Applications of the Offshore Sensing SailBuoy in Coastal and Offshore Regions

In situ measurements of wind, waves and currents

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Introduction and Objectives

The Offshore Sensing SailBuoy (*www.sailbuoy.no* - SB) is a robust and well proven platform for a wide range of offshore applications, including echo sounding for fish stock assessment and MetOcean observations (Figs. 1 and 2). The SB typically has a cruising speed of 1-2 knots or it can heave to and serve at a stationary observation platform. It was the first autonomous vessel to cross the Atlantic Ocean in 2018, and being equipped with solar panels, it can have a mission length of 6 months and more. Here we present a few examples of the MetOcean applications (1; 2; 3).

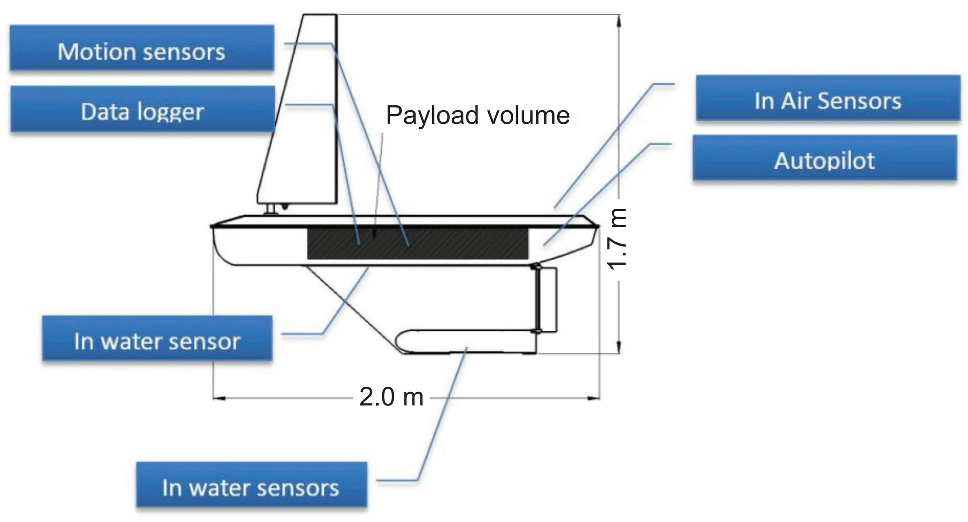

Figure 1: Sketch of the offshore sensing SailBuoy.

Figure 2: The offshore sensing SailBuoy.

Directional wave measurements

A Datawell MOSE G1000 GPS-based 2 Hz wave sensor was mounted on the SB (1). Mean significant wave height (H_s 1 min) measured was 3m, whereas maximum H_s was 6m. Mean wave period was 7.7s, while maximum wave height, H max, was 12.6m. These measurements have been compared with non-directional Waverider observations at the Ekofisk complex. The agreement between the two data sets was very good, with a mean percent absolute error of 7 % and a linear correlation coefficient of 0.97 (Figs. 3, 4).

Current Measurements using Acoustic Doppler Current Profiler (ACDP)

The SB was equipped with an integrated downward-looking Acoustic Doppler Profiler (ADCP) (2). Data, collected on two validation campaigns inshore and offshore, showed a satisfactory correlation between the SailBuoy current records and traditional observation techniques such as bottom mounted and moored current profilers and moored single-point current meter (Fig. 5,6).

