

► Strømmålinger Arendal innseiling

Sammendrag/konklusjon

Norconsult har blitt engasjert av Kystverket for å utføre strømmålinger i Galtesund og i Tromøysund ifb. planlagte utdyping- og dumpingstiltakene.

Strømforholdene i sundene ble undersøkt sommeren 2021. Måleperioden i Galtesund var fra juni til august og i Tromøysund fra august til september. Hydrografiske målinger av vannmassene ble gjennomført ved utsetting og innhenting av strømmålerne. Resultatene er presentert i denne datarapporten. Vurderinger av hvordan de planlagte tiltakene vil kunne endre lokale strømforholdene er presentert i egen rapport.

Hovedresultater fra undersøkelser viser at ved overflaten i Galtesund går hovedstrømmen (brakkvann) ut av sundet, dvs. mot sør-sørøst. Målingene tyder på at ved rundt 10 m vanndyp snur strømmen og saltvann transporteres inn i sundet. I dypere lag, ved 55 m vanndyp viste resultatene svak strøm i nordlig retning.

I Tromøysundet viser resultatene større variasjon i de øverste 10 m. Målingene ved grunnen viste at hovedstrømretning gikk mot sør-sørvest ved 6 m vanndyp, mens mellom 7 og 12 m vanndyp ble det målt tydelig nord-nordvestlig strømretning. I dumpeområdet ble det observert tydelig strøm inn i sundet, dvs. mot sør-sørvest ved 10 m vanndyp. Strømmen snur i dypere vannlag og ved 25 m vanndyp ble det registrert tydelig utgående strømretning, dvs. mot nordøst. I de dypeste vannlagene ble det ikke observert en ensrettet strømretning.

J03	2022-01-07	For bruk	Karram	Aninyb	Aninyb
D02	2021-11-05	For godkjenning hos oppdragsgiver	karram	aninyb	aninyb
Versjon	Dato	Beskrivelse	Utarbeidet	Fagkontrollert	Godkjent

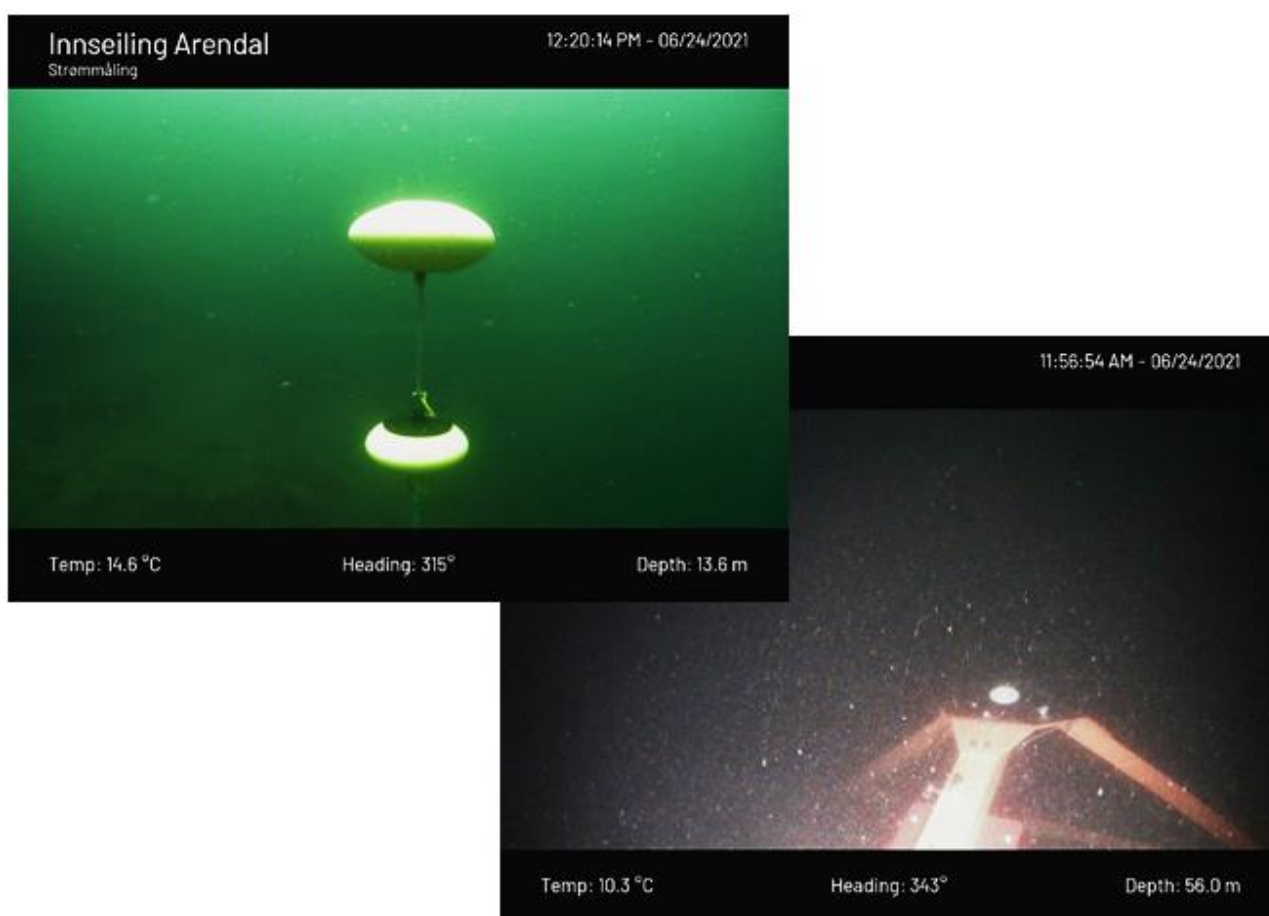
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1 Innledning

Norconsult AS har foretatt strømmålinger i hovedleden gjennom Galtesund fra sør og gjennom Tromøysund fra øst i forbindelse med Kystverkets prosjektet med utdypingen av innseiling til Arendal. Strømmålinger ble foretatt på fire stasjoner. Denne rapporten beskriver metode og resultater fra strømmålingene.

1.1 Utsett og opphenting av strømmålere

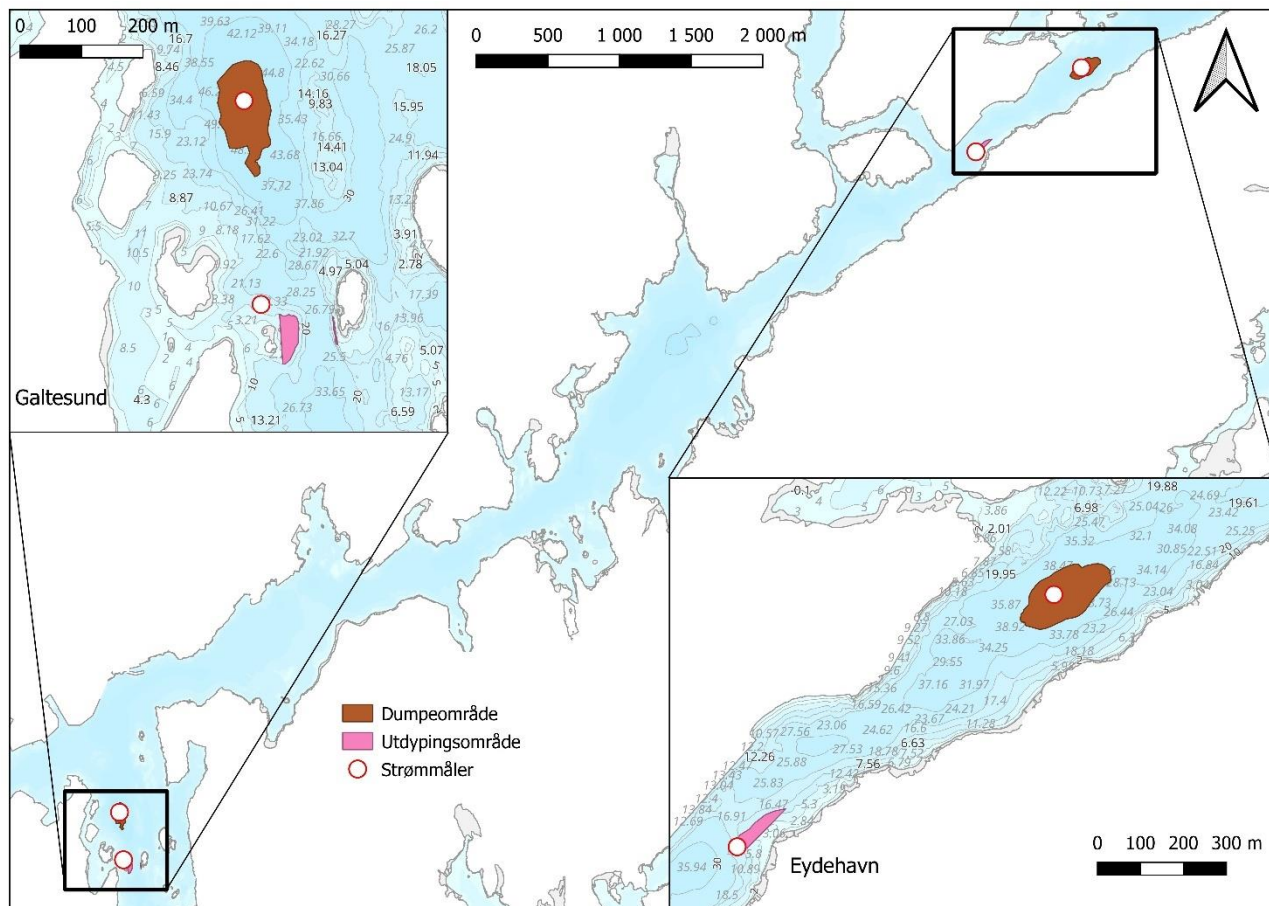
Strømmålerne (Signature500 og Eco, begge produsert av Nortek, se Figur 1) ble satt ut og innhentet av personell fra Norconsult AS.



Figur 1: Strømmåler Eco fra Nortek til venstre og strømmåler Signature500 fra Nortek til høyre. Bildene er tatt av Norconsult ved utsetting av strømmålere i Galtesund.

1.2 Plassering og dybde

Fire strømmålere ble plassert i hovedleden gjennom Galtesund fra sør og gjennom Tromøysund fra øst. Se Figur 2 for plassering av strømmålere og Tabell 1 for oversikt over info om målingene.



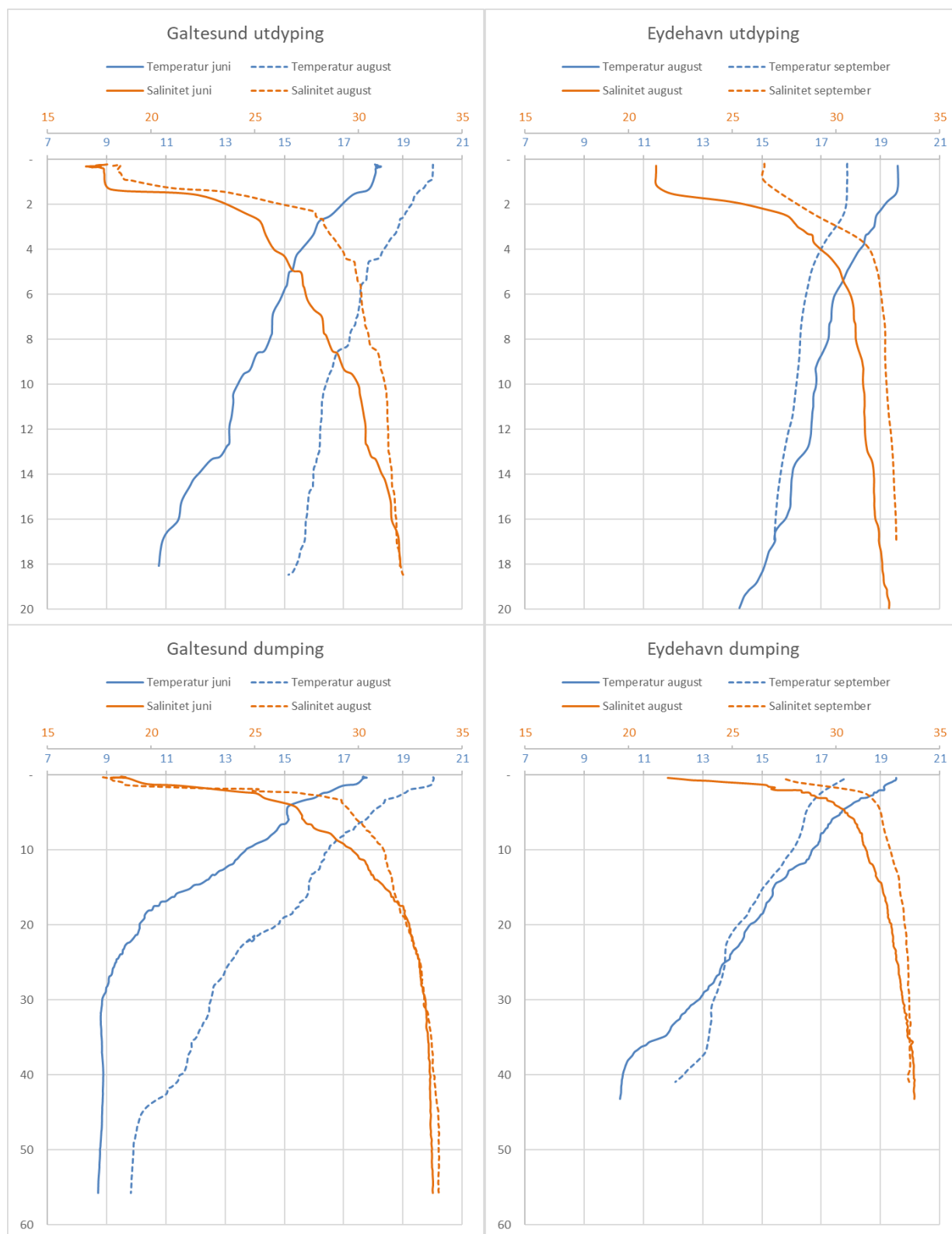
Figur 2: Kart viser plassering av strømmålere.

Tabell 1: Posisjon, totalt dyp, måleperiode og -intervall for strømmålingene foretatt.

Stasjon	Dybde (sjøkartnull)	Posisjon (WGS84)		Måleperiode	Måleintervall
		Øst	Nord		
Galtesund utdyping (GU)	13,5 m	8°46,683	58°27,031	24.06.2021-11.08.2021	10 minutter
Galtesund dumping (GD)	57,4 m	8°46,653	58°27,210	24.06.2021-11.08.2021	10 minutter
Eydehavn utdyping (EU)	11,7 m	8°52,797	58°29,689	12.08.2021-09.09.2021	10 minutter
Eydehavn dumping (ED)	44,1 m	8°53,462	58°29,987	12.08.2021-09.09.2021	10 minutter

1.3 Hydrografisk data

Ved utsetting og innhenting av strømmålere ble det tatt CTD (konduktivitet, temperatur og tetthet)-profiler av vannsøylen. Resultater av salinitet- og temperaturmålinger er vist i Figur 3.



Figur 3: Grafene viser målinger av temperatur og salinitet ved utsetting og innhenting av strømmålere i fire lokalitetene.

2 Resultater av strømmålinger

I dette kapitlet vil resultatene fra strømmålingene bli presentert. Det fokuseres på strømhastighet, hovedstrømretning, vanntransport og variasjon i strømretningen. Strømhastighet blir presentert i tabeller. Variasjon i strømretning blir presentert i grafer. Hovedstrømretning og vanntransport presenteres i både tabeller og grafer. Format på grafer kan variere noe, pga. at det er ulike målere som har blitt benyttet, som har ulike programmer for presentasjon av dataene.

Hovedresultatene er presentert i Tabell 2. Merk at for begge dumpeområdene kan det hentes inn data fra flere vanndybder. I rapporten er det valgt tre vanndybder basert på de planlagte tiltakene og sjøbunnstopografi (terskler).

Tabell 2: Oppsummering av hovedresultatene fra strømmålinger ved to lokaliteter i Galtesund og to lokaliteter i Tromøysund (ved Eydehavn). Hvilken type strømmåler var brukt er vist i parentesens bak stasjonsnavn.

Stasjon	Dybde (m)	Maks. hastighet (m/s)	Gjennomsnittshastighet (m/s)	Hovedretning vanntransport (grader)	Temperaturgjennomsnitt (°C) på instrumentdyp
Galtesund utdyping (Eco)	6,7	0,17	0,04	150-180	Dyp: 13,5 Temperatur: 14,9
	9,1	0,12	0,03	135-165	
	11,5	0,09	0,02	120-180	
Galtesund dumping (Signature500)	10	0,30	0,06	150-180; 320-350	Dyp: 57,4 Temperatur: 9,3
	35	0,40	0,02	5-30; 165-200	
	55	0,17	0,02	Ingen	
Eydehavn utdyping (Eco)	5,6	0,31	0,05	180-225	Dyp: 11,7 Temperatur: 16,8
	7,7	0,36	0,03	300-345	
	9,8	0,18	0,03	300-345	
Eydehavn dumping (Signature500)	10	0,19	0,05	210-225	Dyp: 44,1 Temperatur: 10,5
	25	0,38	0,05	30-60	
	42	0,12	0,02	Ingen	

2.1 Galtesund utdyping

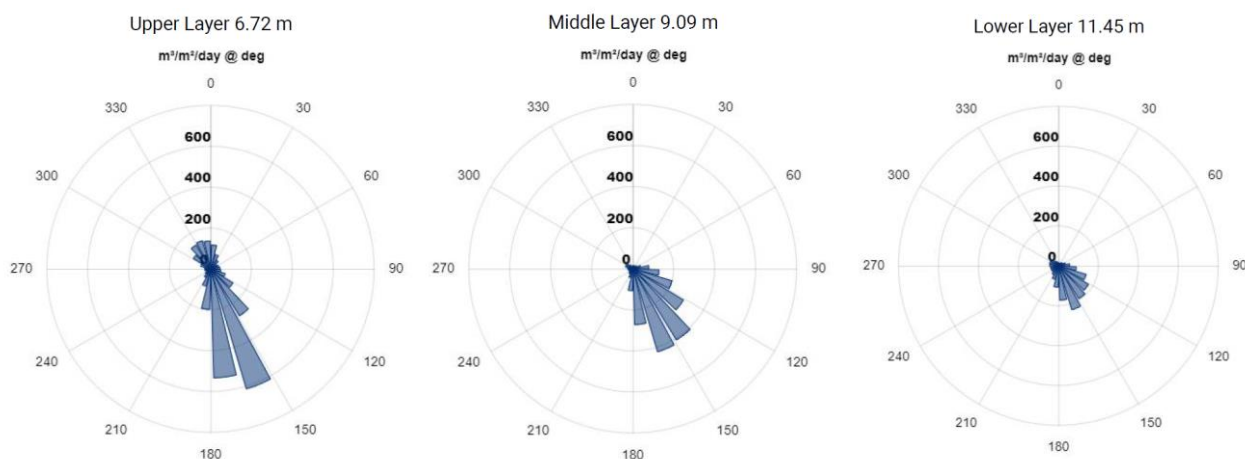
Figur 4 viser retning og mengden vanntransport målt i tre ulike lag, mens Figur 5 viser hvordan strømretningen varierer over tid. Ved tidevannspåvirkning vil Figur 5 viser regelmessig variasjon, men en frekvens på to i løpet av døgnet.

Resultatene fra strømmåling på 6 meters dyp viser at hovedstrømretning og massetransport av vann er registrert mot sør-sørøst, med en returstrøm mot nord-nordvest.

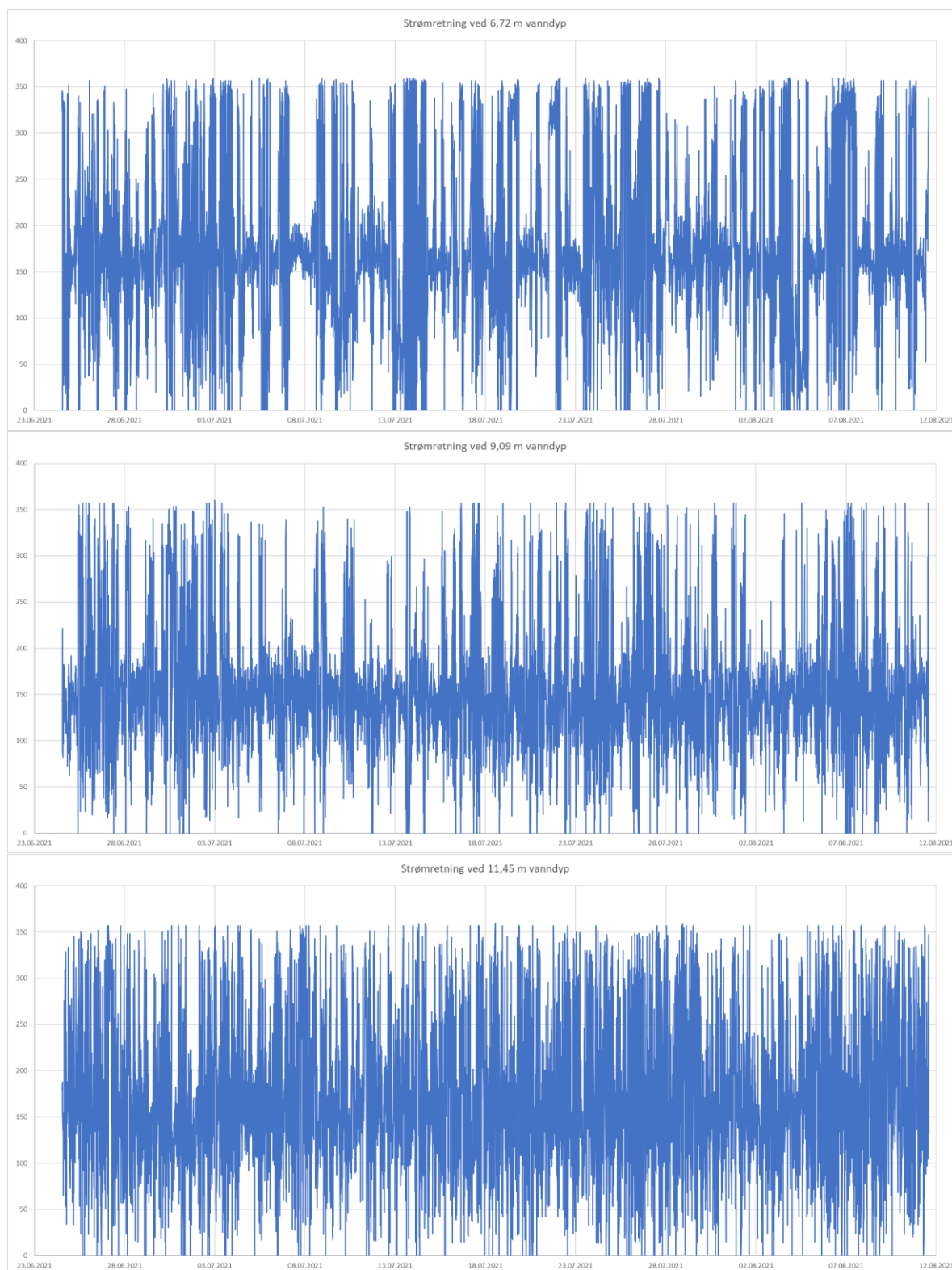
Resultatene fra strømmåling på 9 meters dyp viser at hovedstrømretning og massetransport av vann er registrert mot sør-sørøst.

