Marinetech December 2019

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Product Manager-Jarle Heltne

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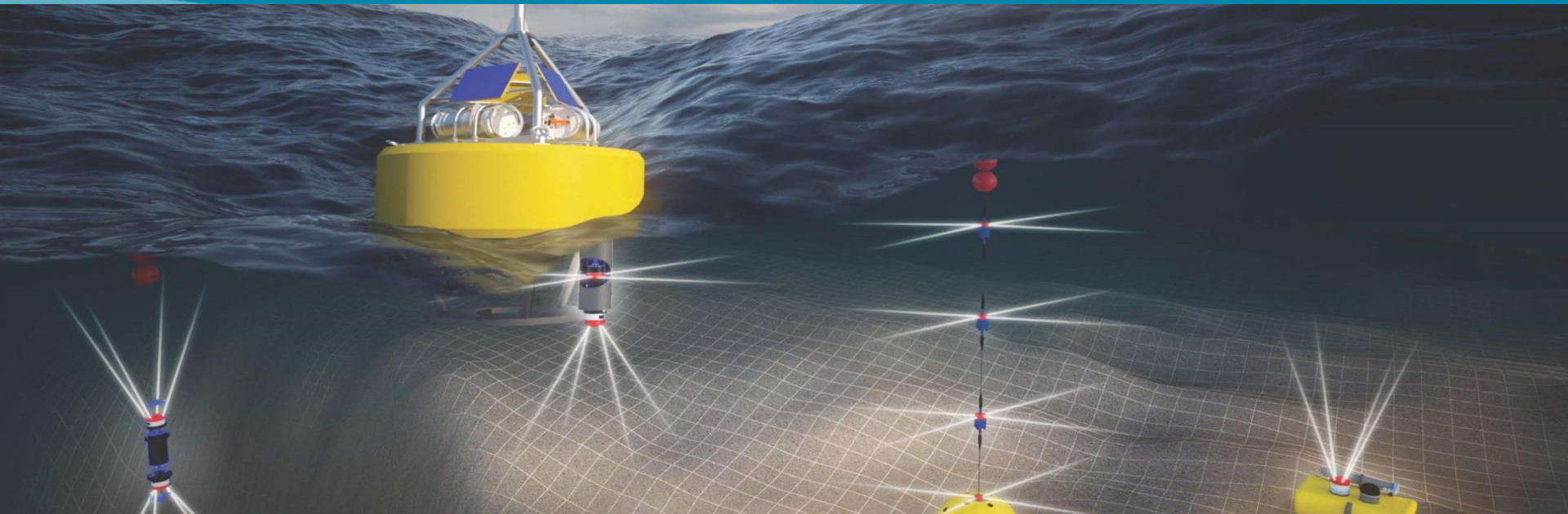
Current and waves from a Buoy



Aanderaa integrated solutions

Aanderaa can provide a Complete End to End Solution.

Aanderaa competence areas are:

- Sensors
- Loggers
- Platforms
- Data communication
- Software solutions

Takes the worry out of managing outdoor water data collection with all products from one vendor!

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Aanderaa Ocean & Coastal Products

Smart Sensors

SmartGuard Datalogger

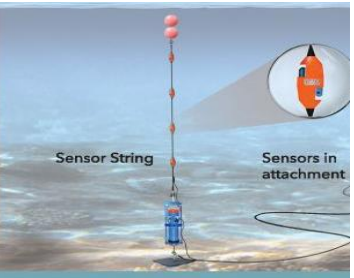
Motus Wave

SeaGuardII DCP

SeaGuard RCM *multiparameter*

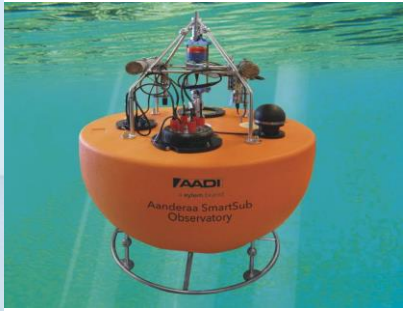
RCM Blue

Strings and cables



Real time and data display

Platforms



Different options for current measurements instruments

Name	In-line DCS	DCPS	SeaGuard RCM	SeaGuardII DCP
Profiling		X		X
Single Point	X	X	X	
Real Time	X	X	X	X
Internal Storage			X	X
Multi-parameter	X		X	X
Broadband		X		X
Depth rated	IW(4500)	SW / IW / DW	SW / IW / DW	SW / IW / DW

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Different options for wave measurements

Name	Wave and Tide Sensor	SeaGuard DCP Wave	MOTUS
Measurement Principe	Pressure based	Acoustic based	Motion based
Directional wave		X	X
Submerged	X	X	
Broadband		X	X
Narrowband		X	X
Depth rated	SW / IW / DW	SW / IW / DW	SW (30m)

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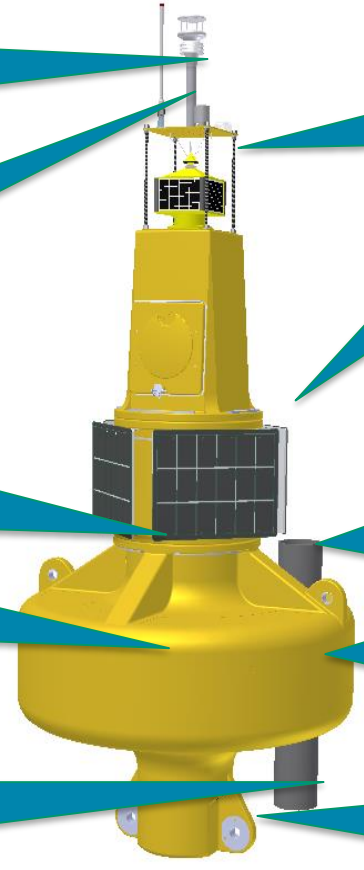
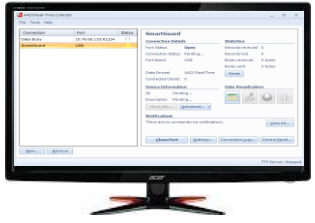
MOTUS WAVE BUOY – complete end to end solution