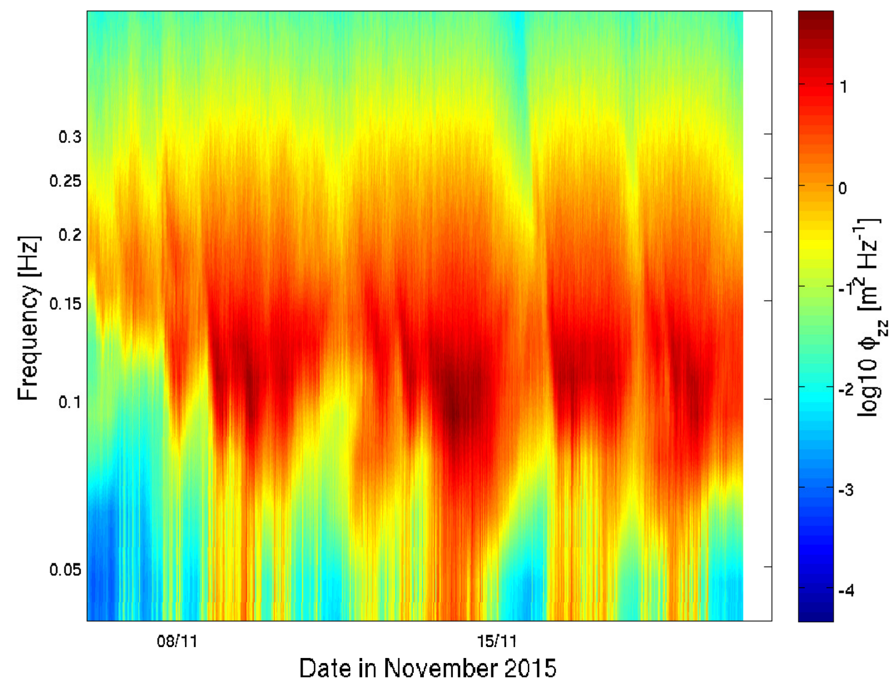

Figure 3: Spectrogram (power spectral density obtained from SB Wave(1). The colour scale is logarithmic.

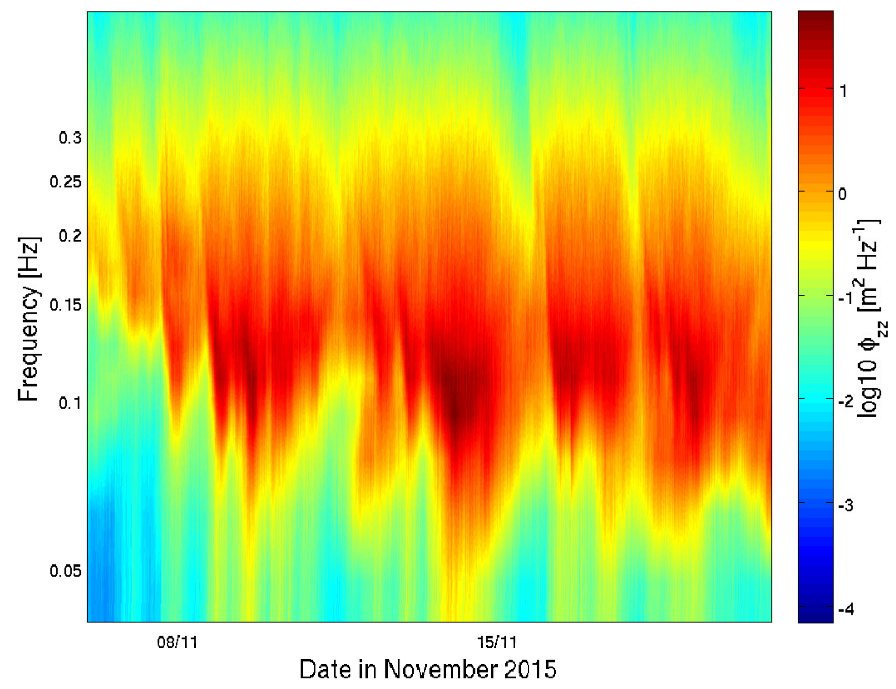

Figure 4: Spectrogram (power spectral density obtained from Waverider (1). The colour scale is logarithmic.

While the highest correlations were found in tidal signals, strong current, and calm weather conditions, low current speeds and varying high wave and wind conditions reduced correlation considerably. Filtering out some events with high sea surface roughness associated with high wind and wave conditions may increase the SailBuoy ADCP listening quality and lead to better correlations.