Resultatene fra strømmåling på 11 meters dyp viser at hovedstrømretning og massetransport av vann er registrert mot sørøst, med en returstrøm mot nord-nordvest.

Det ble registrert sterkere strøm mot overflaten, dette gjelder både gjennomsnitt og maksimum målt strømhastighet. Målinger fra øverste 10 m tyder ikke på at strømmen er tidevannsstyrt.



Figur 4: Grafene viser hovedretning for vanntransport ved tre vanndybder ved Galtesund utdypingsområde.



Figur 5: Grafene viser strømretning over tid ved tre vanndybder ved Galtesund utdypingsområde.

2.2 Galtesund dumping

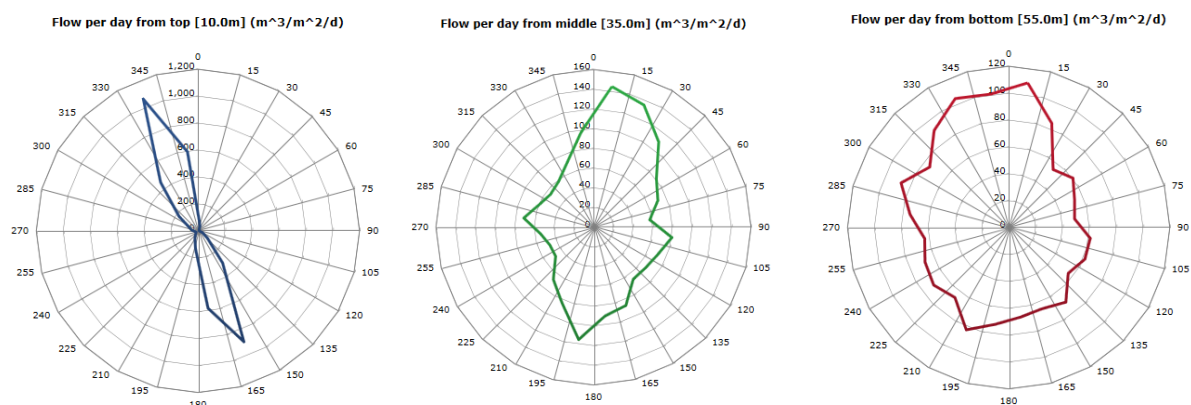
Figur 6 viser retning og mengden vanntransport målt i tre ulike lag, mens Figur 7Figur 5 viser hvordan strømretningen varierer over tid.

Resultatene fra strømmåling på 10 meters dyp viser at hovedstrømretning og massetransport av vann er registrert mot nordvest, med en returstrøm mot sørøst.

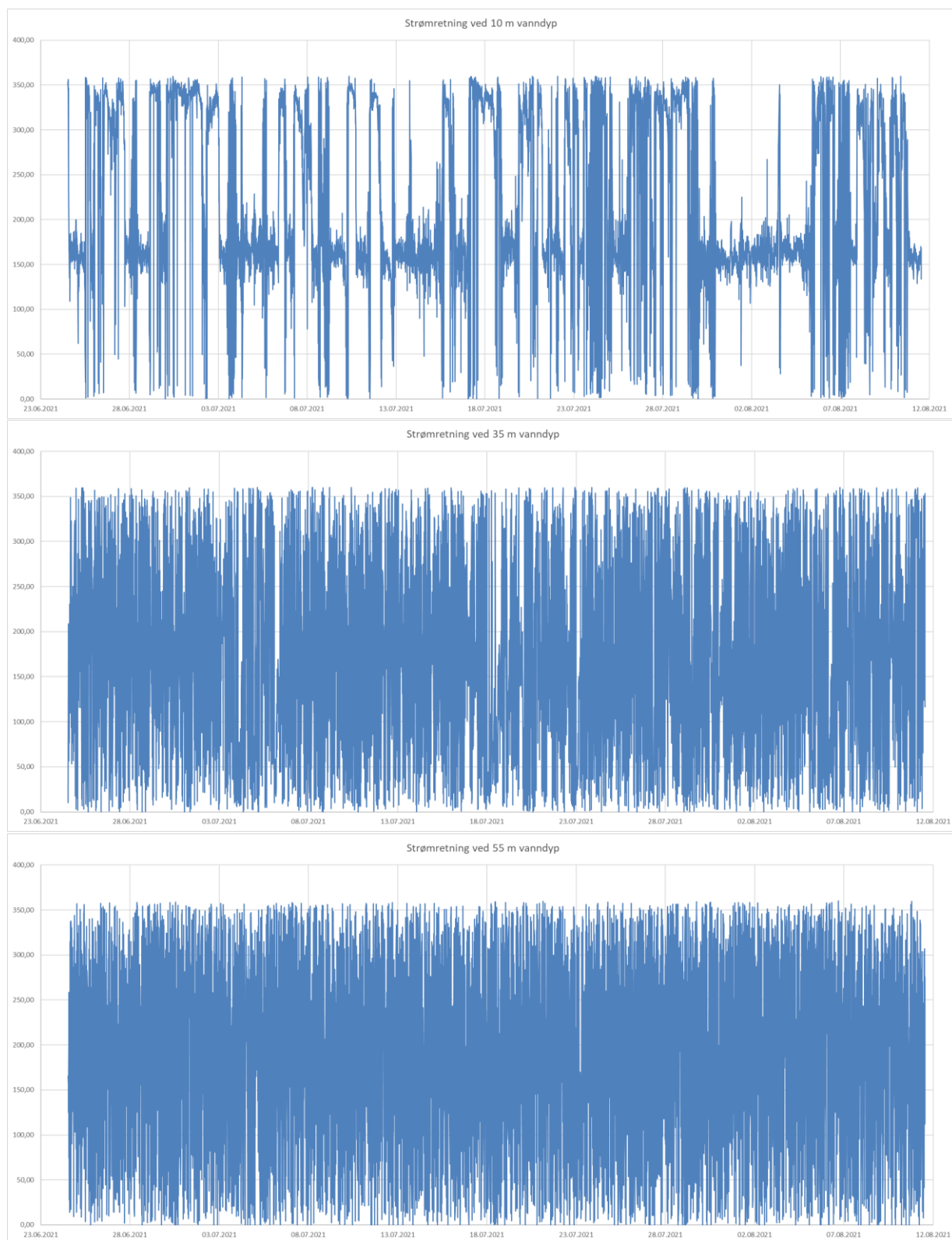
Resultatene fra strømmåling 35 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot nord-nordøst, med en returstrøm mot sør-sørvest.

Resultatene fra strømmåling på 55 meters dyp viser ikke en tydelig hovedstrømretning, men tyder på nordlig massetransport av vann.

Det ble observert sterkere gjennomsnittstrøm ved 10 m enn det som ble registrert i dypere vann. Også strømretning over tid viser to forskjellige vannmassene, én ved 10 m og én fra 35 til 55 m.



Figur 6: Grafene viser hovedretning for vanntransport ved tre vanndybder ved Galtesund dumpeområde.



Figur 7: Grafene viser strømretning over tid ved tre vanddybder ved Galtesund dumpeområde.

2.3 Eydehavn utdyping

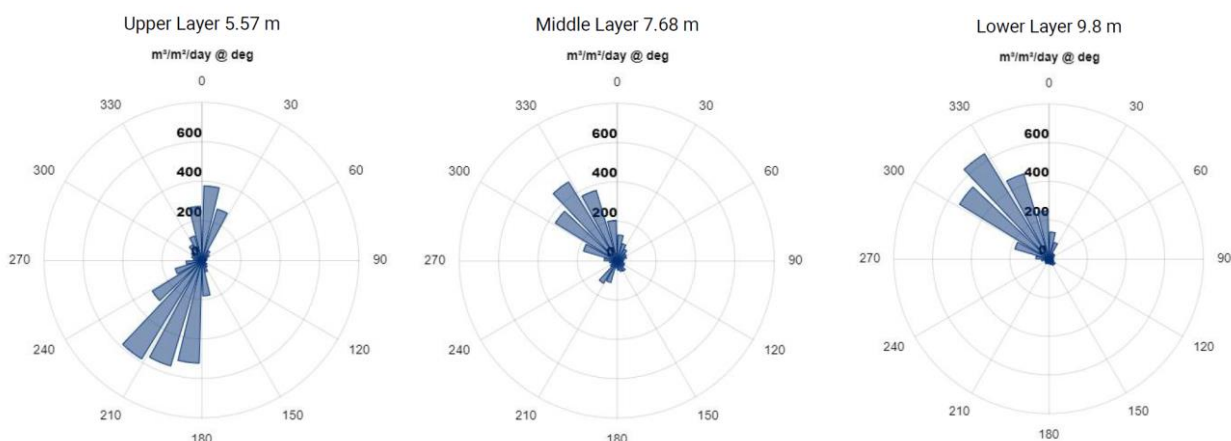
Figur 8 viser retning og mengden vanntransport målt i tre ulike lag, mens Figur 9Figur 5 viser hvordan strømretningen varierer over tid.

Resultatene fra strømmåling på 5 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot sør-sørvest, med en returstrøm mot nord-nordvest.

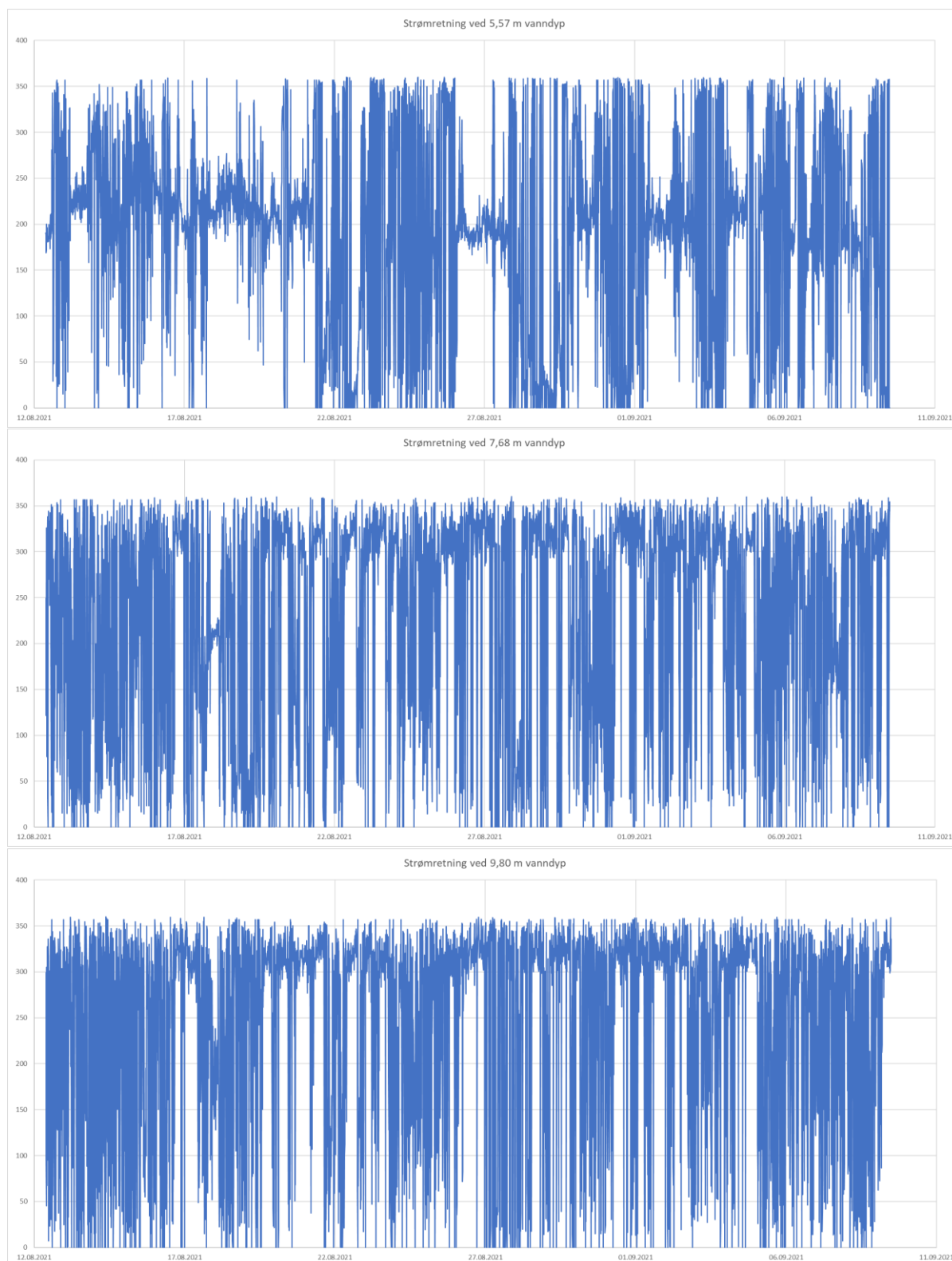
Resultatene fra strømmåling på 7 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot nordvest.

Resultatene fra strømmåling på 9 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot nordvest, med en returstrøm mot nord-nordvest.

Høyest gjennomsnittlig strømhastighet ble målt ved overflaten, mens høyest maksimal strømhastighet ble målt ved 7 m vanddyb. Strømretningsdata viser mer variasjon i strøm ved grunnere vann, enn ved dypere vannmasser.



Figur 8: Grafene viser hovedretning for vanntransport ved tre vanddybder ved Eydehavn utdypingsområde.



Figur 9: Grafene viser strømretning over tid ved tre vanndybder ved Eydehavn utdypingsområde.

2.4 Eydehavn dumping

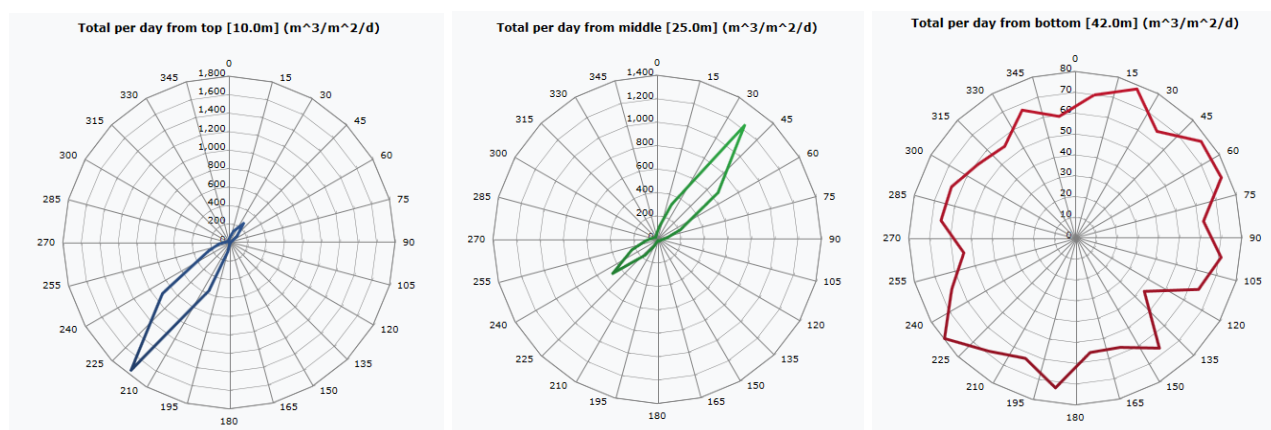
Figur 10 viser retning og mengden vanntransport målt i tre ulike lag, mens Figur 11 viser hvordan strømretningen varierer over tid.

Resultatene fra strømmåling på 10 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot sørvest.

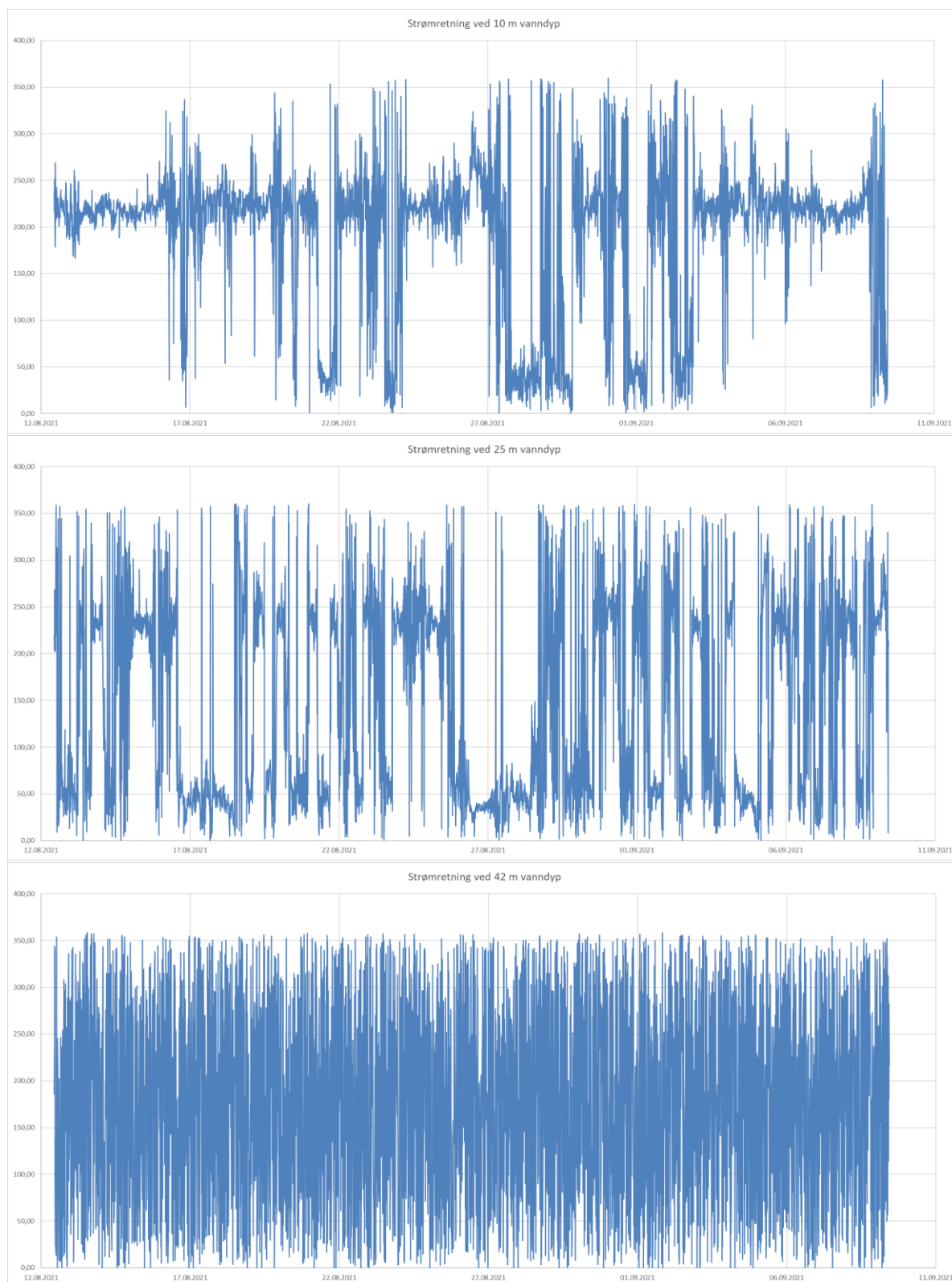
Resultatene fra strømmåling 25 meters dyp viser at hovedstrømretning og massetransport av vann er definert mot nord-nordøst, med en returstrøm mot sørvest.

Resultatene fra strømmåling på 42 meters dyp viser ikke en tydelig hovedstrømretning.

Gjennomsnittlig strømhastighet ble observert å være den samme ved 10 og 25 m vanndyp. Maksimal strømhastighet i den målte perioden var høyest ved 25 m vanndyp. Variasjon i strømretninger over tid viser mer variasjon i de dypeste vannlagene.



Figur 10: Grafene viser hovedretning for vanntransport ved tre vanndybder ved Eydehavn dumpeområde.



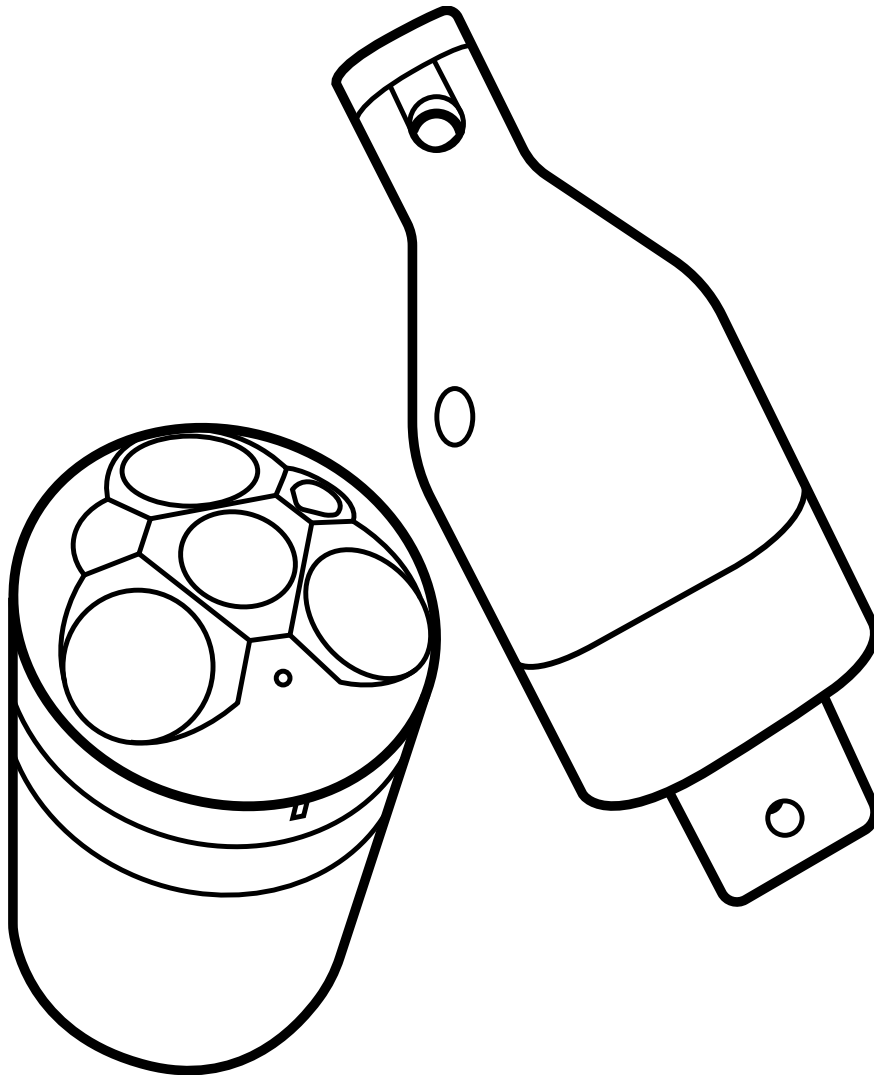
Figur 11: Grafene viser strømretning over tid ved tre vanddybder ved Eydehavn dumpeområde.