- Meteorology
- Real Time Communications
- Wave Measurement Sensor
- Data Management
- Current Measurement Sensor
- Aids to Navigation
- Long Term Power Solutions
- Customizable Water Quality Sensor Payload
- Internationally Proven Buoy
- Sensor string



- Control & Display solutions

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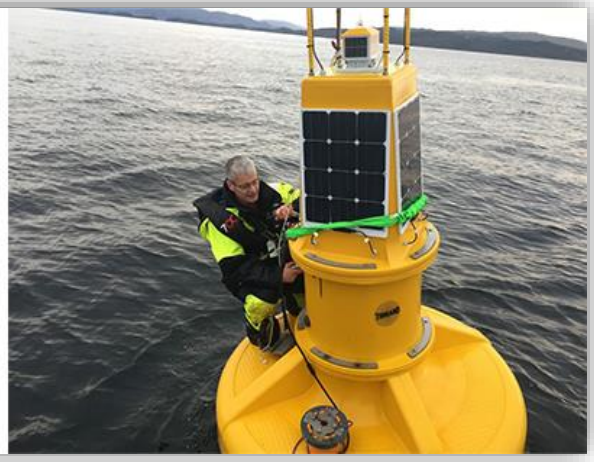
Current Profile from a Buoy

Comparison test



Buoy #1 – YSI

Type EMM2.0 Coastal

- MOTUS Wave sensor #2
- MOTUS Wave sensor #18
- DCS In-line
- DCPS 600
- Gill GMX500-5 Weather station
- GPS Orientation sensor

Buoy #2 – Tideland

Type SB-138P Sentinel®

- MOTUS Wave sensor #17
- DCS In-line
- Airmar Weather Station
- Airmar H2183 Magnetic compass

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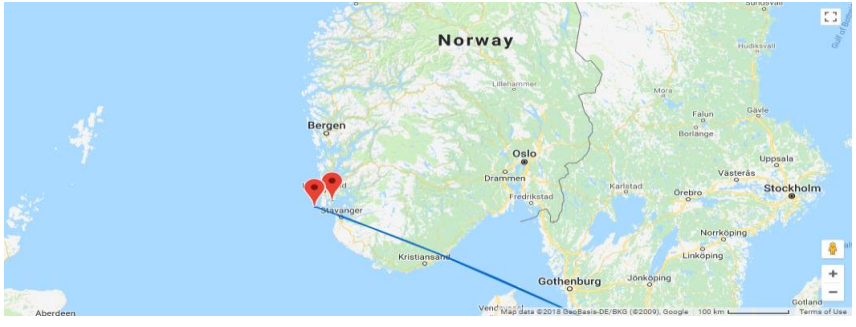
Position of Buoys

Position of Buoys:

Outside Karmøy in south-vest Norway.

Three buoys in a Cluster

- YSI - EMM2.0 Coastal
- Tideland - Type SB-138P Sentinel®
- Waverider



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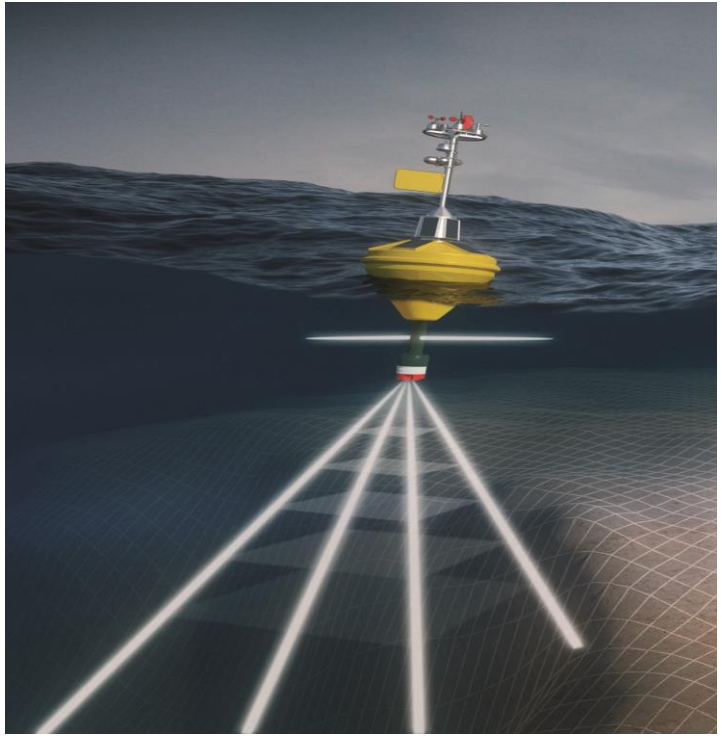
DCPS and DCS Installation



- The single-point DCS is located about 0.7m below the surface and looks horizontally.
- The profiler DCPS is located about 1.0m below the surface and looks downwards with 4 beams at an angle of 25^{o} from instrument centerline.
  - The first cell location is at 4m below surface (center of cell).
  - DCPS cell distance is 2m.