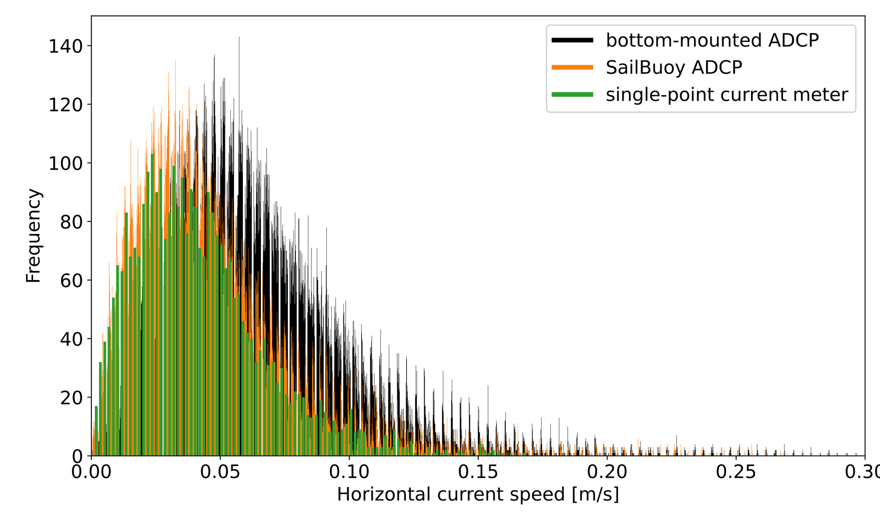

Figure 5: Histogram of the current speed data measured by the SailBuoy and bottom-mounted ADCPs and single-point current meter in Fusafjorden (inshore)(2).

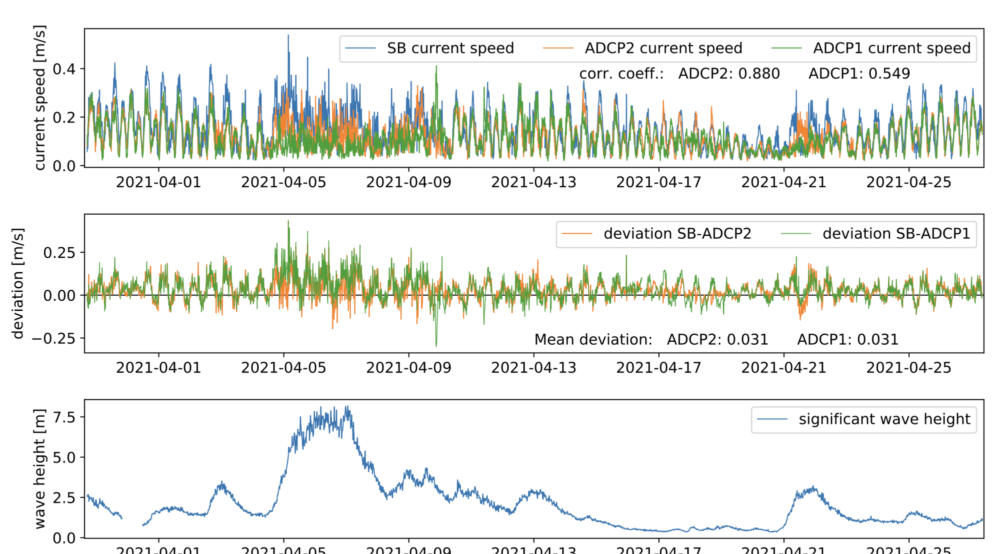

Figure 6: Depth-averaged current speed measured by the freely maneuvering SailBuoy ADCP and two moored reference ADCPs during an offshore test campaign. Deviation between the current speed measurements are shown in panel two. Panel three shows significant wave height data from a near-by weather station that affects the Sailbuoy's measurement capabilities (2).

Wind measurements

The SB is suitable for measurements of wind near the ocean surface. In a free-floating oil spill experiment (with two oil types) wind measurements from the SB at about 1m above the sea surface were used as input to the OpenDrift/OpenOil model for simulations of the oil spill drift (3). It was shown that inclusion of *in situ* wind forcing clearly improved the simulations compared to simulated wind input.

Future Outlook

The high modularity of the SB allows for the placement of different sensors on the platform. Interesting now for future MetOcean measurement campaigns and possible usage of the data for model validation is the combination of different sensors within one SB. By including all three sensors presented here on the same vessel, the datasets could be used individually but also supplementing each other, e.g. for data quality screening of the SB current data itself which is influenced by wind speed and wave height. The advantages of having these complementary data and disadvantages of shorter battery period must of course be balanced, well planned and calculated before each deployment. With sensors expected to become lighter and less power demanding over time, however, the fitting of multiple sensors onto the vessel becomes more realistic.

References

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[3] C. Brekke, M. M. Espeseth, K.-F. Dagestad, J. Röhrs, L. R. Hole, and A. Reigber, "Integrated analysis of multisensor datasets and oil drift simulations—a free-floating oil experiment in the open ocean," *Journal of Geophysical Research: Oceans*, vol. 126, no. 1, p. e2020JC016499, 2021.

Acknowledgements

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More info:

https://www.sailbuoy.no