3 Vedlegg

Datarapporter fra strømmålinger:

1. Galtesund utdyping
2. Galtesund dumping
3. Eydehavn utdyping
4. Eydehavn dumping

Eco Deployment Report



Norconsult AS
Karin Raamat
Kjørboveien 22
1337 Sandvika



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Mission

This section contains basic mission information, including information about the instrument used in this deployment mission, a location map and basic data statistics from the mission. All times are referenced to the local time of the device used to configure the Eco. All depths are referenced to the water surface

General info

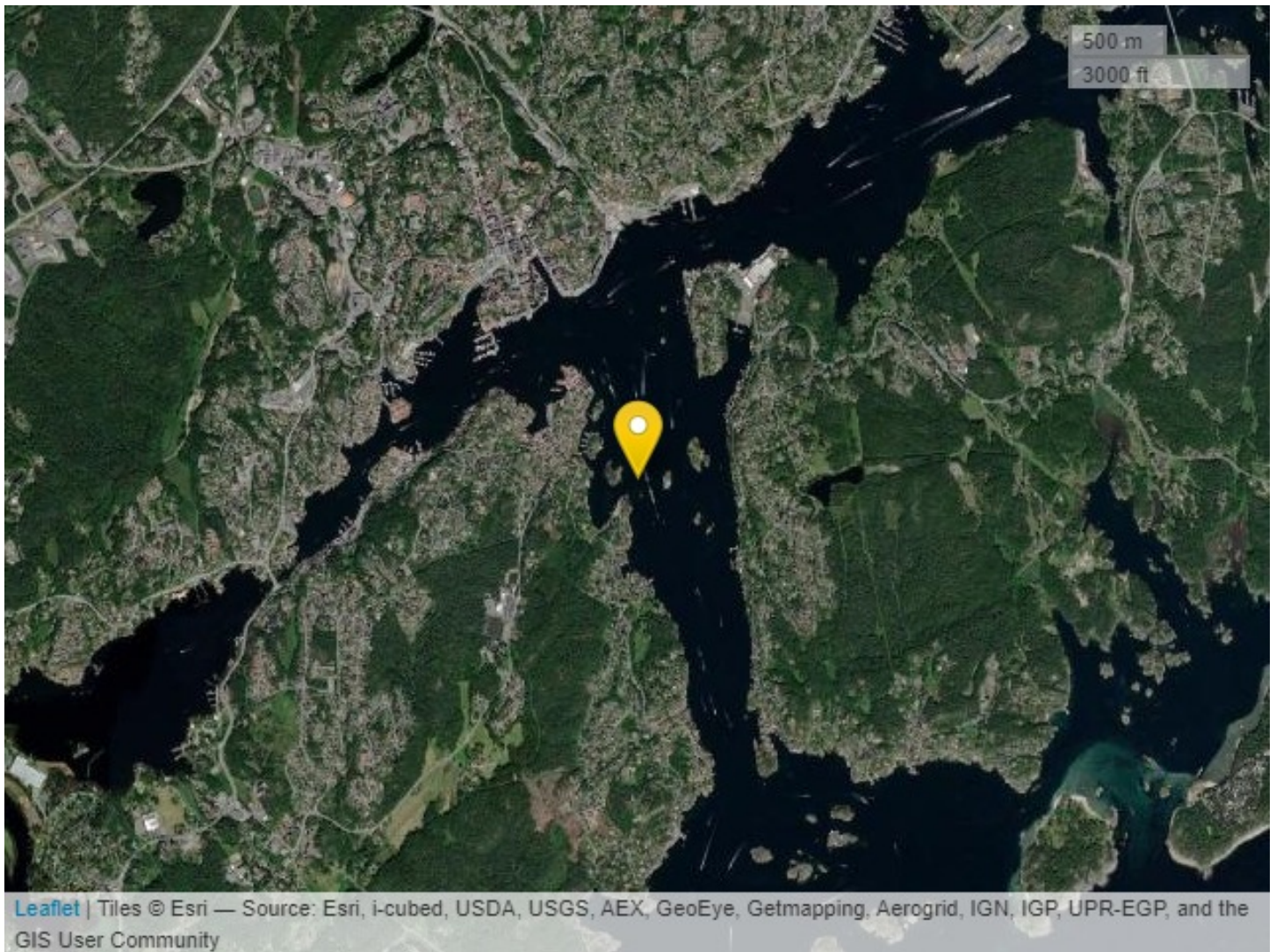
Deployment/File Name: Eco213_20210624115844			
Operator: Karin Raamat			
Full Deployment Date Range: 24.6.2021, 11:58:51 to: 11.8.2021, 18:58:51			
ID	Eco_0213	Firmware	8008.4
Samples	6955	Interval (minutes)	10
Salinity	Salt water	35 ppt	
Latitude	58.450081	Longitude	8.77654
Magnetic declination	3.22793		
Average direction	150.6 deg	Average speed	0.03 m/s
Max Depth Below Surface	13.82 m		
Upper layer depth	6.72 m		
Middle layer depth	9.09 m		
Lower layer depth	11.45 m		
User id	258B34DD-F274-491B-B371-239C53801AFD		
Data id	B18C2271-244A-4369-8E15-70BA7DAE8431		
Created	11.8.2021, 19:35:34		
Processor version	1.0.22.0		
Processed	11.8.2021, 19:51:30		

Statistics (for Report Date Range only)

		Upper	Middle	Lower	Unit
Speed	Mean	0.04	0.03	0.02	m/s
	Max	0.17	0.12	0.09	m/s
	Min	0.00	0.00	0.00	m/s
	Std. dev	0.02	0.02	0.01	m/s
	Mean	Max	Min	Std. dev	Unit
Temperature	14.9	29.1	11.8	1.9	°C
Pressure	13.5	13.9	0.0	1.0	m
Tilt	1.4	44.8	0.6	1.8	deg

Location

Deployment location: Latitude 58.450081 and Longitude 8.77654.

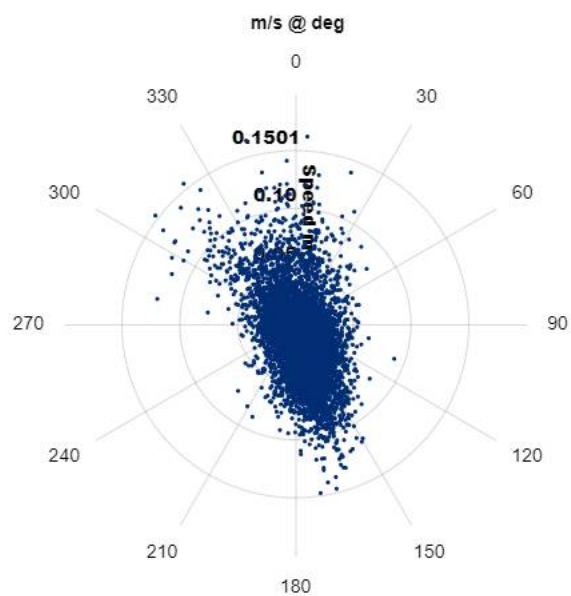


Figures

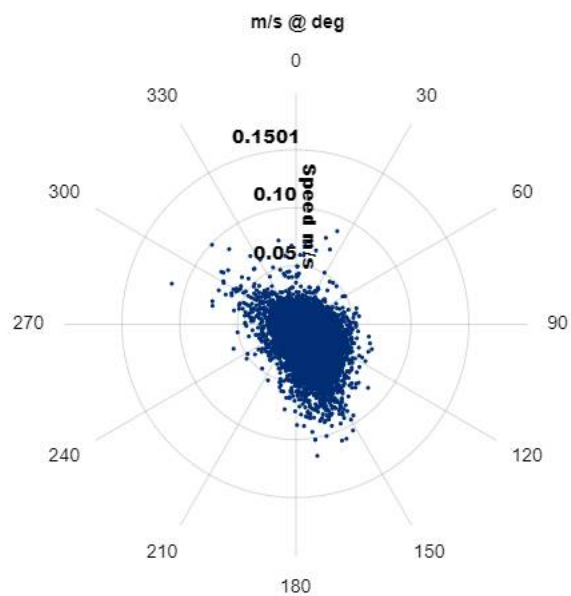
Polar Scatter Plots

These plots show the current speed and direction in a polar coordinate graph (North at the top, 0°) for each of the three depth layers. Data is shown for the Report Date Range. The numbers on the outside of the graph indicate the direction the current is flowing towards for that layer. For example, if a dot is plotted along the 40° line, then it indicates current flowing towards the Northeast. The distance away from the center of the graph indicates how fast the current is flowing: the closer to the center, the slower the water is moving.

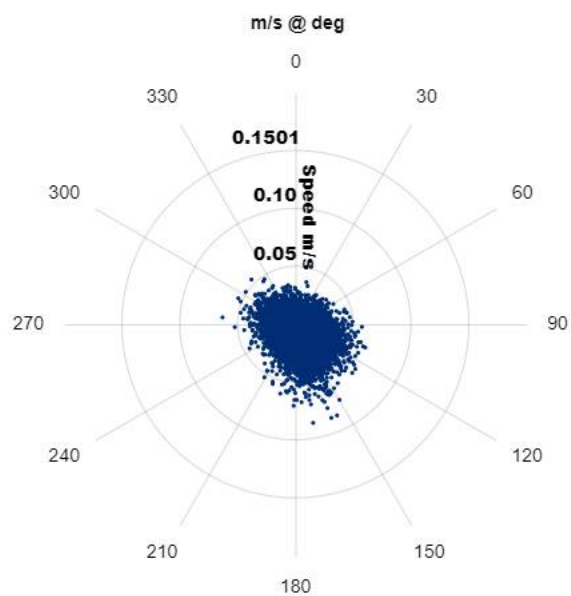
Upper Layer 6.72 m



Middle Layer 9.09 m



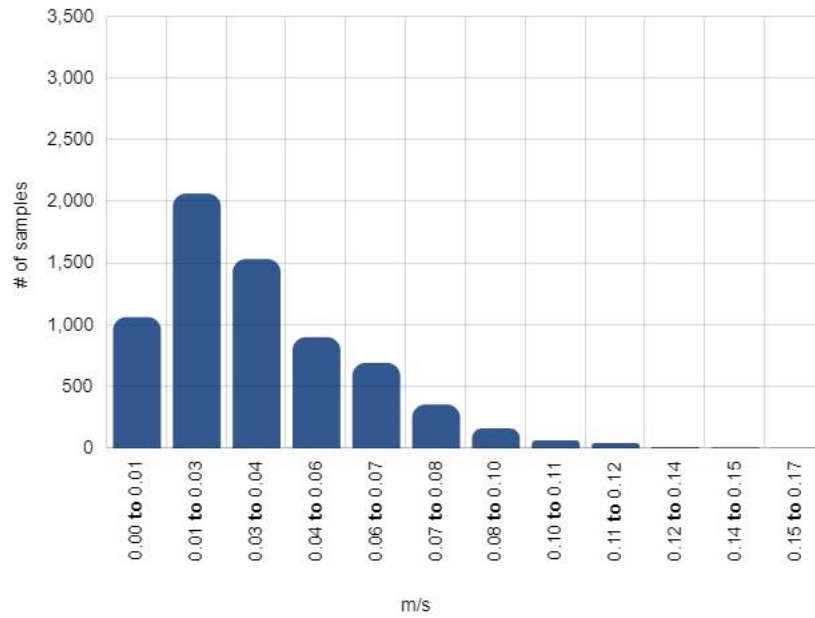
Lower Layer 11.45 m



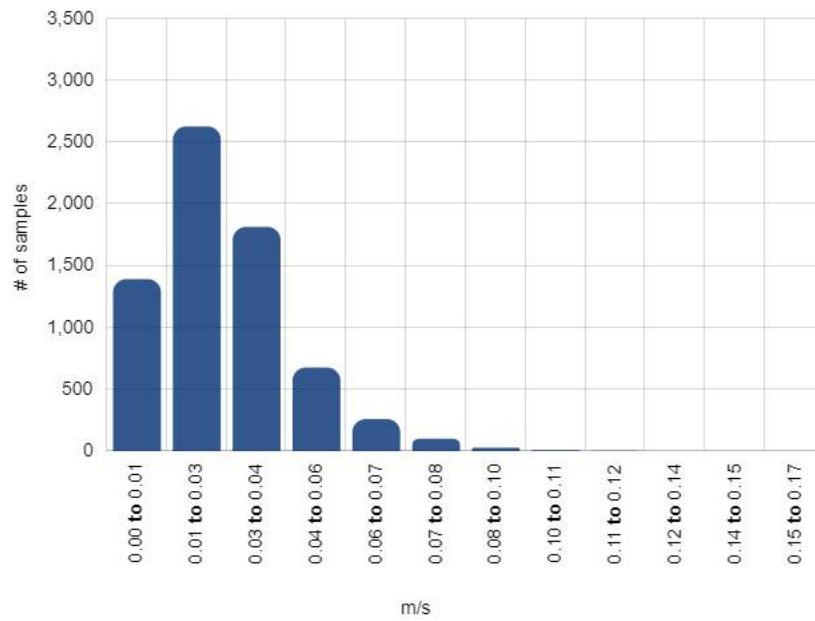
Histogram of Speed

These plots indicate the distribution of current speed for each of the three depth layers. The graph is generated by first taking the current speed data from the Report Date Range and dividing it into intervals of equal size. Then, the number of samples (i.e. an individual measurement interval) in each interval is counted. The numbers on the bottom (X-axis) indicate the speed intervals. The numbers on the left (Y-axis) indicate the number of samples in each interval. For example, if the highest bar on the graph is from the 0.3-0.4 m/s range, then that means that the current speed in this range happens more often than any other speed in the Report Date Range.

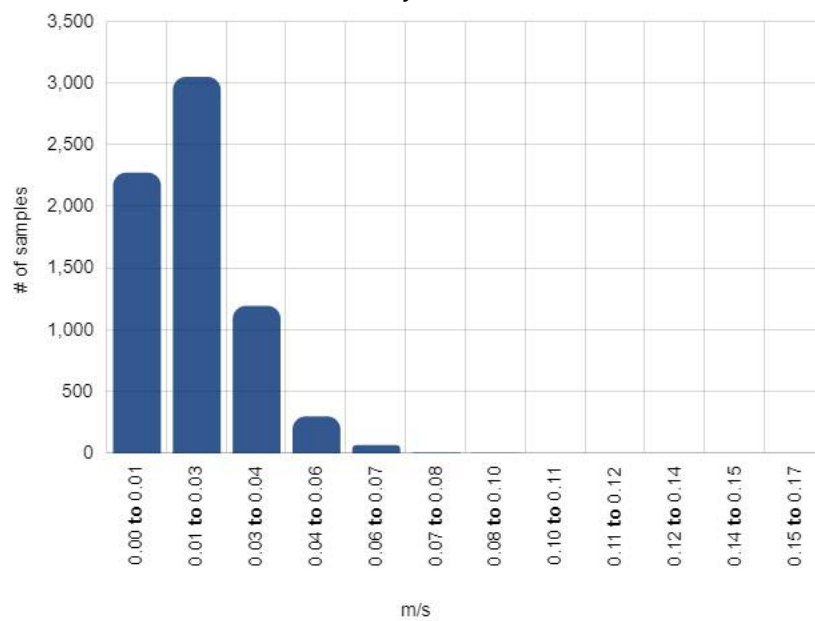
Upper Layer 6.72 m



Middle Layer 9.09 m



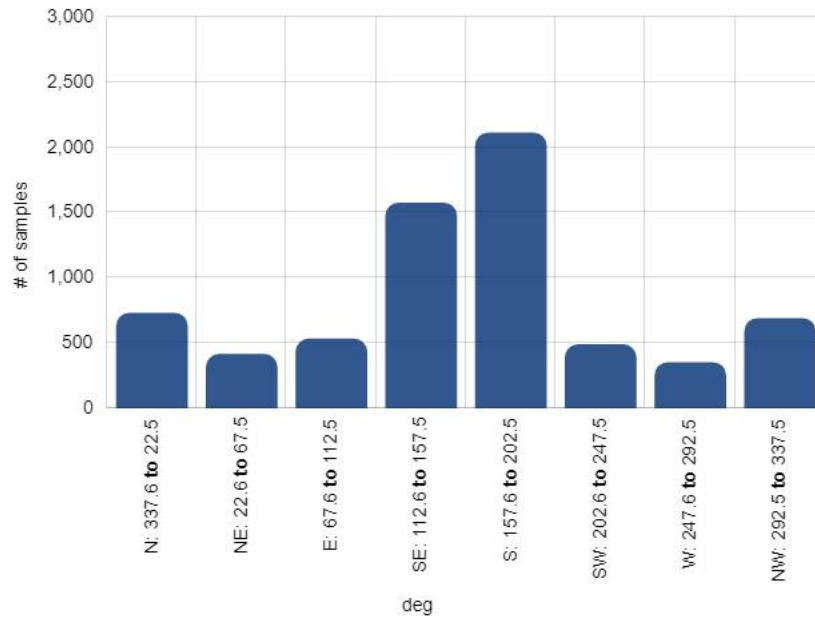
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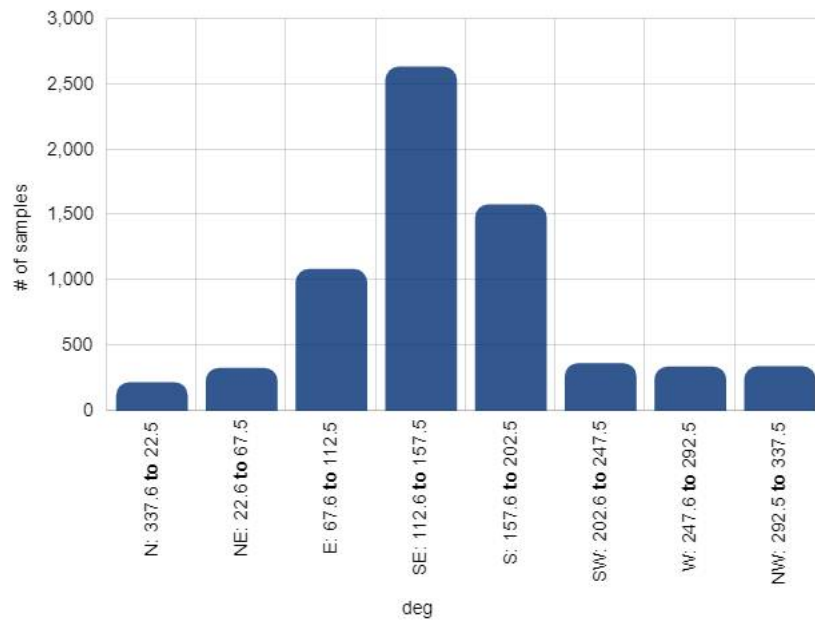
Histogram of Direction

These plots indicate the distribution of current direction for each of the three depth layers. The graph is generated by first taking the current direction data from the Report Date Range and dividing it into ranges of equal size. Then, the number of samples (i.e. an individual measurement interval) in each range is counted. The numbers on the bottom (X-axis) indicate the direction ranges. The numbers on the left (Y-axis) indicate the number of samples in each range. For example, if the highest bar on the graph is from the 90-120° range, then that means that the current direction in this range happens more often than any other direction during the Report Date Range.