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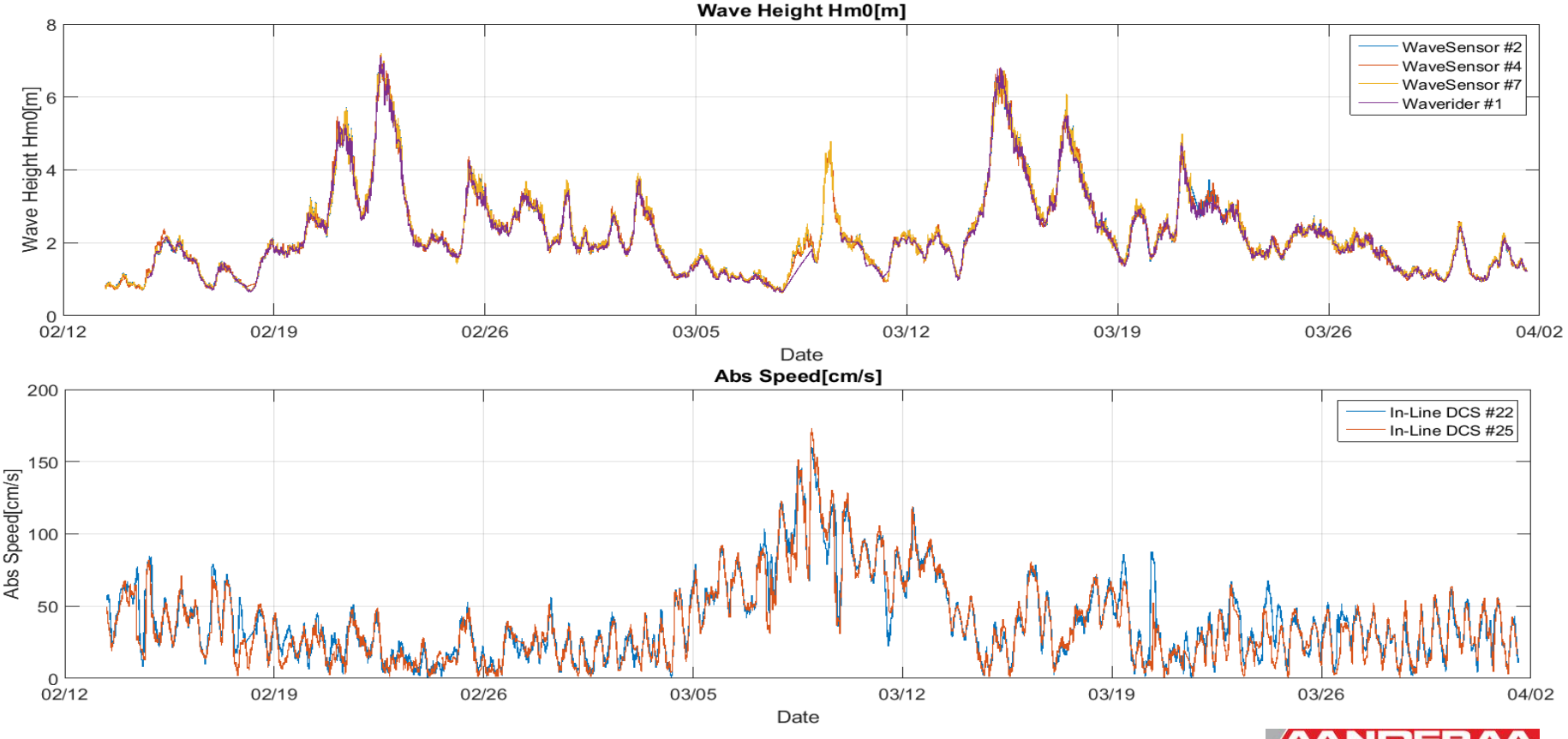
Withstand hard conditions, high current conditions



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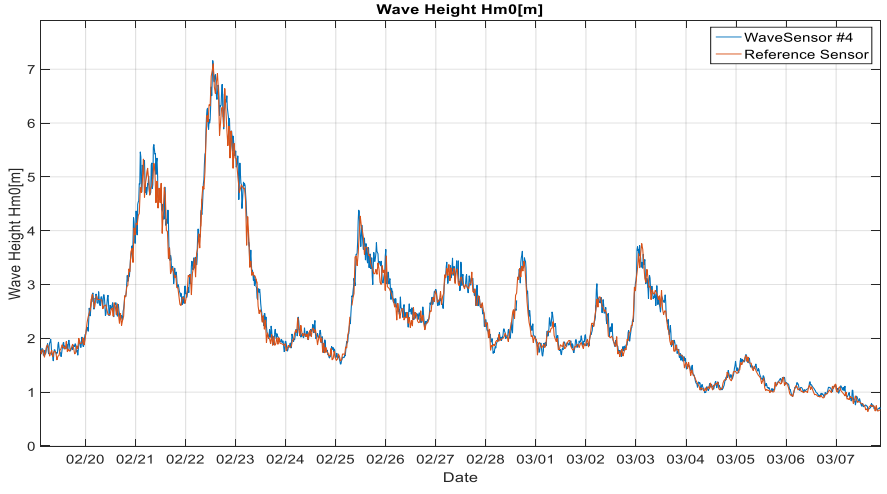
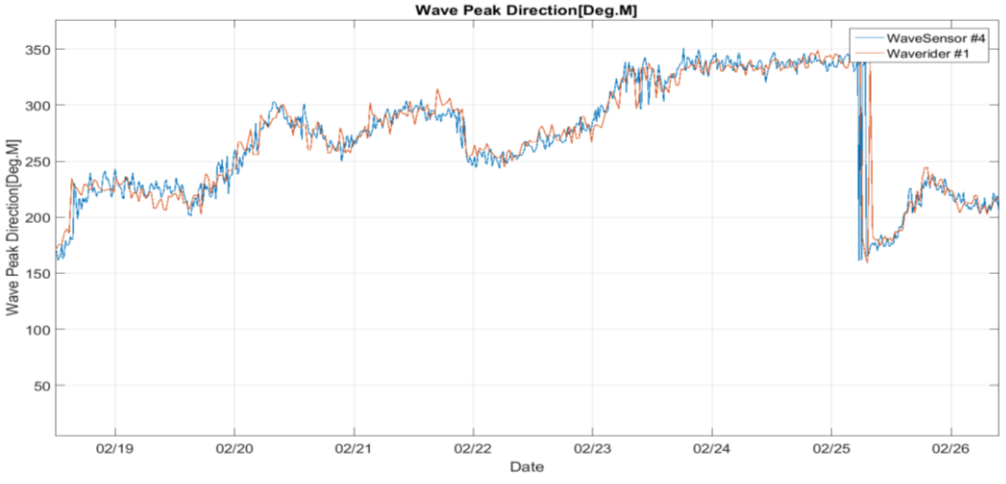
Sea Comparison Results





