# Near Surface Turbulence and Gravity Wave Measurements Using a Lagrangian Drifter

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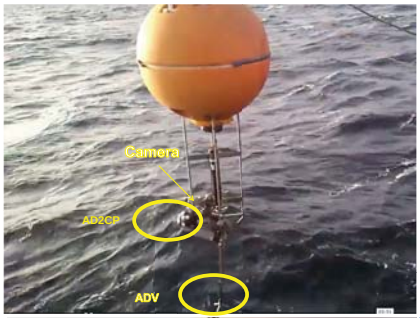
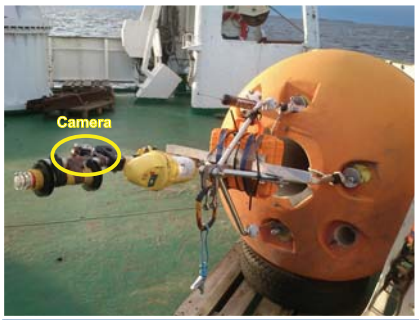
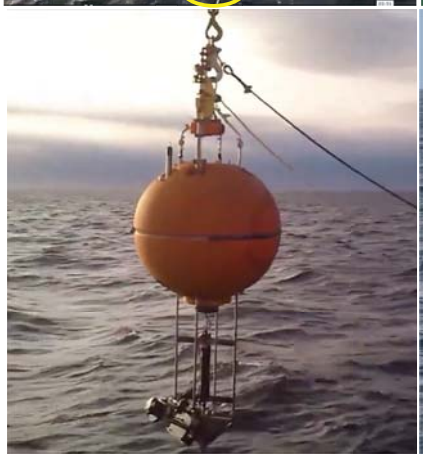
## Introduction

In this study, we primarily demonestrate high-resolution measurements of upper ocean flow using a new designed Lagrangian platform equipped with appropriate oceanographic sensors. Spherical drifter as a wave-following floating structure is able to mitigate the contaminations induced by wave orbital velocities and the problems associated with velocity ambiguities. The platform, with primary dimensions of 1.13 m diameter and 2.30 m overall length, was modified to include an Acoustic Doppler Velocitimeter (ADV) to measure time series of velocity fluctuations, a GPS logger, two GoPro video cameras to estimate both platform orientation and breaking wave crest length, and a 5-beam Nortek's Acoustic Doppler Current Profiler (Signature 1000) with its heading pointing 45º from the vehichle's horizontal plane. This platform was deployed for few hours during a 2-day cruise in November 2014, Karmøy, Norway. It should be noted that this measuring system, with its flexibility to be specialized for various air-sea interaction missions, provides very high quality data of breaking waves and their interactions with upper ocean, and wave-affected marine atmospheric boundary layer.

## Lagrangian air-sea interaction platform



- **AD2CP (Signature 1000):**

Nortek's Signature1000 is a five-beam scientific powerhouse which provides an ideal platform for measurements of standard current profile as well as turbulence.

- **Nortek Acoustic Doppler Velocitimeter (ADV):**

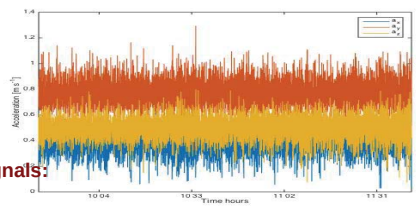
a three-component Nortek's vector Acoustic Doppler Velocitimeter (ADV) is used for point-wise measurement of high-resolution three-dimensional velocity fluctuations at a fixed level. This moored ADV has been equipped with an Inertial Motion Unit (IMU) that records the ADV orientation and 9 degree of freedom motions.

- **GoPro video camera:**

GoPro HD Hero3 Black camera is a small rugged action camera which ables to shoot 4K video.

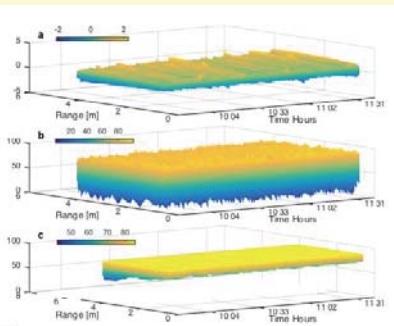
## Preliminary Results

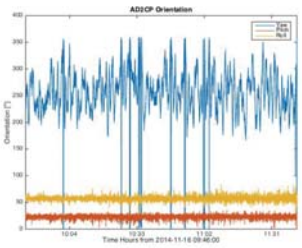
Tilted looking S1000 (Signature 1000 kHz Doppler current profiler, 5 beams with AD2CP technology, Nortek AS) and 1 Nortek vector ADV. The sampling frequency of the AD2CP was 4 Hz and the sampling frequency of the ADV was 8 Hz at a duty cycle of 15 min on, and 1 min off.




Time series of AD2CP accelerometer signals.

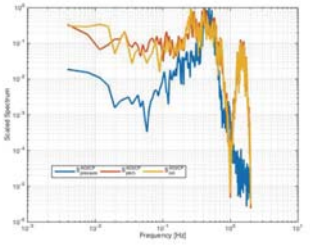
AD2CP: This figure shows the raw data of AD2CP vertical beam velocity (a); correlation (b); and amplitude (c) for upper 4 m. We use this information together with pressure data to detect sea surface.

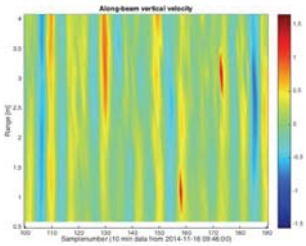



AD2CP has been equipped with motion sensors which provide platform orientations and 9 DOF motion information.

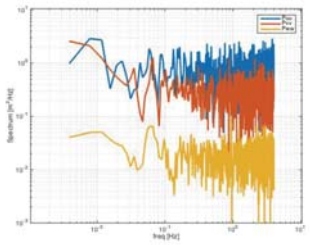
AD2CP: Ten minutes burst data, started from 2014-11-16 09:46: pressure, pitch, and roll. Three signals indicate strong energy elevations in wave frequency band.

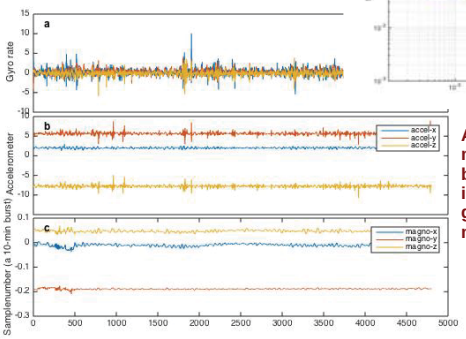




AD2CP: vertical beam velocity for a 10 minutes burst.

ADV: three dimensional water velocity measured from the downlooking ADV.






ADV: orientations and motions of ADV measured by inertial sensors including accelerometer, gyroscope, and magnometer.

Air-side camera

Water-side camera

## Summary

In this study, we primarily presented the data collected from a new designed Lagrangian air-sea interaction platform. This drifter operates as a wave-following platform which is able to measure the upper ocean turbulent fluxes and sea surface gravity waves using both acoustic and vision based techniques.

## Acknowledgement

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