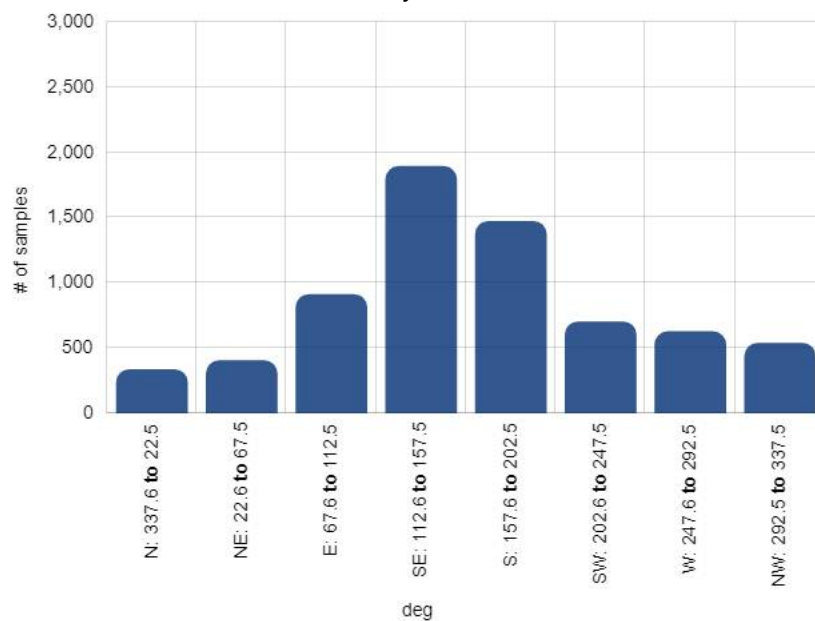
Upper Layer 6.72 m



Middle Layer 9.09 m



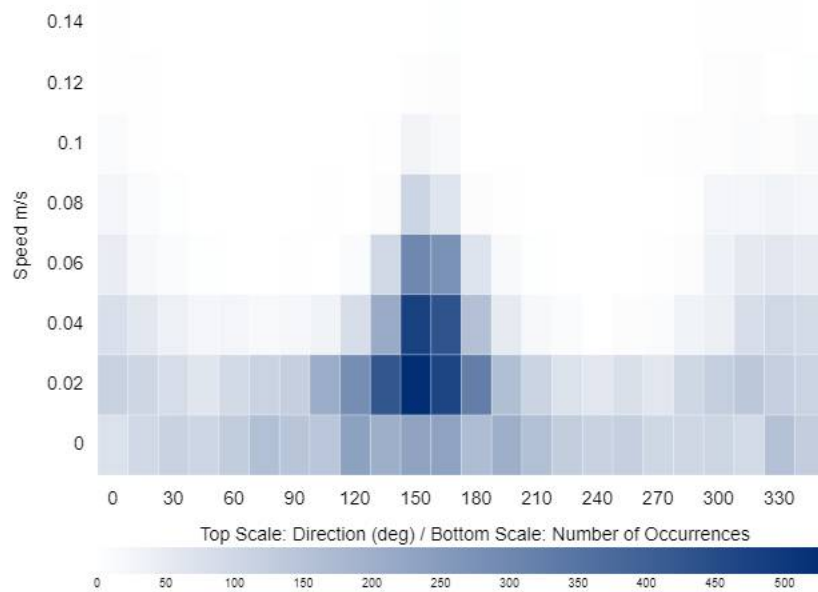
Lower Layer 11.45 m



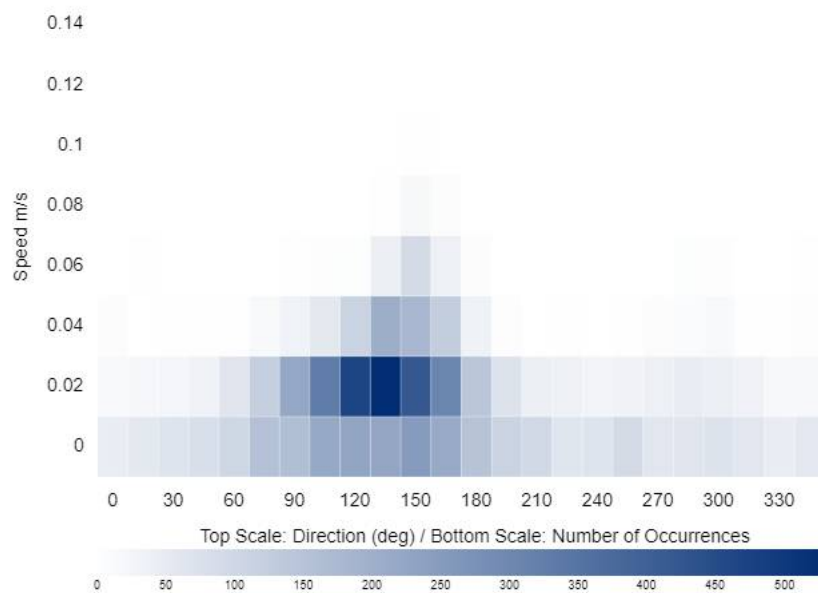
Speed/Direction Occurrence Frequency

These plots combine the speed and direction histograms to show the occurrence frequency of current speed and direction for each of the three depth layers in a cartesian coordinate graph. Data is shown for the Report Date Range. The numbers on the left (Y-axis) indicate the current's speed while the numbers along the lower (X-axis) indicate the direction the current is flowing towards. The color of each block inside the graph indicates the occurrence frequency of that particular speed/direction combination, scaled by the color bar on the bottom. For example, if the block with the darkest color is the intersection of 270° and 0.3 m/s, then that means that the currents are moving at this speed and direction more often than any other speed/direction.

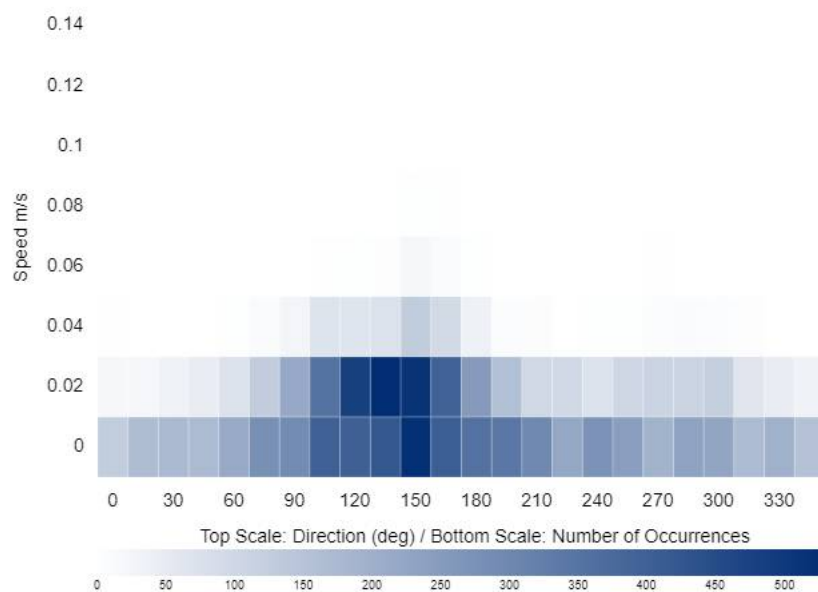
Upper Layer 6.72 m



Middle Layer 9.09 m



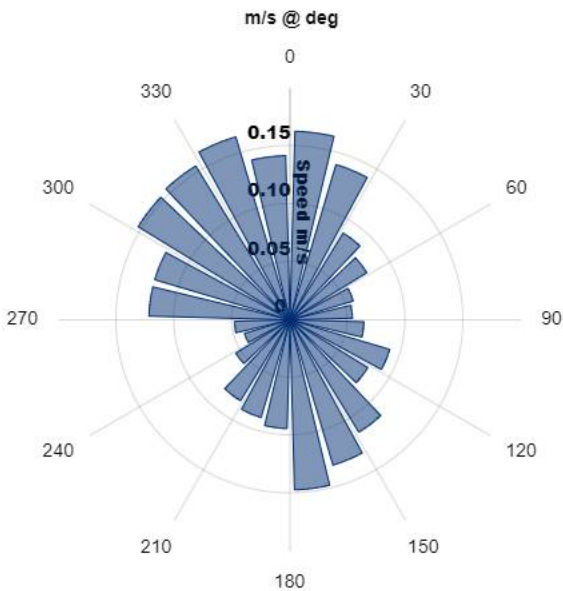
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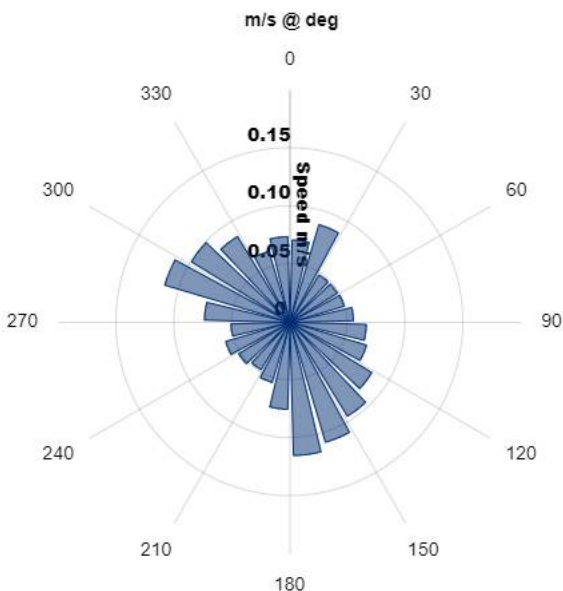
Direction and Maximum Speed

Similar to the Polar Scatter plots, these plots show the current speed and direction in a polar coordinate graph (North at the top; 0°) for each of the three depth layers. However, here only the maximum current speed, and its corresponding direction, are shown. The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 270° , then that means the highest current speed was measured along this direction for this particular depth layer.

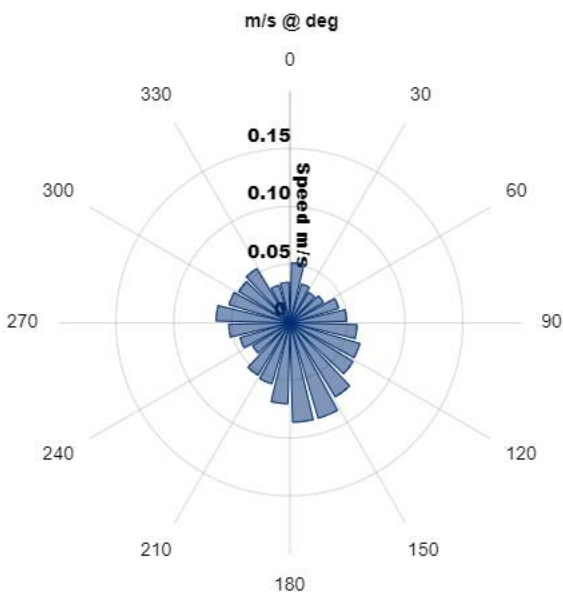
Upper Layer 6.72 m



Middle Layer 9.09 m



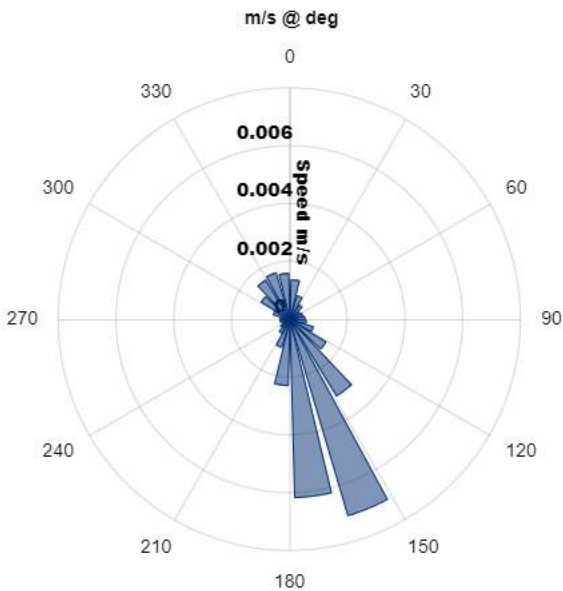
Lower Layer 11.45 m



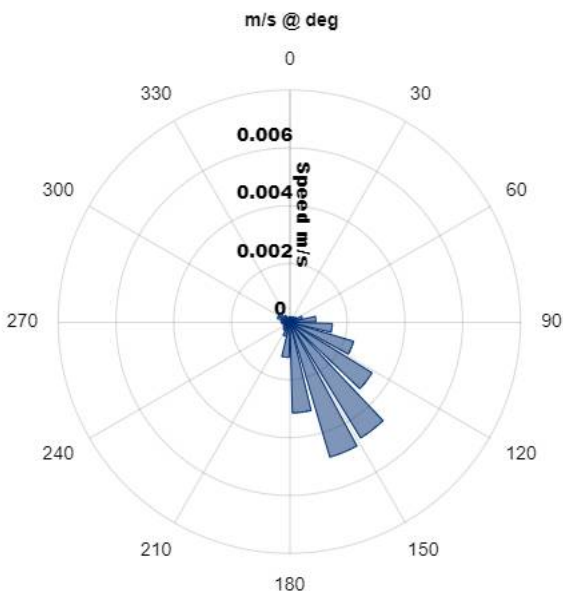
Direction and Mean Speed

Similar to the Polar Scatter plots, these plots show the current speed and direction in a polar coordinate graph (North at the top; 0°) for each of the three depth layers. However, here only the mean current speed, and its corresponding direction, are shown. The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 180° , then that means the mean (average) current speed was measured along this direction for this particular depth layer.

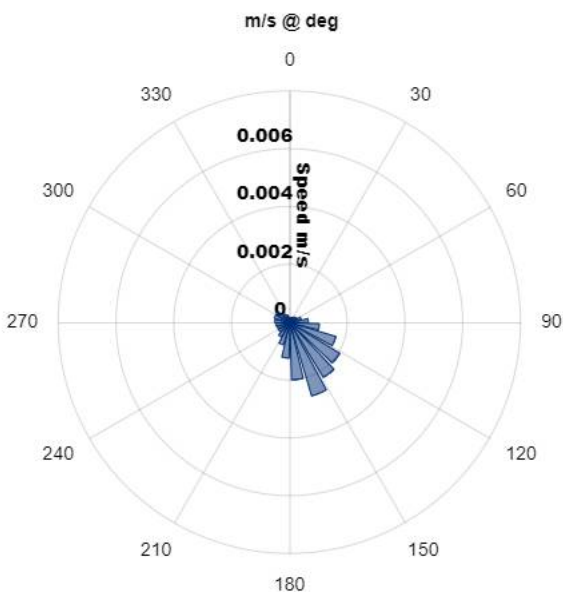
Upper Layer 6.72 m



Middle Layer 9.09 m



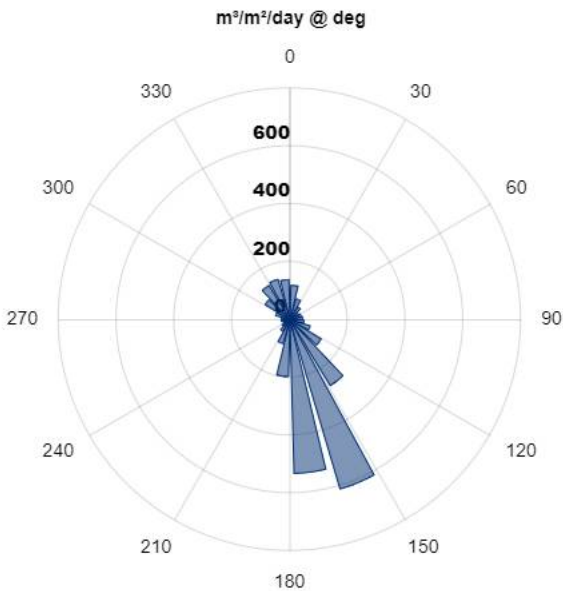
Lower Layer 11.45 m



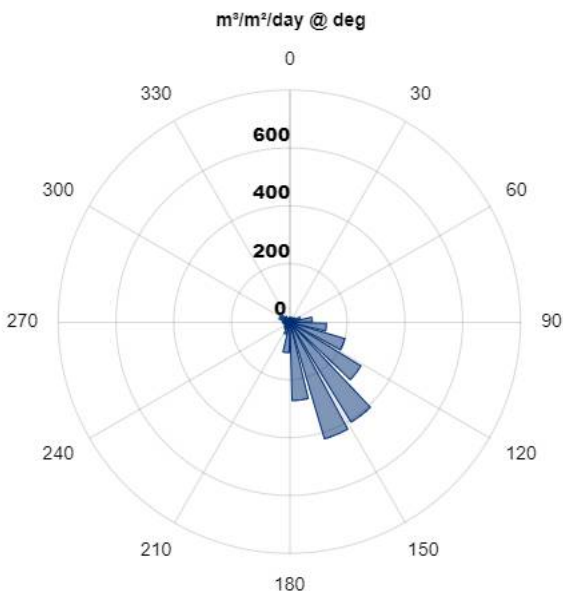
Direction and Flow

These plots show the average volume of water per day (flow) over the cross sectional area of the acoustic cone above the instrument. Data has units of $\text{m}^3/\text{m}^2/\text{day}$ (cubic meter per square meter per day). The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 320° , and the distance from the center of the graph is along the 10,000 inner circle, that means that an average of 10,000 m^3 of water per day flows across the acoustic cone of the instrument for that particular depth layer.

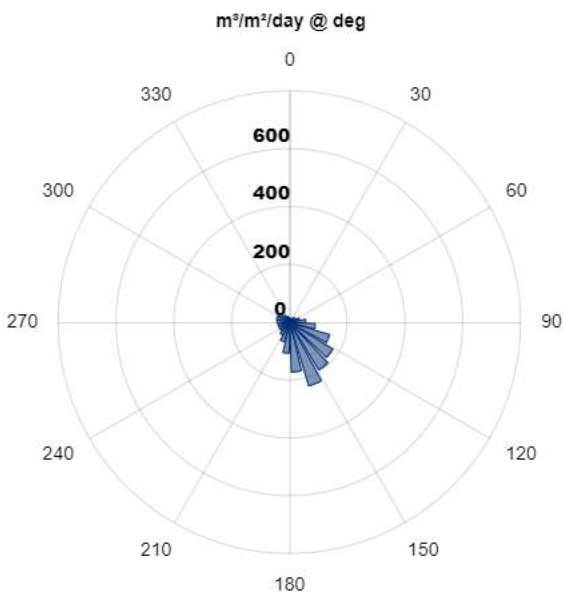
Upper Layer 6.72 m



Middle Layer 9.09 m



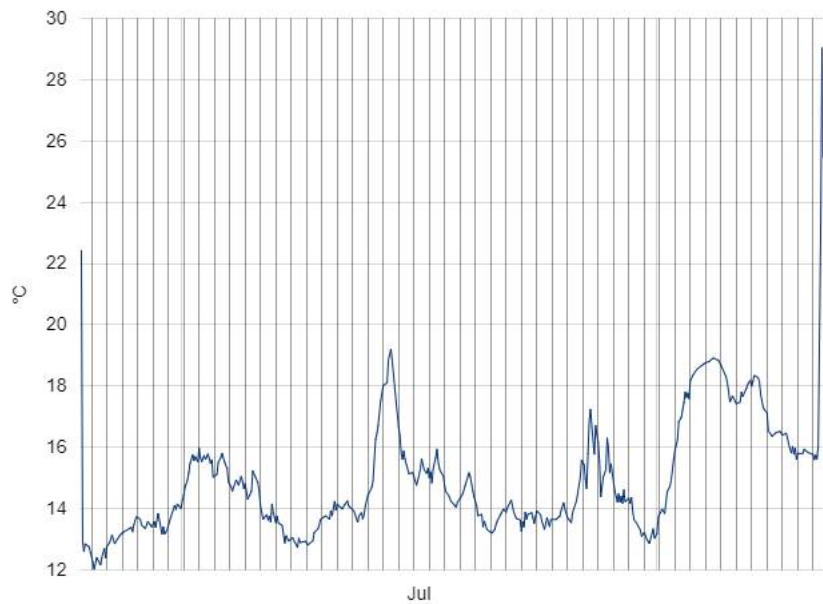
Lower Layer 11.45 m



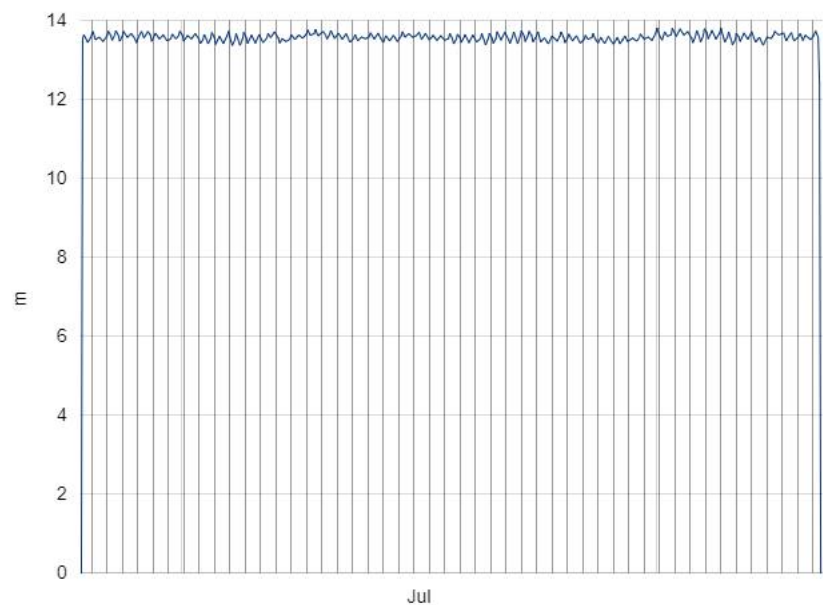
Enviroment

Three plots provide details about the environment over time (i.e. a time-series). These include: water temperature, water pressure (depth) and instrument tilt angle. Data is shown for the Report Date Range. The number on the bottom (X-axis) indicate the date/time while the numbers of the left (Y-axis) indicate the respective data value.

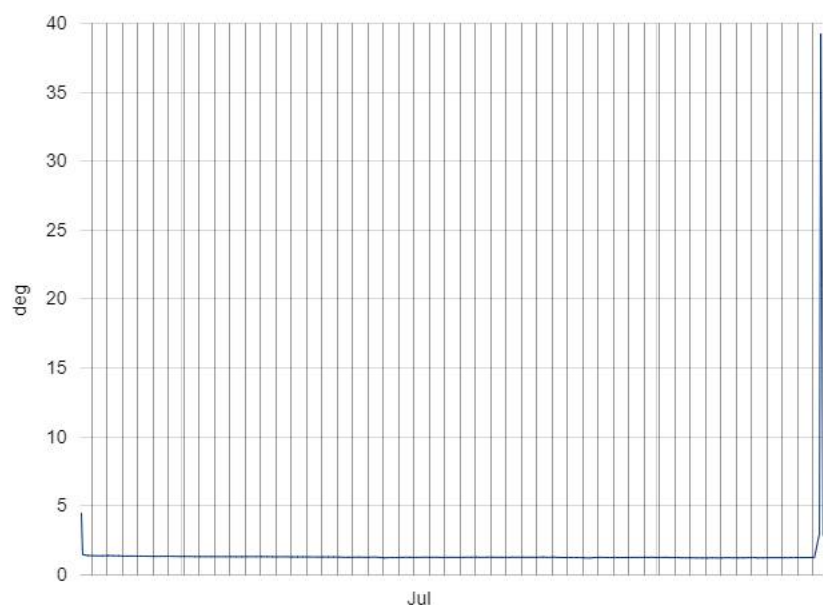
Temperature



Pressure



Tilt

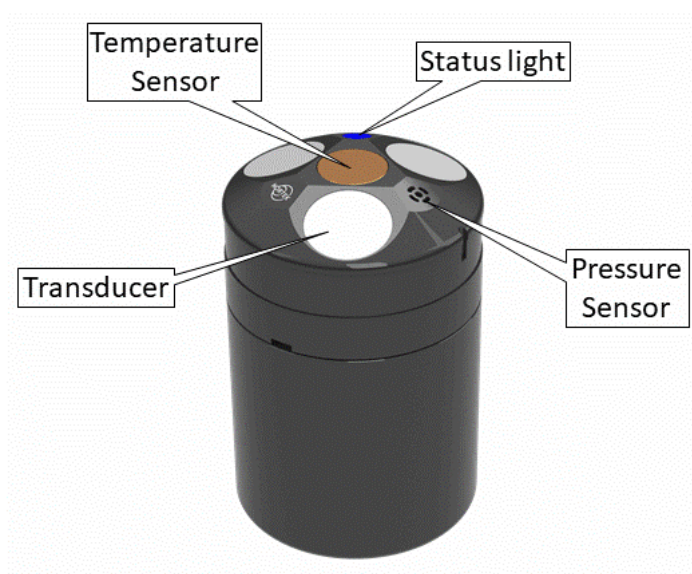


Nortek Eco

Nortek designs, develops and produces scientific instruments that apply the Doppler principle to underwater acoustics in order to measure water in motion, such as currents and waves. We provide truly innovative, robust, and accurate instruments, backed up by advanced software and comprehensive support to ensure customers maximize value from their measurements. To learn more about Nortek, please visit our website at

www.nortekgroup.com.