- Comparison of Significant wave height for Datawell and Tideland/EMM2.0 shows excellent agreement.
- Comparison of Wave Peak Direction for Datawell and Tideland/EMM2.0 shows excellent agreement.

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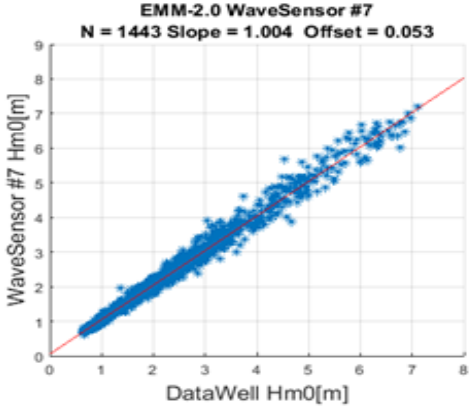
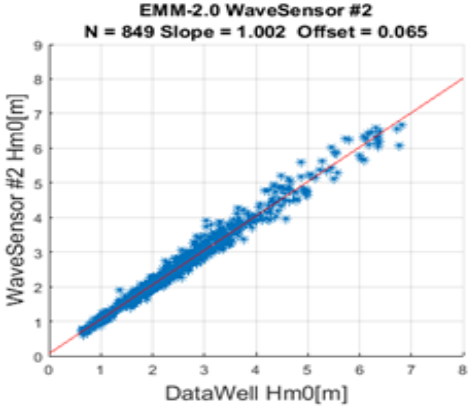
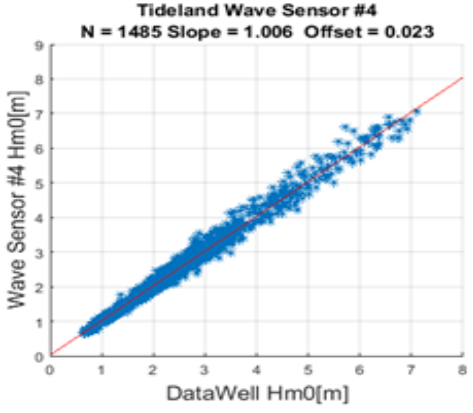
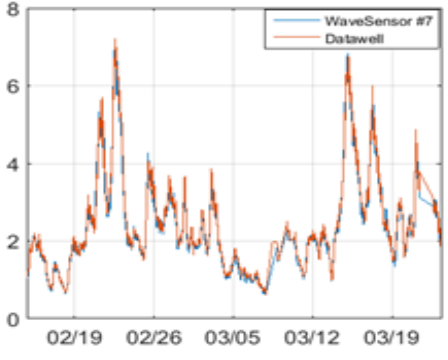
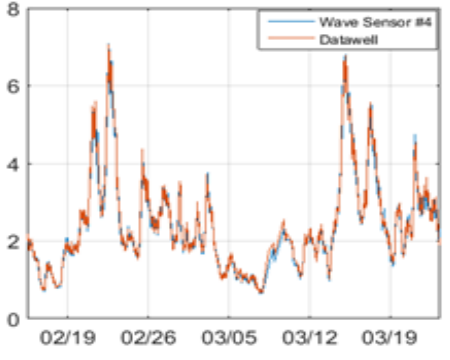
Comparison MOTUS vs. Waverider





