does not matter which buoy measures what, but rather, in which region is the buoy, so that we can reduce the variability of the random wave measurement by averaging the different buoys together. This averaging allows us to use shorter time records and thus observe strong gradients that would otherwise be lost if we computed average spectra over 30 minutes .

1.1 Author's changes in manuscript

A detailed version of the modifications in the manuscript are add in a separate PDF version of the manuscript where modification from the previous version are highlighted in the text.

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2018-45/os-2018-45-AC1-supplement.pdf

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