The Nortek Eco is a class of oceanographic instruments called Acoustic Doppler Current Profilers (or ADCPs). As the name suggests, an ADCP uses the acoustic Doppler principle to measure current speed and direction at different depths, all from a single instrument. The Nortek Eco is the world's first portable ADCP and it was designed specifically to measure currents in shallow waters (up to 20 m depth).



The Nortek Eco and its main components.

Measurement principle

To measure water speed, the Nortek Eco transmits acoustic pulses that propagate upward through the water column. These pulses reflect off the particles in the water, generating echoes that are detected by the instrument. From this detection, the Eco uses the Doppler principle to compute the current's speed and direction. The acoustic pulses transmitted by the Eco originate from the three white circles (called transducers) on the instrument's top.

How to interpret the data

Data from the Nortek Eco can be read directly from the graphs generated in this report. All of the data have already been processed so no further processing is required. The Nortek Eco has a maximum profiling range of 20 m. This means that it can detect the current speed and direction as far as 20 m above it.

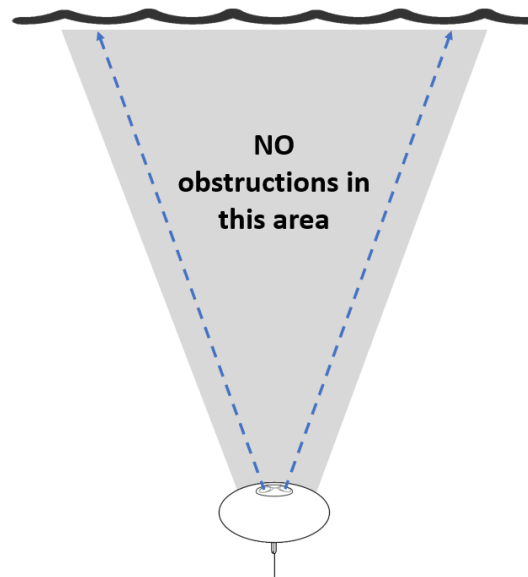
The water column above the Eco is divided into three layers: Upper, Middle and Lower. The Lower layer is the one closest to the Eco and the Upper layer is the one farthest from the Eco (that is, closest to the surface). Both the WebApp and this report provide the depth for each layer. For further details, see the next Section.

The velocity inside each layer is referenced to Earth coordinates, with direction being the direction that the current is flowing to. So for example, a velocity of 0.6 m/s at 90° for the upper layer means the top of the water column is flowing to the East at 0.6 m/s.

The Nortek Eco also records water pressure (depth), water temperature and its own tilt. These data are provided as time series along with the current speed data.

Sources of error

The Nortek Eco automatically processes all data collected, excluding data that do not meet quality standards, so you can be sure you are getting valid data for your deployment missions. Despite this robust internal processing, some conditions may increase the chances of collecting low quality data and should be avoided. These include: high tilt, blocked pressure sensor and blocked transducer. To minimize these effects, please ensure the following conditions are met for each Eco deployment mission:



Gray area (acoustic cone) must be free from obstructions during a mission. Angle of cone is 40°.

END OF REPORT

Strømmåling Galtesund dumping

Innseiling Arendal

10/14/2021

Norconsult AS

Karram

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Details

Instrument

Head Id	102819
Board Id	I-3
Frequency	500

Configuration

File	S102819A003_Galtedeponi_avgd.ad2cp
Start	24.06.2021 12:25
End	11.08.2021 18:15
Data Records	6948
Longitude	8° 46.65' E
Latitude	58° 27.21' N
Orientation	UP
Cells	30
Cell Size [m]	2
Blanking Distance [m]	0.5
Average Interval [sec]	00:01:00
Measurement Interval [sec]	00:10:00

Quality

Low Pressure Threshold	0
HighTilt Threshold	30
Expected Orientation	UP
Amplitude Spike Threshold	70
Velocity Spike Threshold	5
SNR Threshold	3
Correlation Threshold	50

Post processing

Selected Start	24.06.2021 12:50
Selected End	11.08.2021 13:15
Selected Records	6915
Reference	Water Surface
Top Depth [m]	10
Top Invalid Data	0
Middle Depth [m]	35
Middle Invalid Data	0
Bottom Depth [m]	55
Bottom Invalid Data	9

Statistics

Top [10.0m]

Mean current [m/s]	0.06
Max current [m/s]	0.30
Min current [m/s]	0.00
Measurements used/total [#]	6915 / 6915
Std.dev [m/s]	0.04
Significant max velocity [m/s]	0.10
Significant min velocity [m/s]	0.02
10 year return current [m/s]	0.500
50 year return current [m/s]	0.561
Most significant directions [°]	165°, 180°, 345°, 360°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20
Most flow	1059.03m ³ / day at 330-345°
Least flow	9.28m ³ / day at 75-90°
Neumann parameter	0.09
Residue current	0.00 m/s at 309°
Zero current [%] - [HH:mm]	6.04% - 01:00

Middle [35.0m]

Mean current [m/s]	0.02
Max current [m/s]	0.40
Min current [m/s]	0.00
Measurements used/total [#]	6915 / 6915
Std.dev [m/s]	0.02
Significant max velocity [m/s]	0.04
Significant min velocity [m/s]	0.01
10 year return current [m/s]	0.657
50 year return current [m/s]	0.737
Most significant directions [°]	15°, 30°, 195°, 180°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20
Most flow	143.93m ³ / day at 0-15°
Least flow	47.72m ³ / day at 240-255°
Neumann parameter	0.09
Residue current	0.00 m/s at 51°
Zero current [%] - [HH:mm]	24.09% - 01:20

Bottom [55.0m]

Mean current [m/s]	0.02
Max current [m/s]	0.17
Min current [m/s]	0.00
Measurements used/total [#]	6906 / 6915
Std.dev [m/s]	0.01
Significant max velocity [m/s]	0.03
Significant min velocity [m/s]	0.01
10 year return current [m/s]	0.284
50 year return current [m/s]	0.318
Most significant directions [°]	15°, 345°, 330°, 300°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20

Most flow	108.69m ³ / day at 0-15°
Least flow	49.59m ³ / day at 75-90°
Neumann parameter	0.10
Residue current	0.00 m/s at 316°
Zero current [%] - [HH:mm]	18.72% - 00:50

Sensors

	Mean	Min	Max
Pressure [dbar]	57.37	57.13	57.67
Temperature [°C]	9.23	8.76	9.88
Heading [°]	277.68	277.30	279.07
Pitch [°]	-2.95	-2.98	-2.78
Roll [°]	0.89	0.85	1.03

Direction with return period

Top [10.0m]

Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.064	0.303	0.106	0.500	0.119	0.561
45	0.021	0.165	0.035	0.272	0.039	0.305
90	0.020	0.148	0.033	0.244	0.037	0.274
135	0.050	0.220	0.082	0.362	0.092	0.406
180	0.049	0.169	0.081	0.279	0.090	0.313
225	0.021	0.097	0.035	0.161	0.040	0.180
270	0.028	0.113	0.046	0.187	0.051	0.210
315	0.066	0.265	0.109	0.438	0.122	0.491

Middle [35.0m]

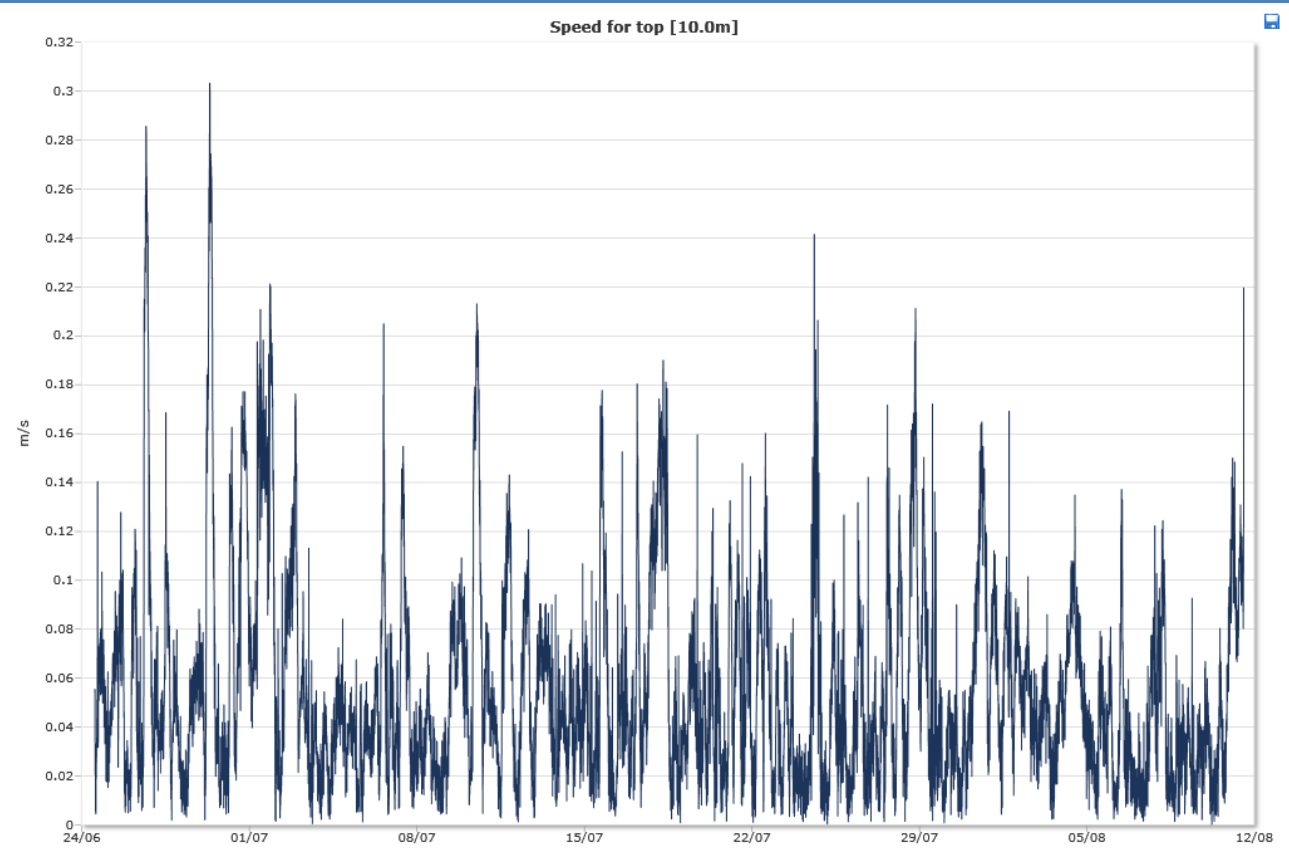
Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.026	0.258	0.043	0.426	0.048	0.478
45	0.026	0.206	0.043	0.340	0.048	0.381
90	0.022	0.180	0.036	0.297	0.041	0.333
135	0.019	0.213	0.031	0.352	0.035	0.395
180	0.023	0.398	0.039	0.657	0.043	0.737
225	0.018	0.233	0.030	0.384	0.034	0.430
270	0.020	0.194	0.032	0.320	0.036	0.358
315	0.018	0.159	0.029	0.262	0.033	0.294

Bottom [55.0m]

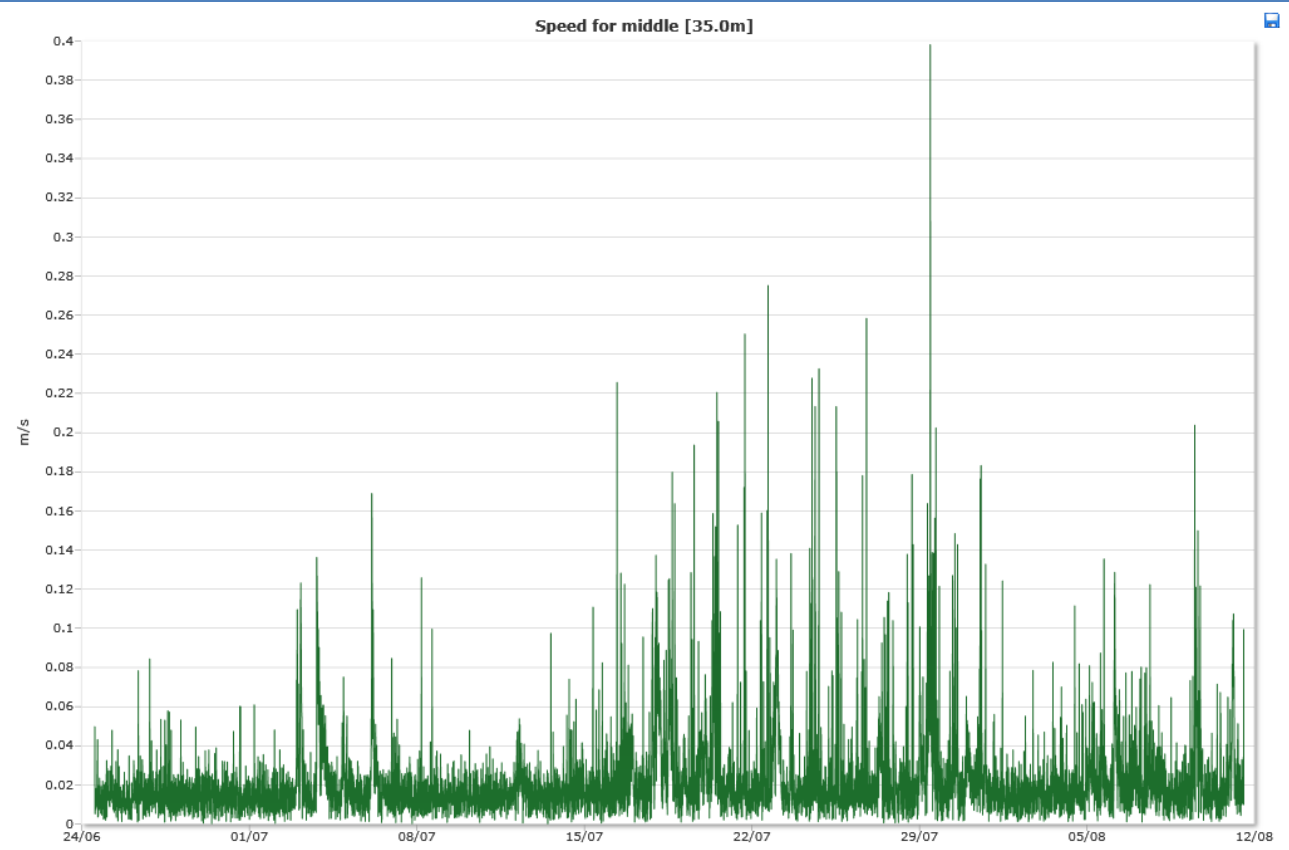
Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.023	0.139	0.039	0.229	0.043	0.257
45	0.020	0.118	0.032	0.195	0.036	0.218
90	0.019	0.081	0.031	0.134	0.035	0.150
135	0.019	0.085	0.031	0.141	0.035	0.158
180	0.020	0.070	0.033	0.116	0.037	0.130
225	0.020	0.172	0.033	0.284	0.037	0.318
270	0.019	0.084	0.032	0.139	0.036	0.156
315	0.021	0.101	0.034	0.167	0.038	0.187

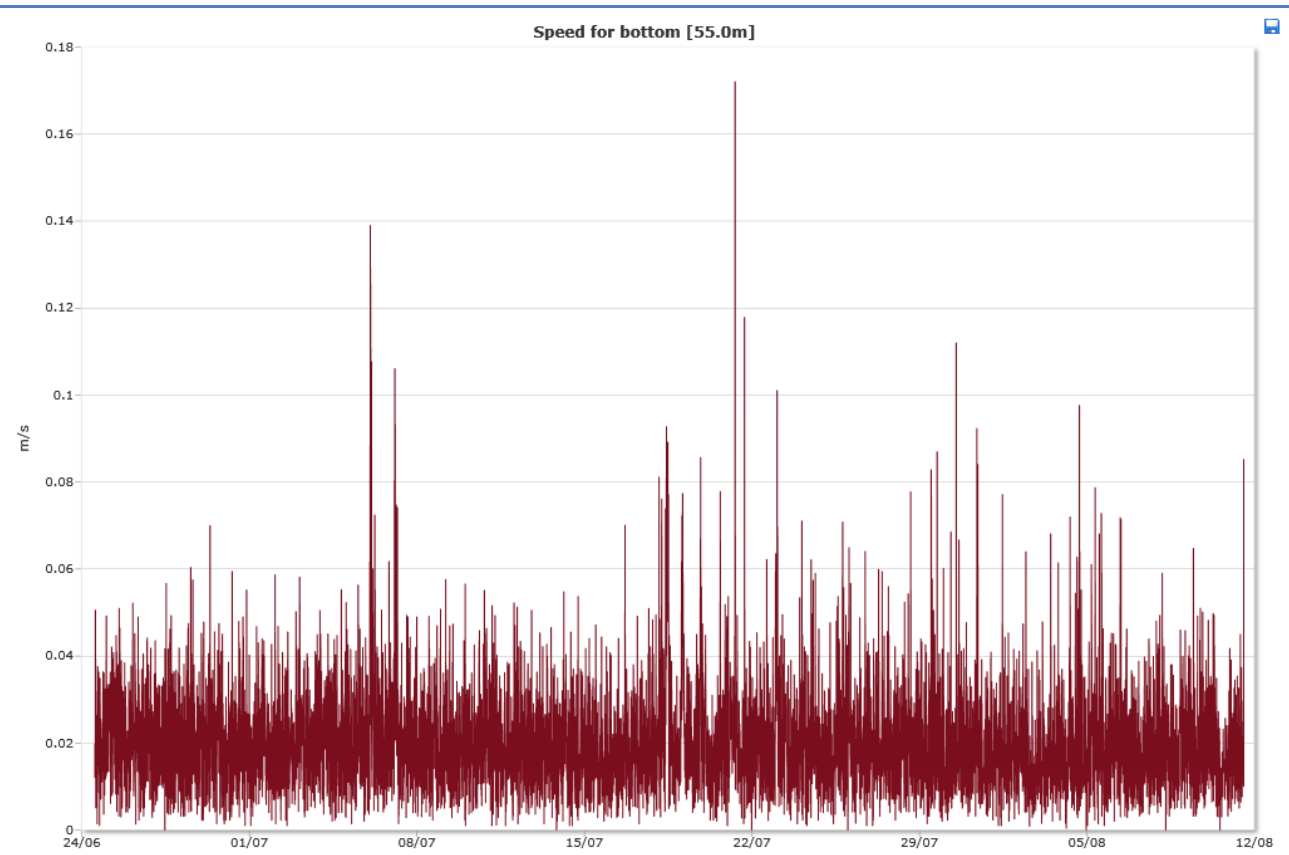
Time series

Top [10.0m]



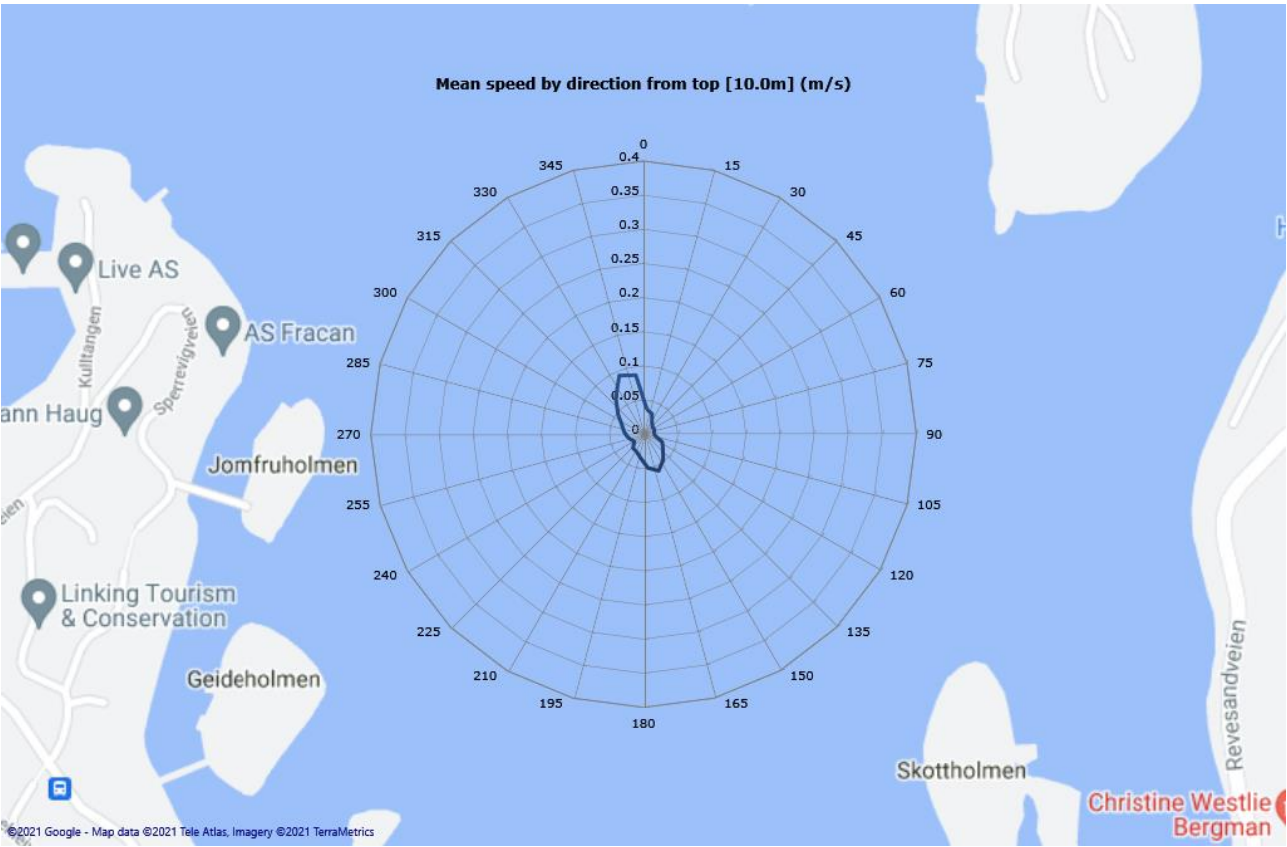
Middle [35.0m]