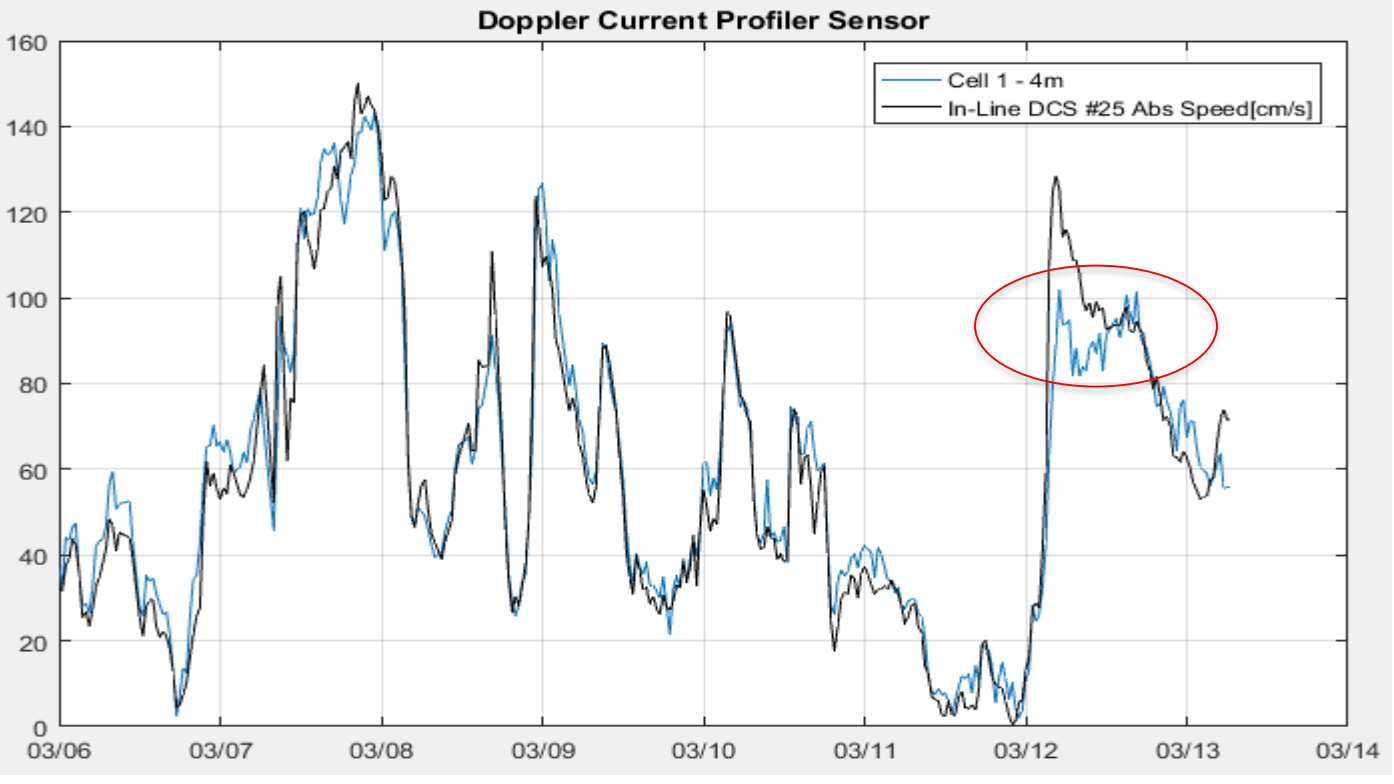






Comparing DCPS to DCS

Cell 1 – 4m, DCS – 0.7m



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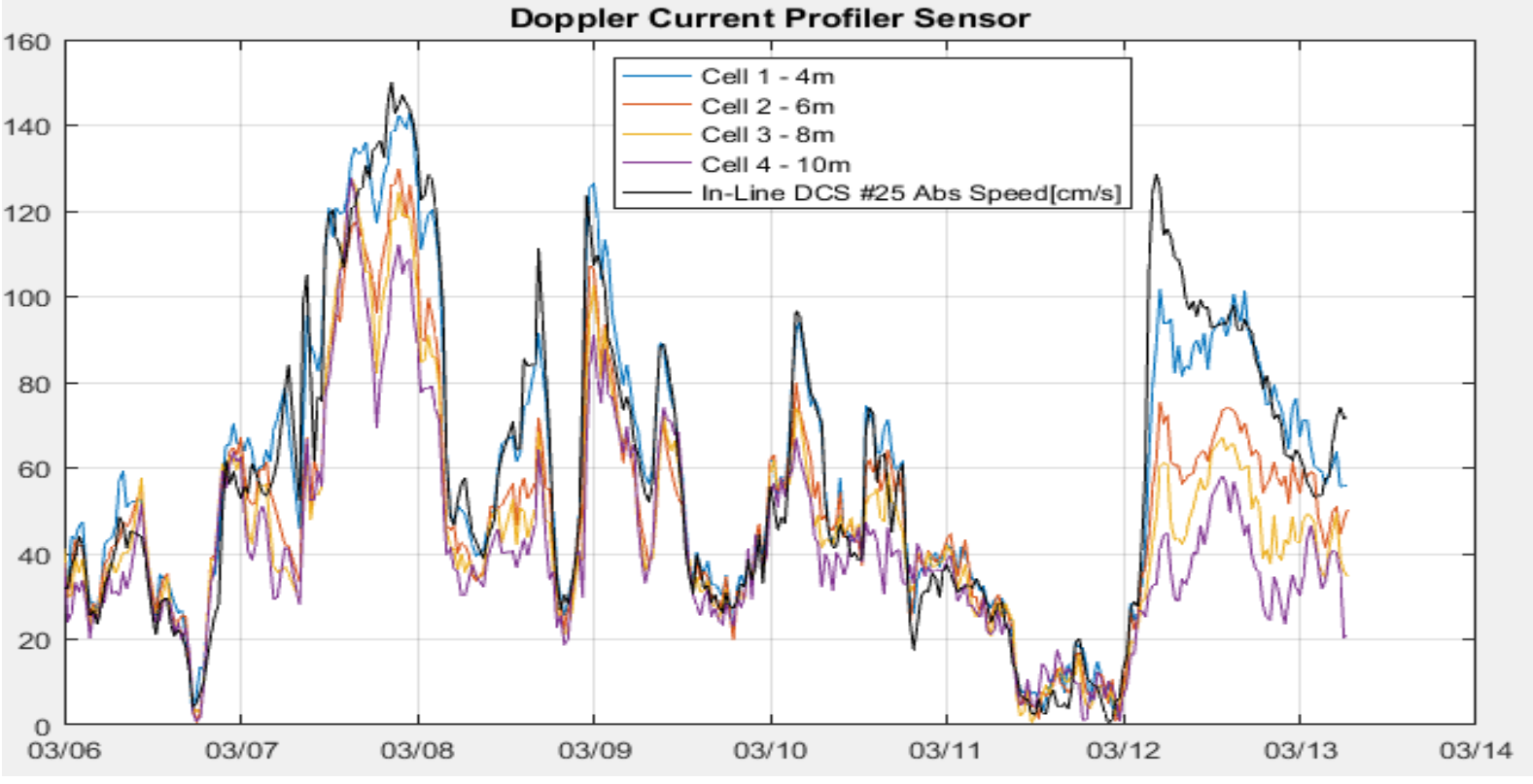
Comparing DCPS to DCS