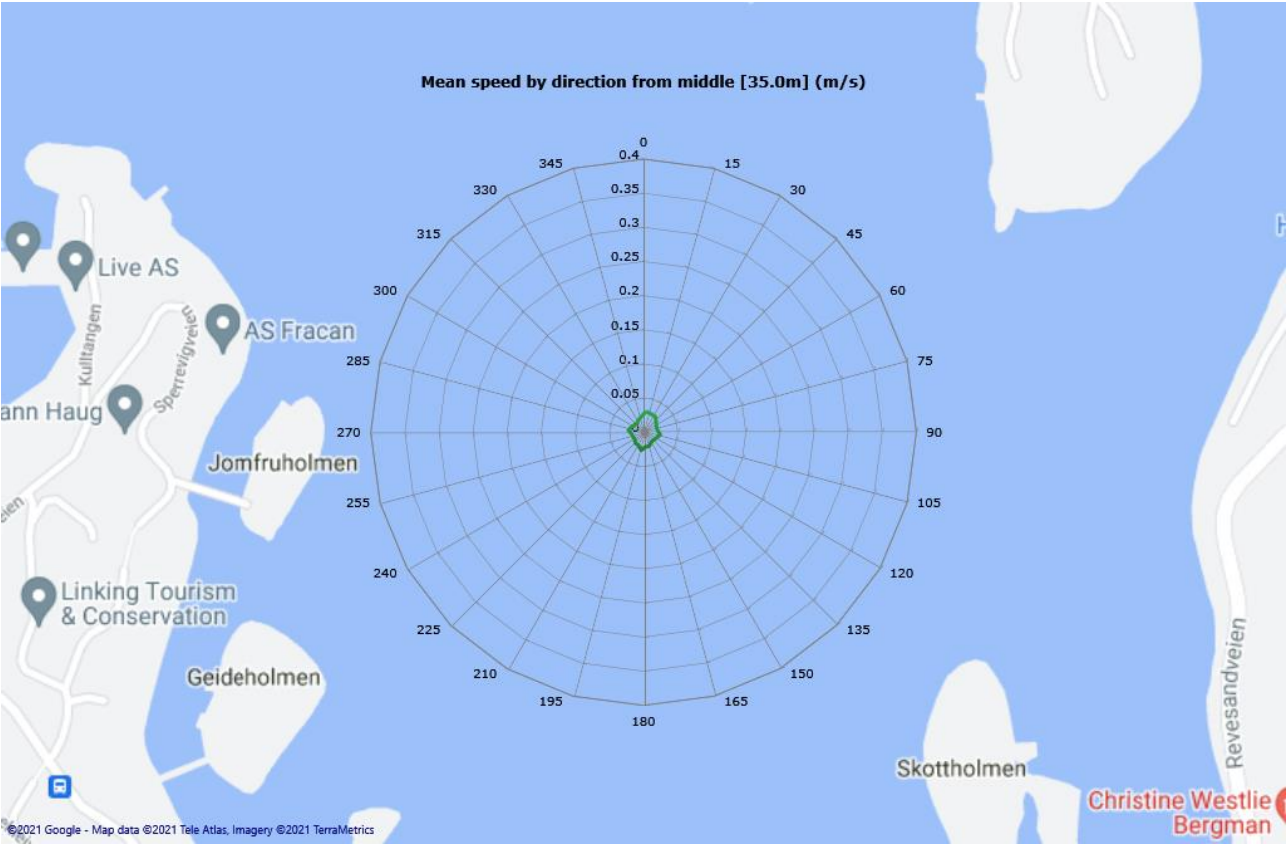


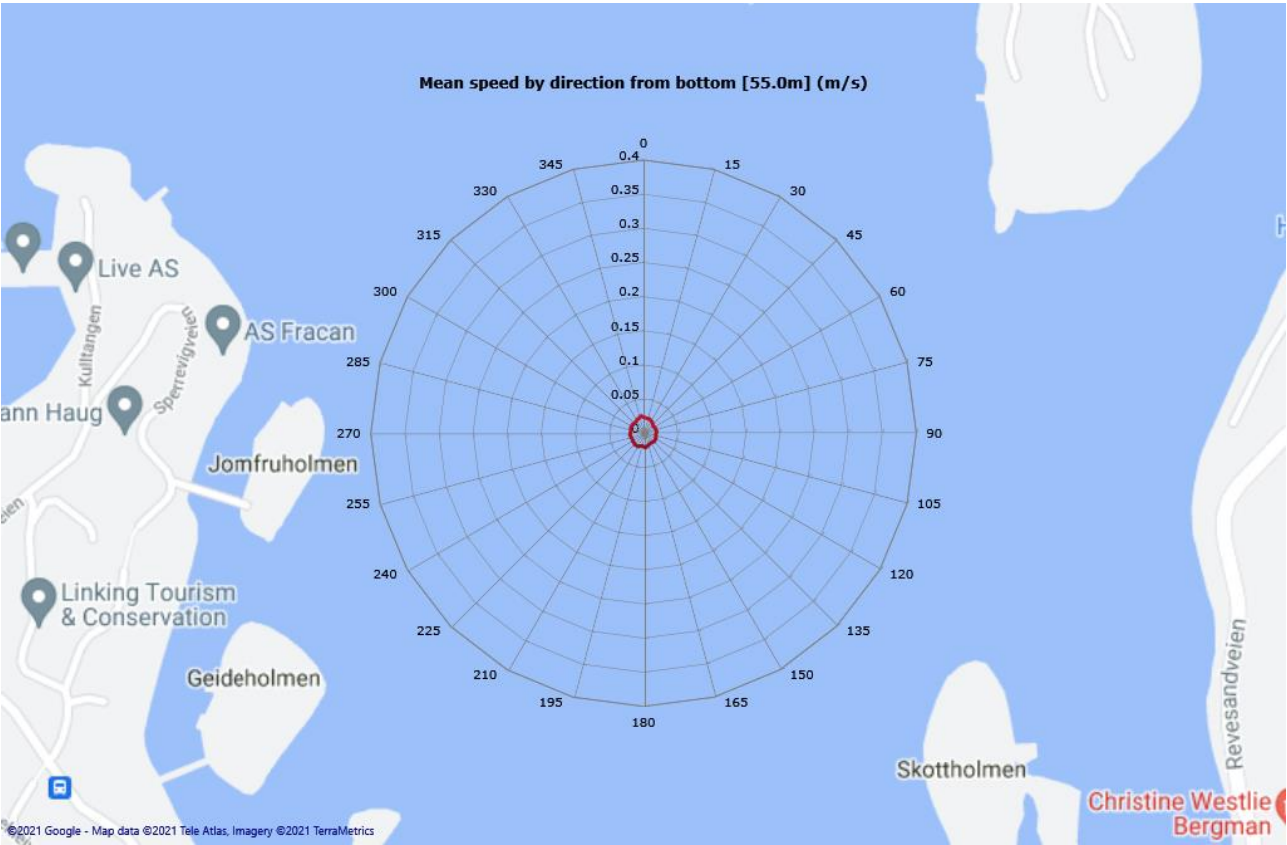
Mean speed - roseplot

Top [10.0m]



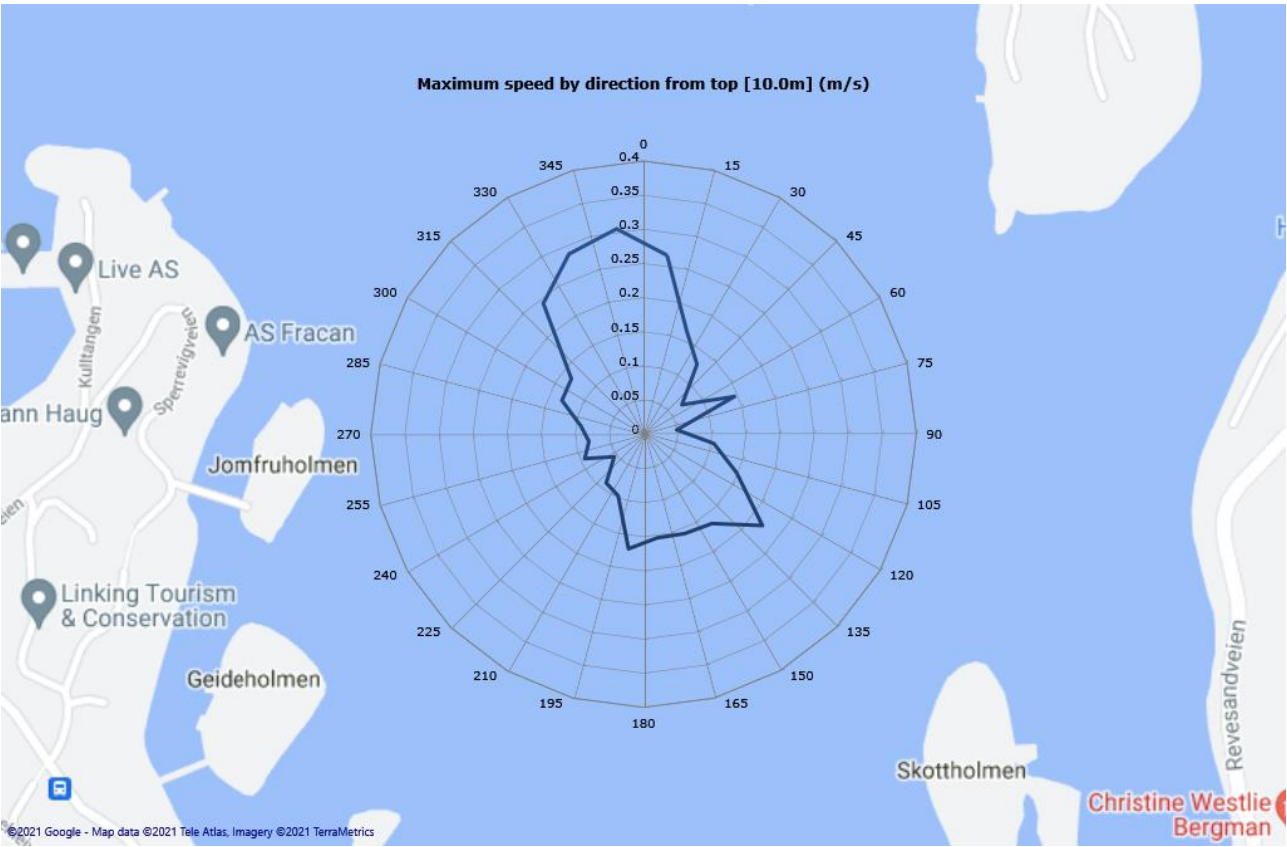
Middle [35.0m]



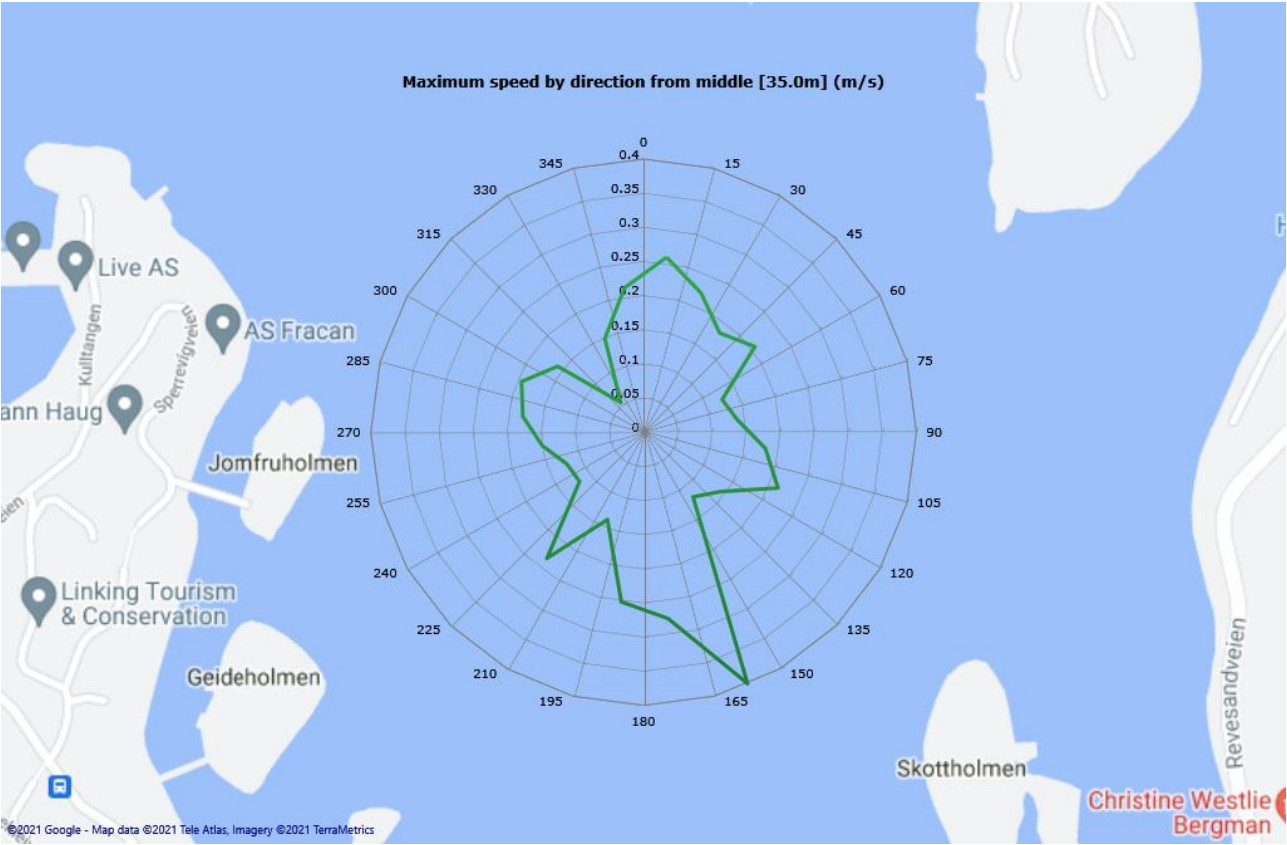


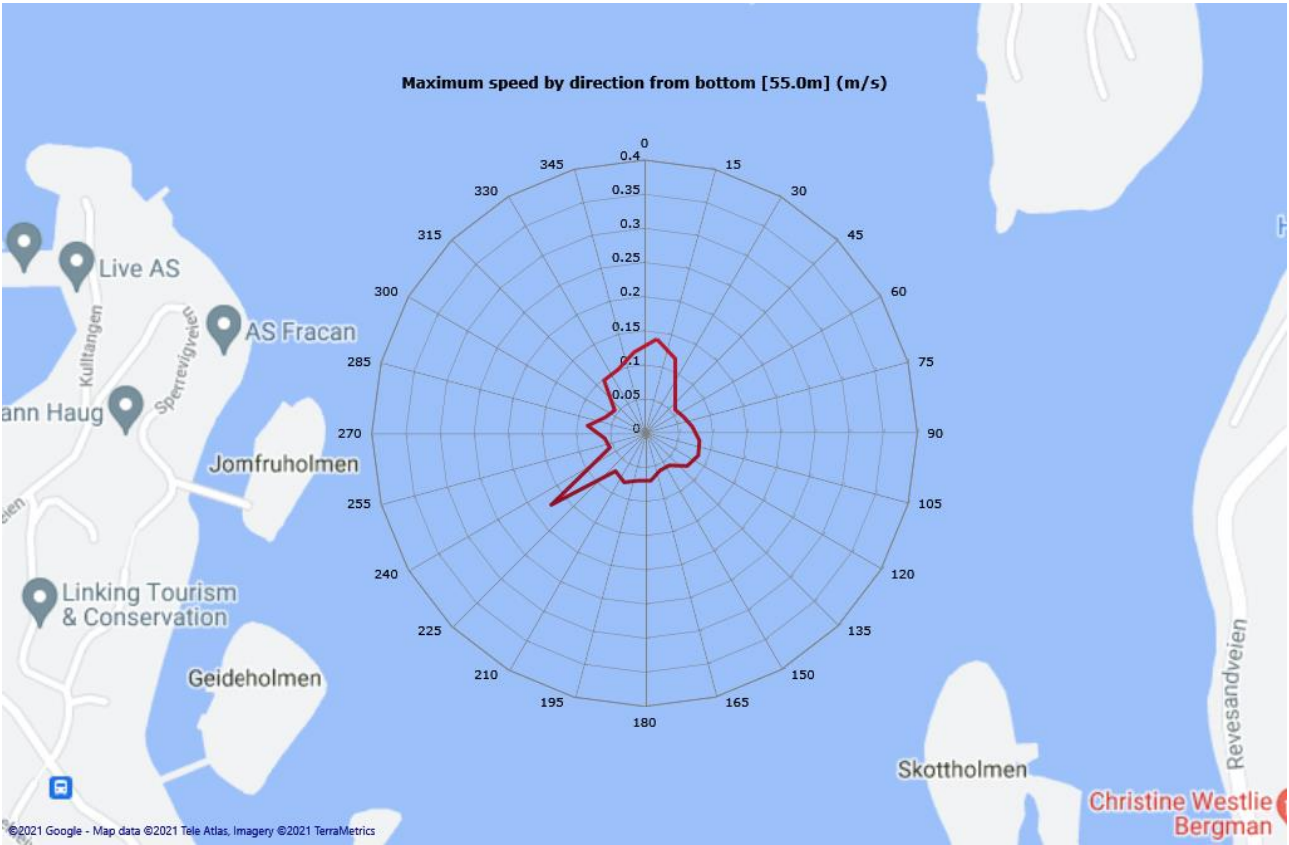
Max speed - roseplot

Top [10.0m]



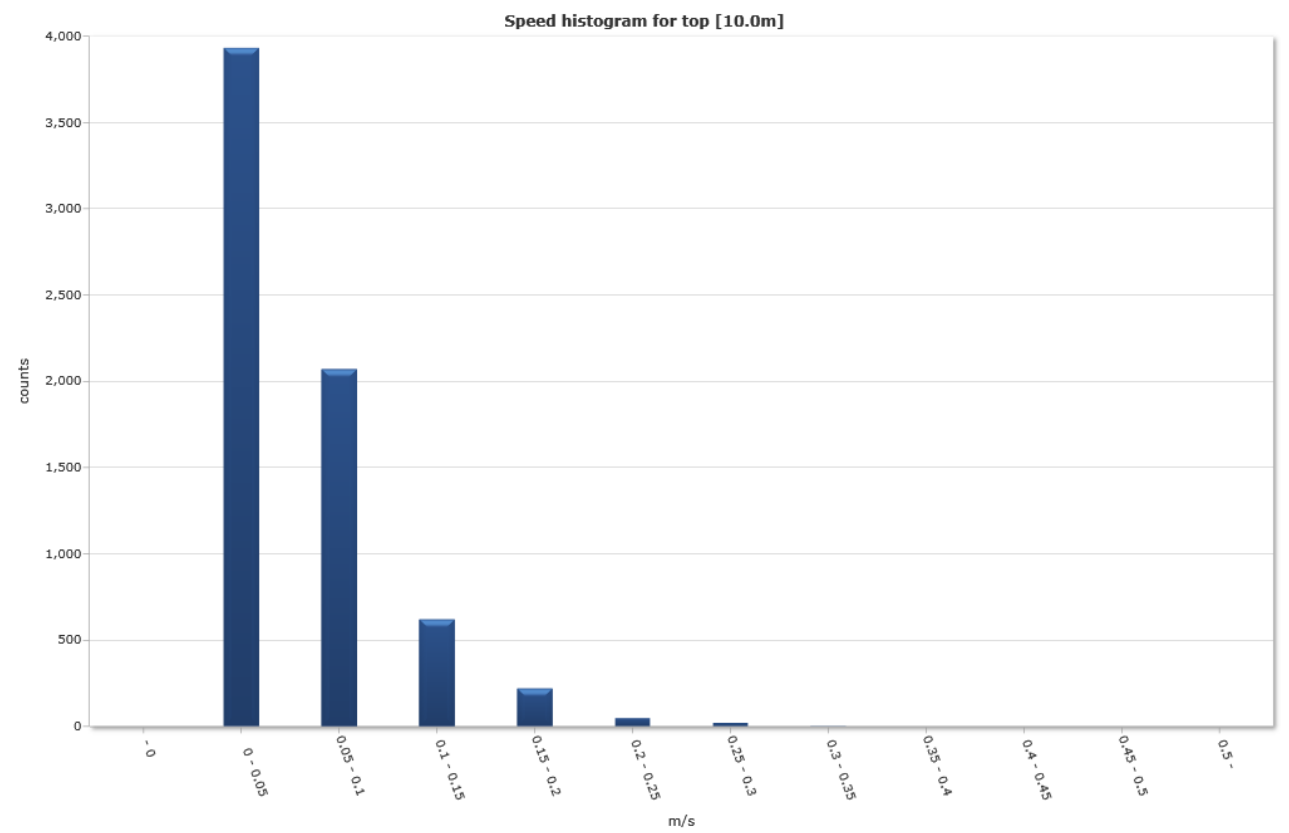
Middle [35.0m]



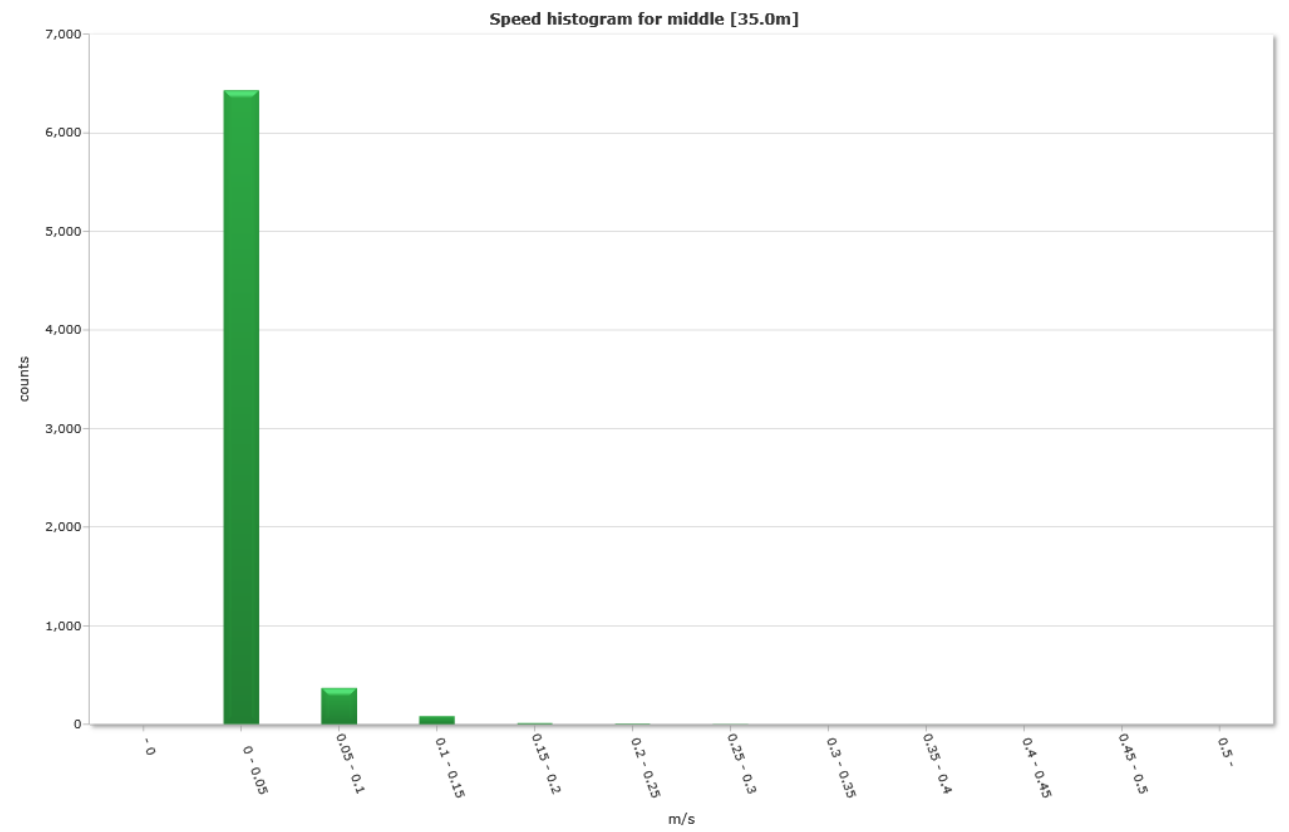


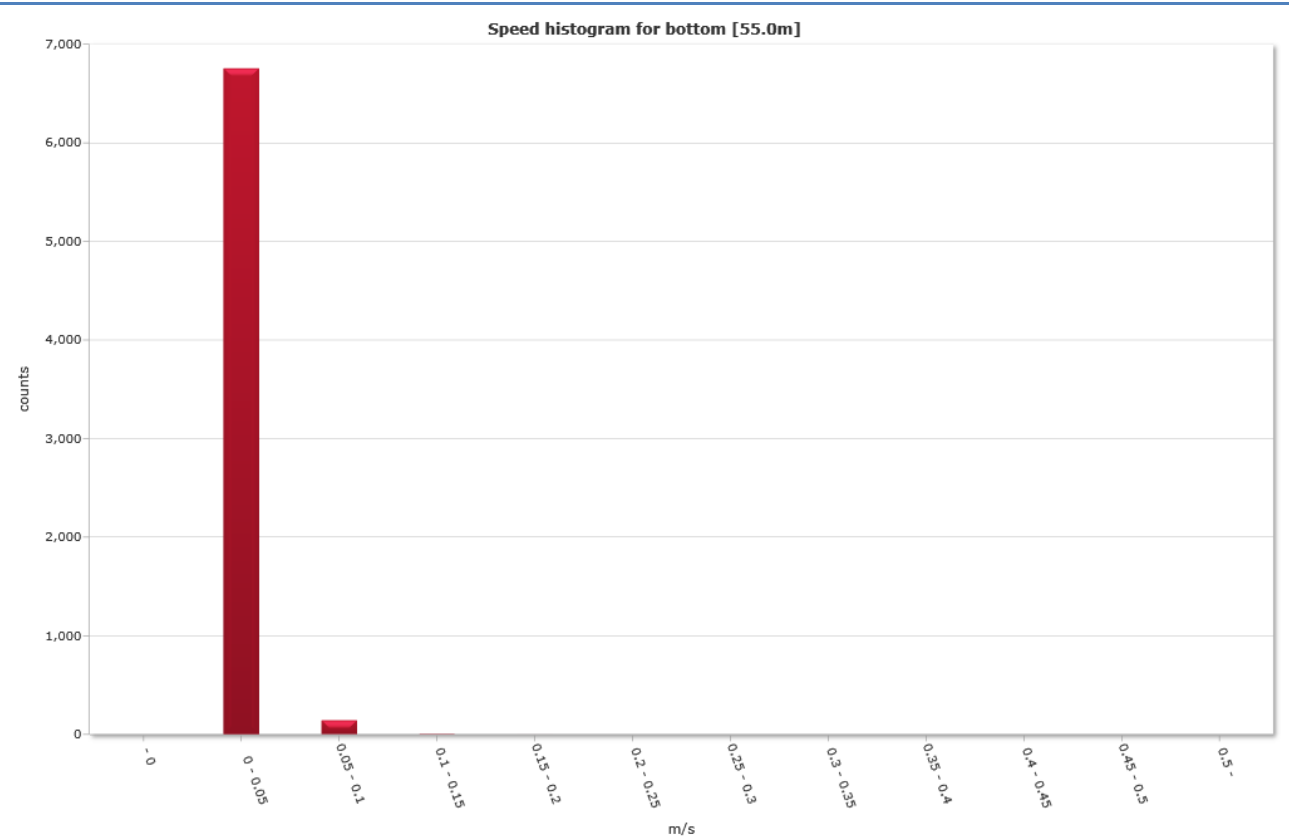
Speed histogram

Top [10.0m]



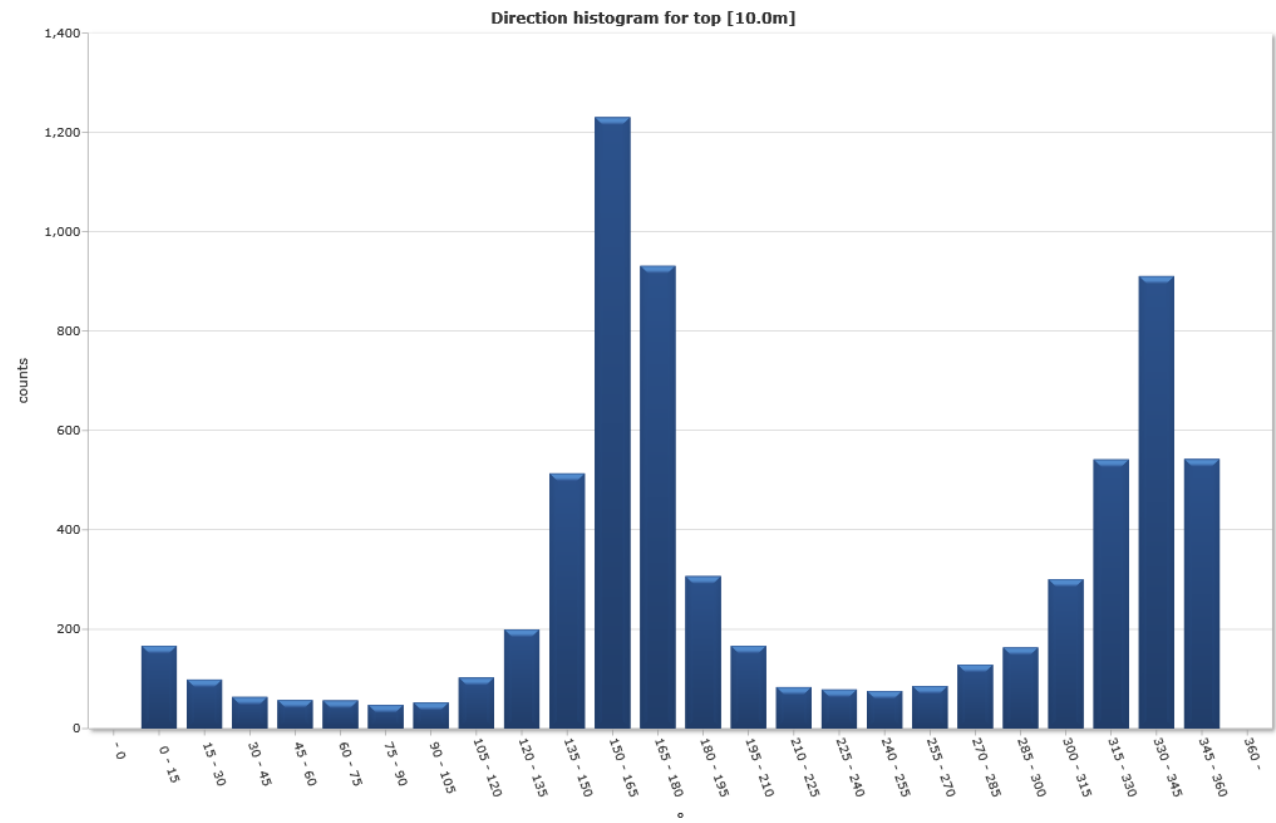
Middle [35.0m]



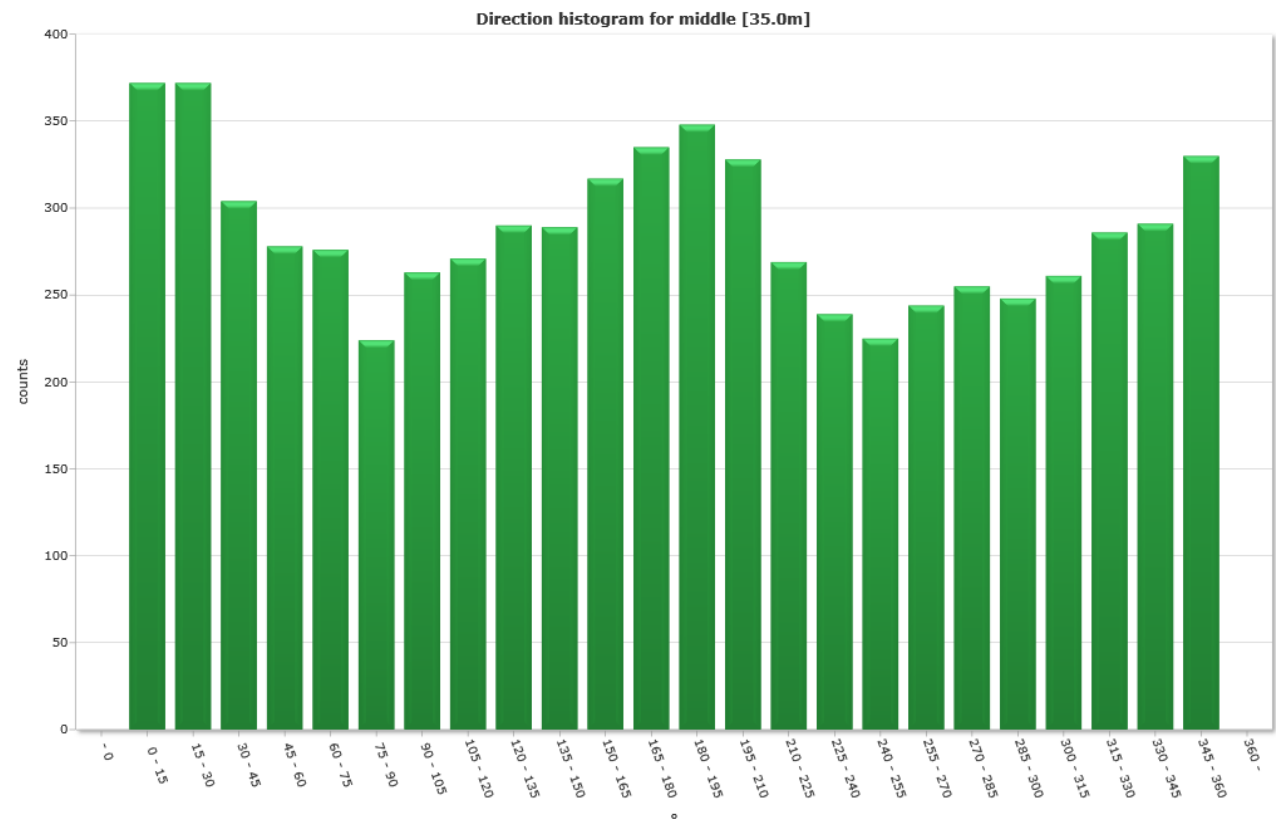


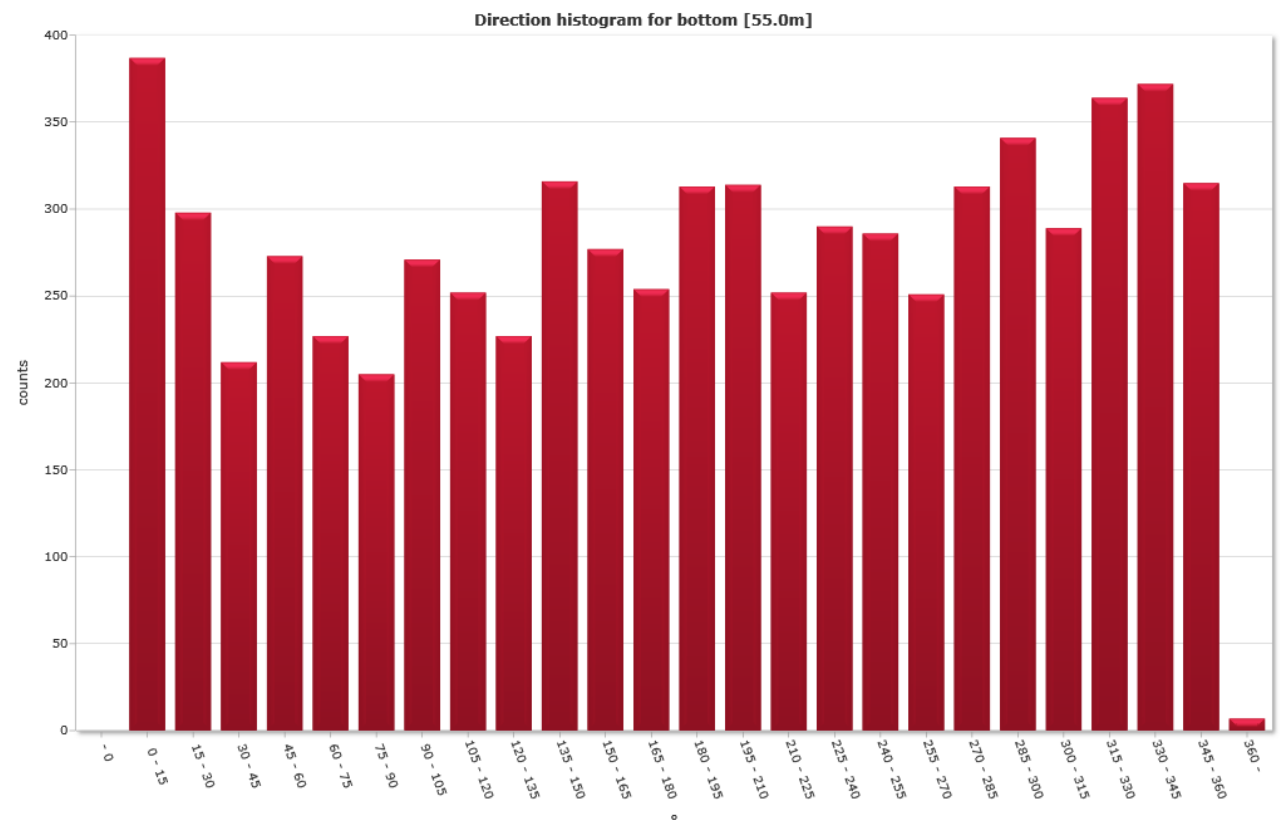
Direction histogram

Top [10.0m]



Middle [35.0m]





Direction/Speed histogram

Top [10.0m]

° m/s	Direction/speed matrix for top [10.0m]																								%	Sum
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	%	Sum
0.05	132	82	62	56	55	48	51	88	166	332	520	505	260	157	77	78	74	77	111	131	192	229	247	203	56.9	3933
0.10	25	12	1	2	1	0	1	12	28	154	616	406	41	10	7	1	2	9	18	31	90	185	273	145	29.9	2070
0.15	6	3	1	0	1	0	1	3	5	24	91	19	4	0	0	0	0	0	0	2	19	108	239	94	9.0	620
0.20	3	2	0	0	0	0	0	0	0	4	4	2	2	0	0	0	0	0	0	0	0	19	120	64	3.2	220
0.25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	23	24	0.7	49
0.30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	11	0.3	21	
0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0	2	
0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	
%	2.4	1.4	0.9	0.8	0.8	0.7	0.8	1.5	2.9	7.4	17.8	13.5	4.4	2.4	1.2	1.1	1.1	1.2	1.9	2.4	4.4	7.8	13.2	7.9	100.0	100.0
Sum	167	99	64	58	57	48	53	103	200	514	1231	932	307	167	84	79	76	86	129	164	301	542	911	543	100.0	6915

Middle [35.0m]

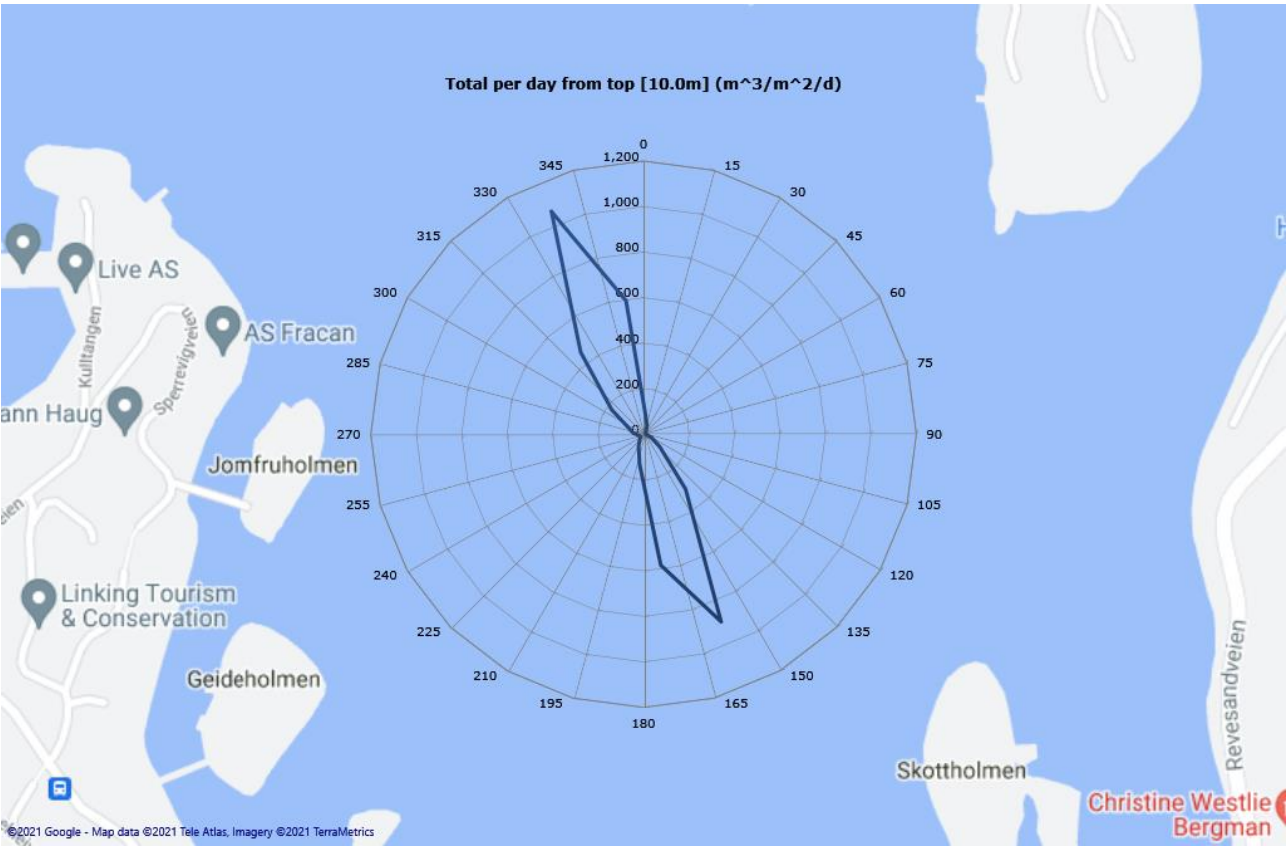
° m/s	Direction/speed matrix for middle [35.0m]																								%	Sum
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360		
0.05	303	311	249	254	261	209	234	255	284	283	306	319	317	304	257	237	220	235	231	238	257	284	280	303	93.0	6431
0.10	55	52	44	18	13	12	22	10	3	5	8	12	20	22	7	1	2	6	16	5	2	2	9	23	5.3	369
0.15	11	8	8	5	2	3	4	3	3	1	2	2	5	2	4	1	3	3	6	2	1	0	2	3	1.2	84
0.20	0	0	3	0	0	0	3	2	0	0	0	1	3	0	0	0	0	0	2	3	1	0	0	0	0.3	18
0.25	2	1	0	1	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	0.1	9
0.30	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0.0	3
0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.40	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	1
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
%	5.4	5.4	4.4	4.0	4.0	3.2	3.8	3.9	4.2	4.2	4.6	4.8	5.0	4.7	3.9	3.5	3.3	3.5	3.7	3.6	3.8	4.1	4.2	4.8	100.0	100.0
Sum	372	372	304	278	276	224	263	271	290	289	317	335	348	328	269	239	225	244	255	248	261	286	291	330	100.0	6915

Bottom [55.0m]

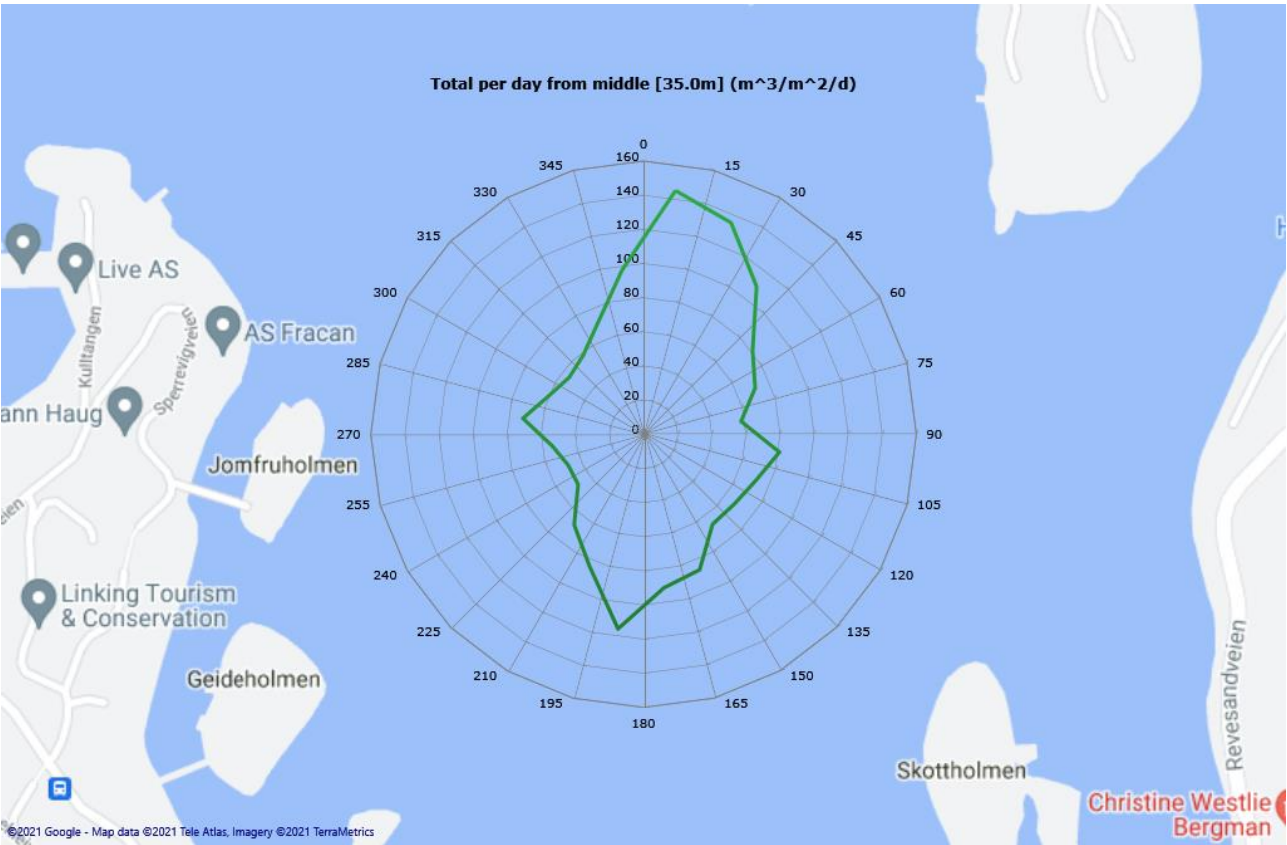
• m/s	Direction/speed matrix for bottom [55.0m]																									
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	%	Sum
0.05	365	286	208	270	224	201	265	248	224	312	275	250	309	307	245	286	284	248	307	334	285	359	359	296	97.8	6747
0.10	20	11	4	3	3	4	6	4	3	4	2	4	4	7	7	3	2	3	6	7	4	5	12	15	2.1	143
0.15	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0.1	8
0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.0	1
0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
%	5.6	4.3	3.1	4.0	3.3	3.0	3.9	3.7	3.3	4.6	4.0	3.7	4.5	4.6	3.7	4.2	4.1	3.6	4.5	4.9	4.2	5.3	5.4	4.6	100.0	100.0
Sum	387	298	212	273	227	205	271	252	227	316	277	254	313	314	252	290	286	251	313	341	289	364	372	315	100.0	6899