Adding Cell 2, 3 and 4



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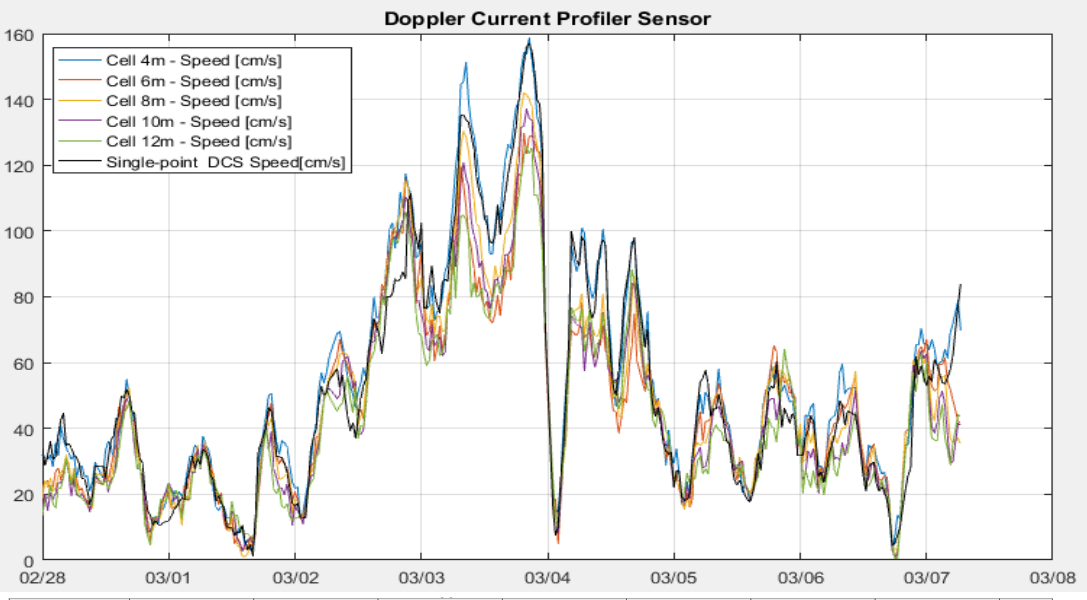
Currents in the profiles data

Comparison DCPS, Cell 1 to 5 - DCS



- DCS located about 0.7m below surface.
- DCPS cell 1 located about 4m below surface.
- DCPS cell distance is 2m.

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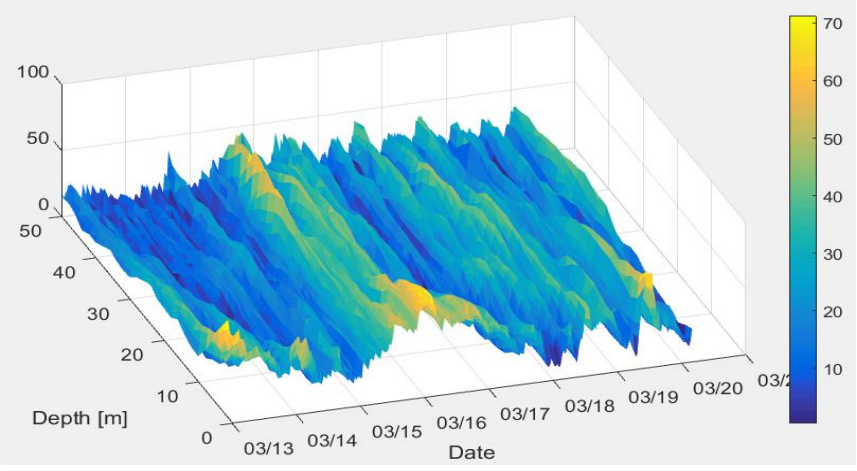
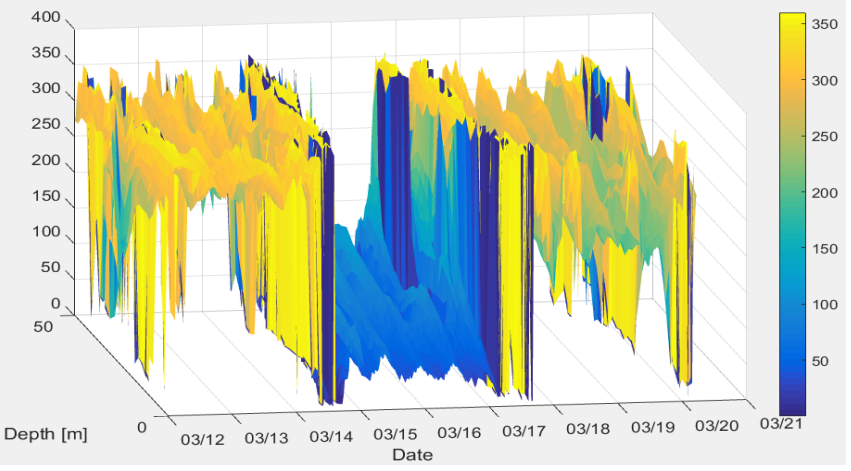
Current Flow vs Storm Surge

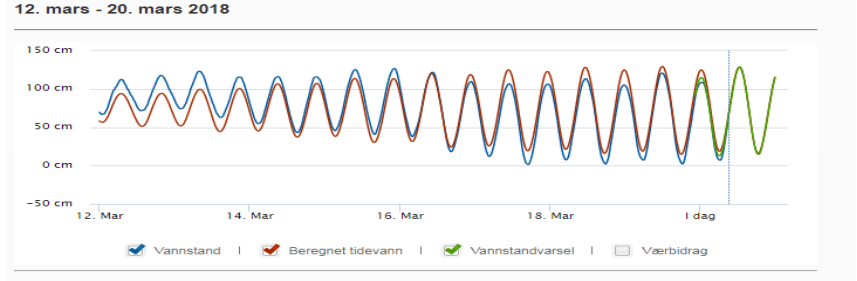
Inflow and outflow

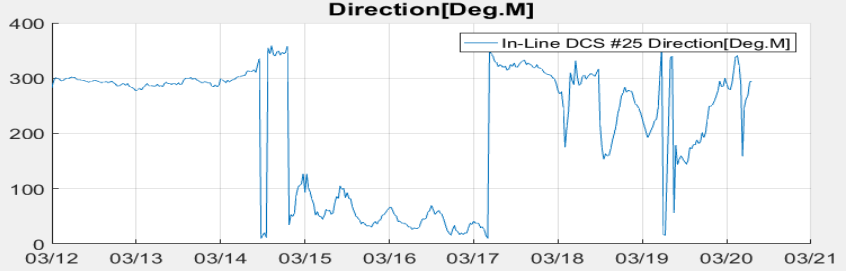
Current Speed

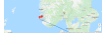


Current Direction









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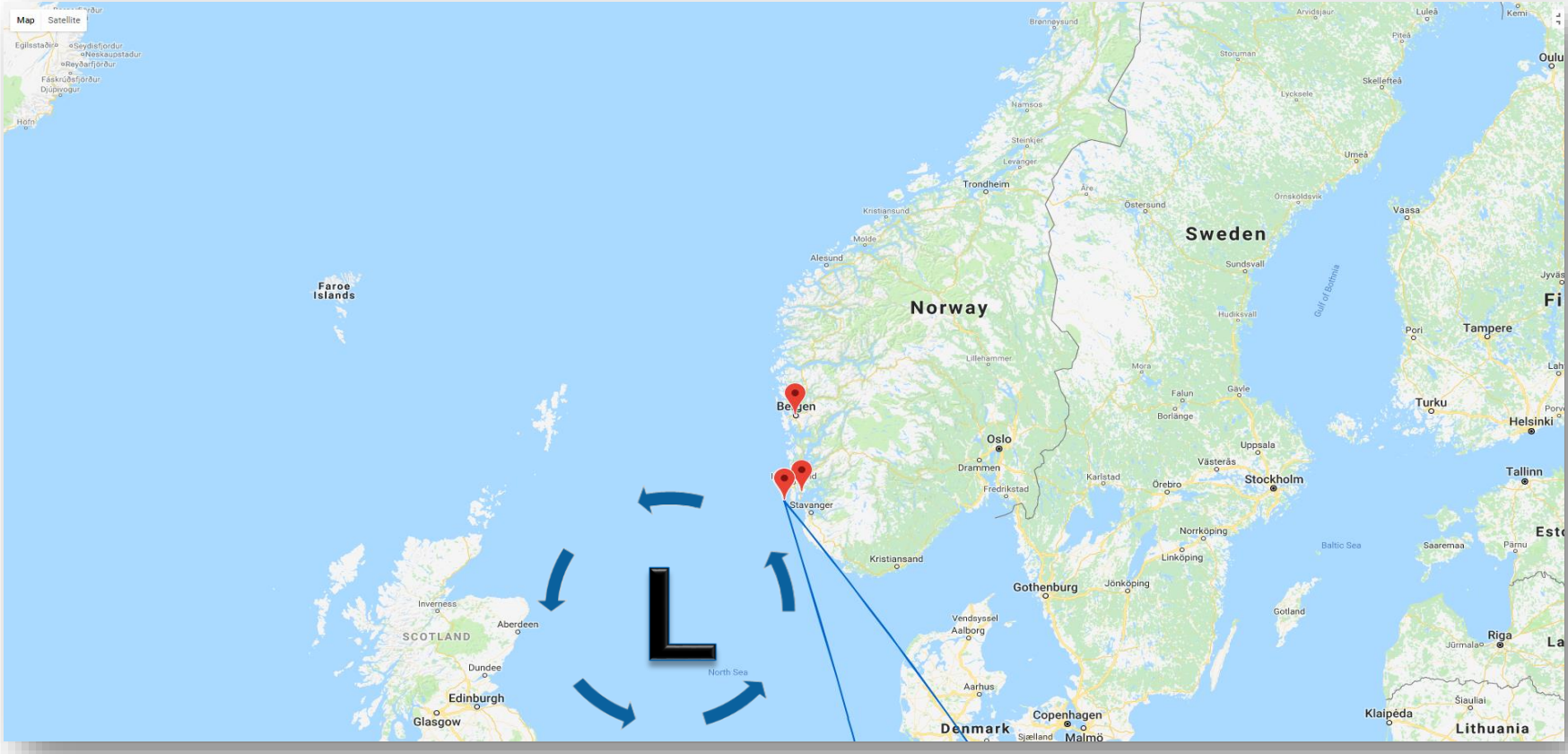
Position of Buoys

Outside Karmøy in south-vest Norway



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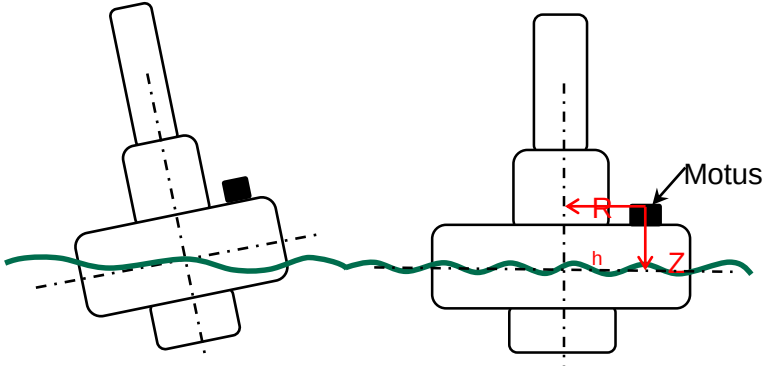
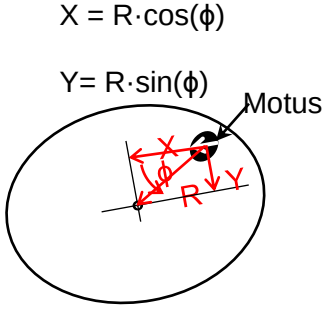
Off-Center Compensation

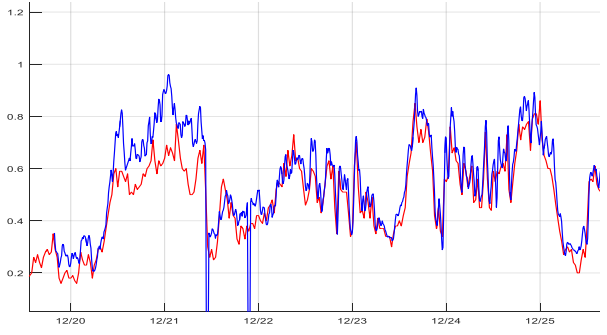
Sea trials in Norwegian fiords indicate that the error introduced when not compensating for this effect can be in the order of 10 -15 % (50cm installation offset) depending on the sea state and spectral distribution of the waves.



Side view



Top view



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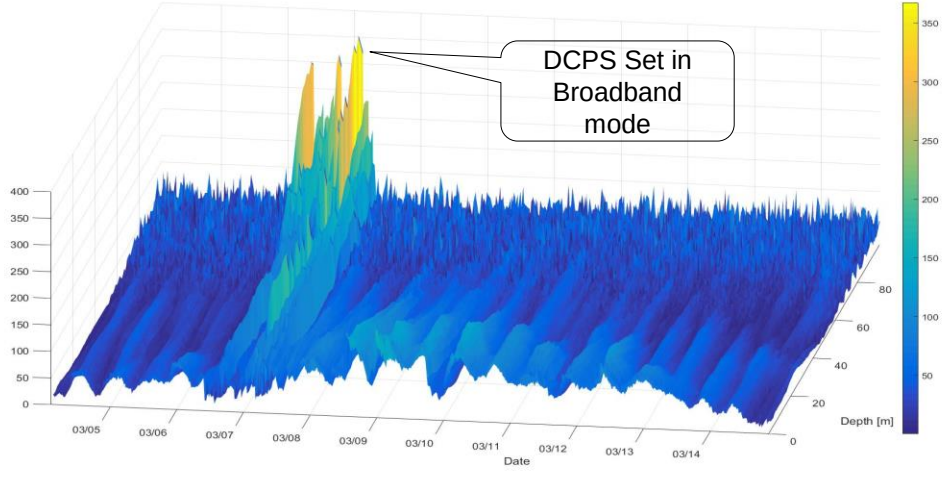
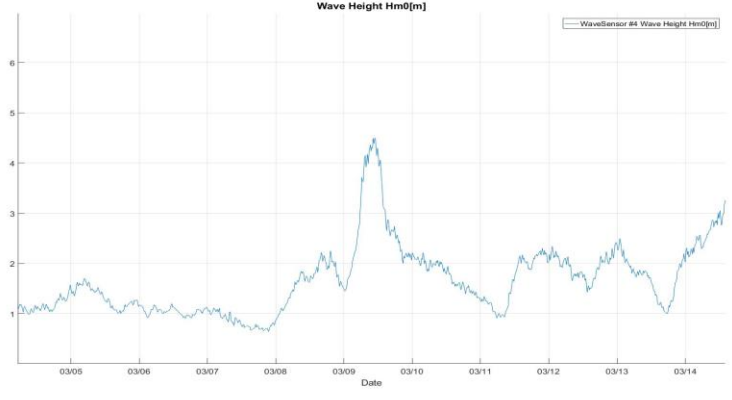
Narrowband and Broadband Mode

(On the same graph)





- The period where the DCPS was run in broadband mode shows corrupt data.
- The measurement problem in broadband is due to platform (buoy) movement in the time slot between the first and second pulse component of the ping.
- In narrowband there is only one pulse. That makes it more suitable for less stable platforms.
- Averaging of pings in narrowband mode attenuates platform velocity components present in each single ping.
- In narrowband, the averaging was based on 300 pings.

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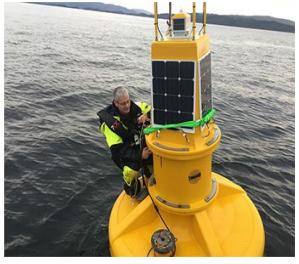
Current Profile from a Buoy

Summary



- Buoy solutions are usually less expensive than bottom based moorings and may provide prolonged real-time data access via modern satellite based communications.
- The DCPS yields valuable current profile data when used on a buoy, even when the sea is rough. DCS adds current measurement of toplayer

- DCPS must be set in Narrowband mode. Use “Spread” average mode and sufficient number of pings (>= 300).
- The DCPS data has higher variance than the DCS, but the variance is not that noticeable in the data. They are still very useful.
- If magnetic fields occur in the near sensors use an external compass suitable for buoy mounting
- Off-center compensation important for optimal accuracy

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Thanks