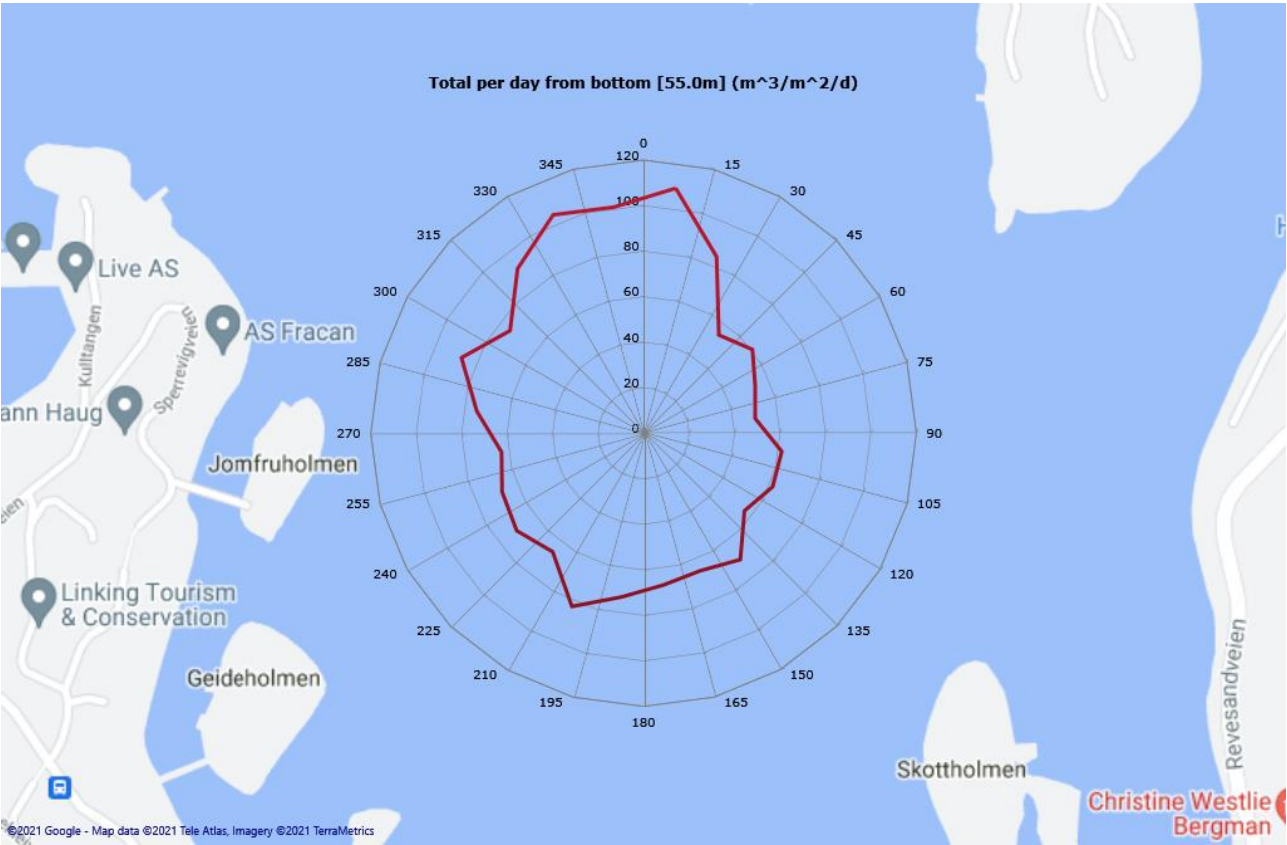
Flow

Top [10.0m]



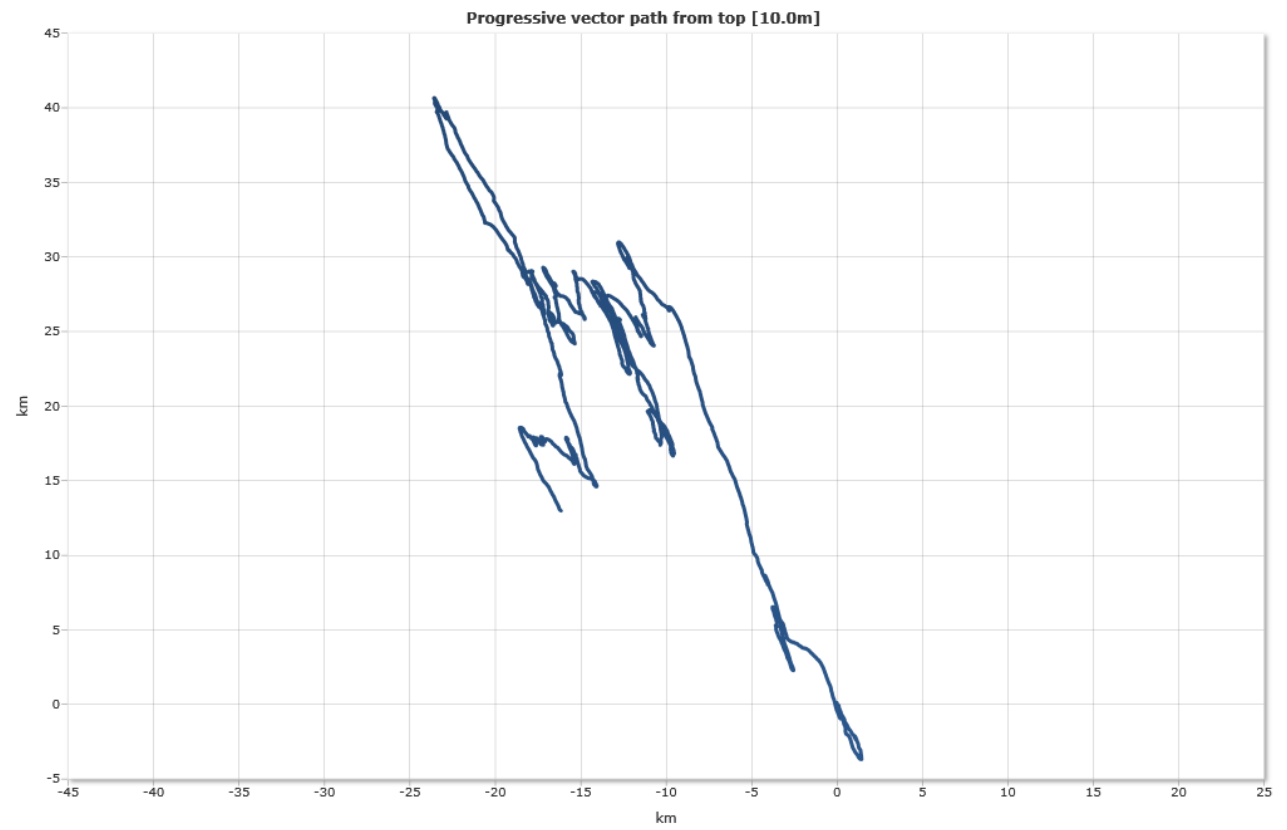
Middle [35.0m]



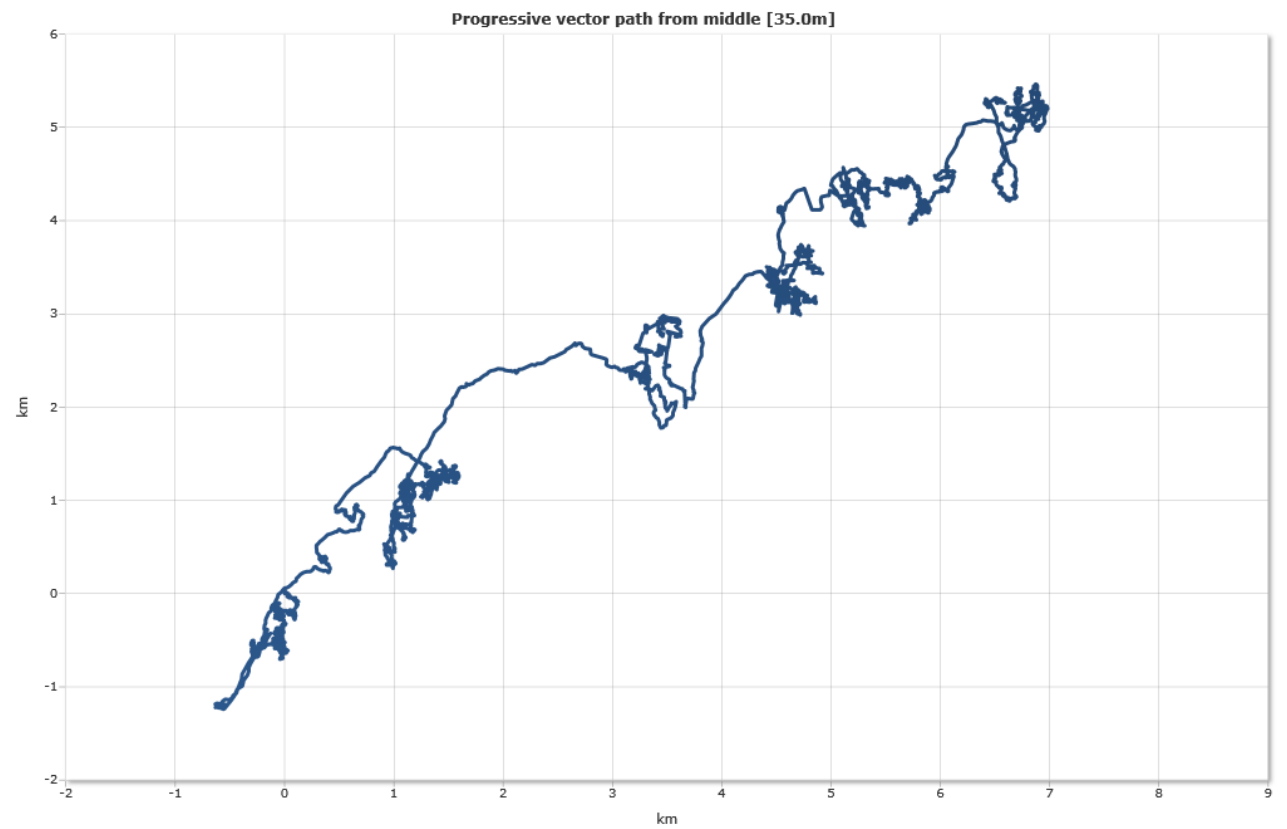


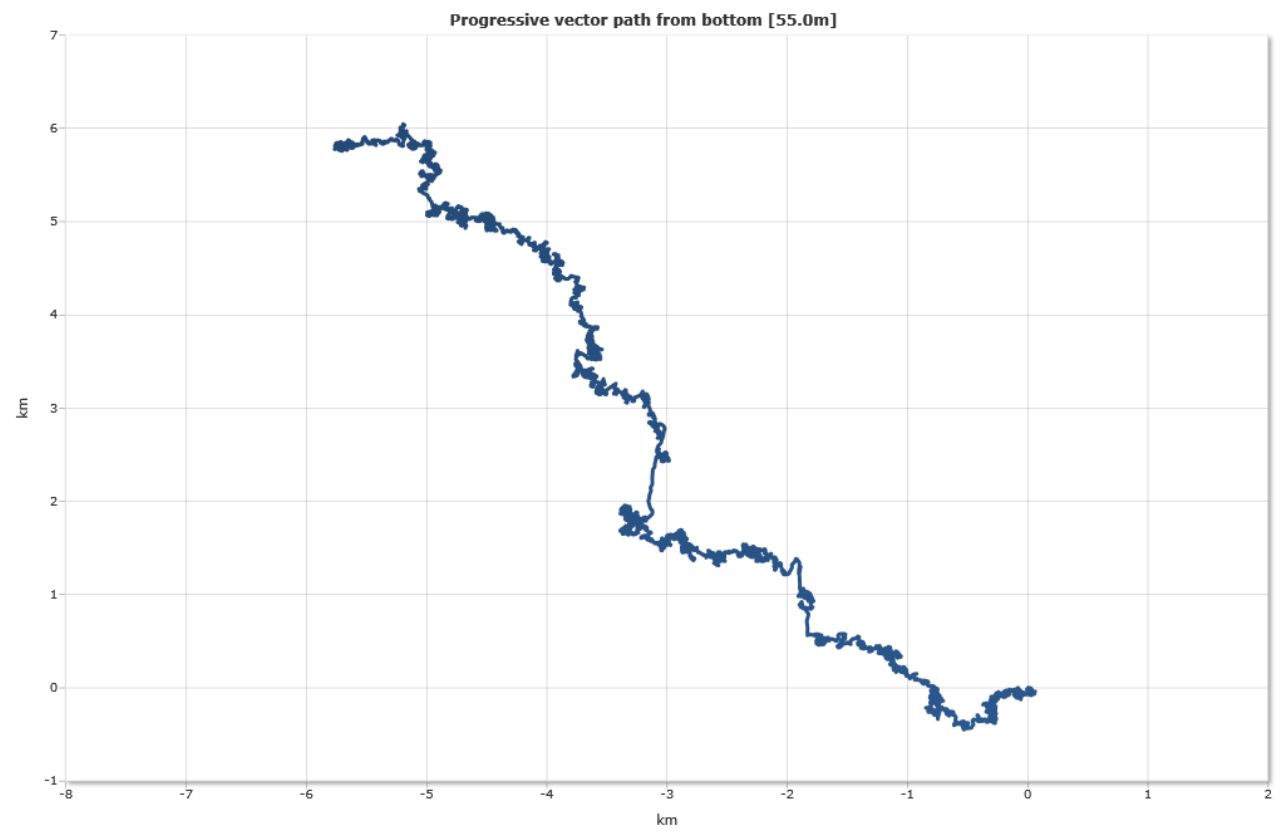
Progressive vector

Top [10.0m]



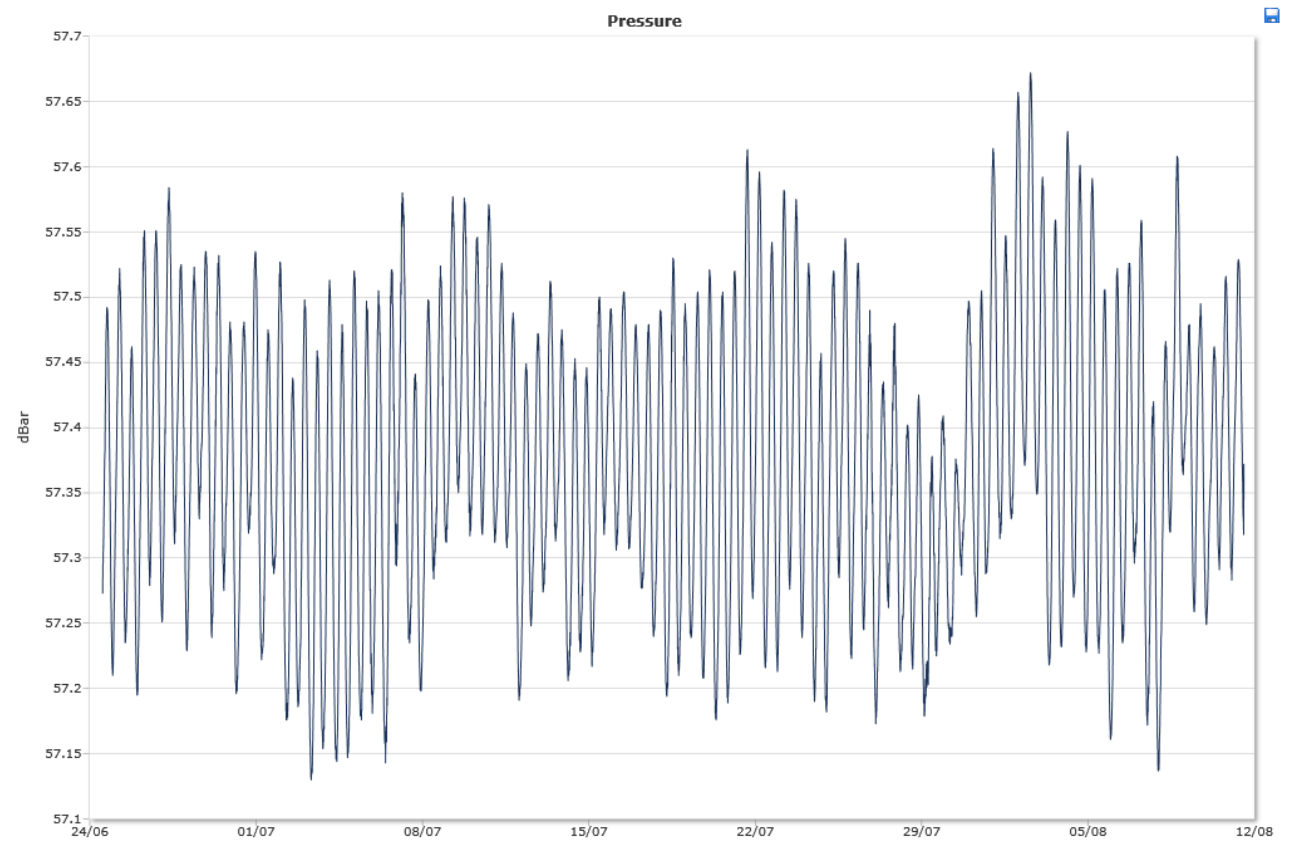
Middle [35.0m]





Sensors

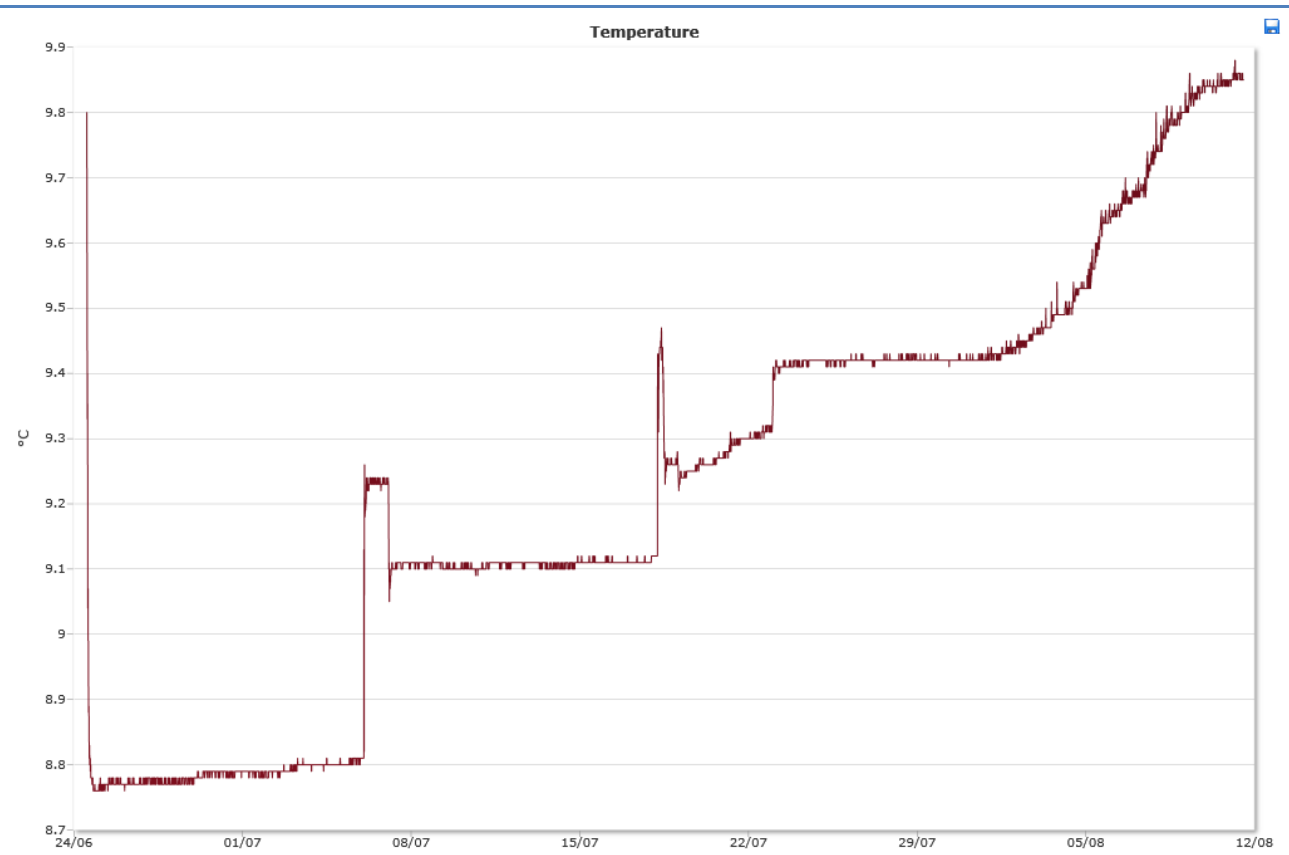
Pressure



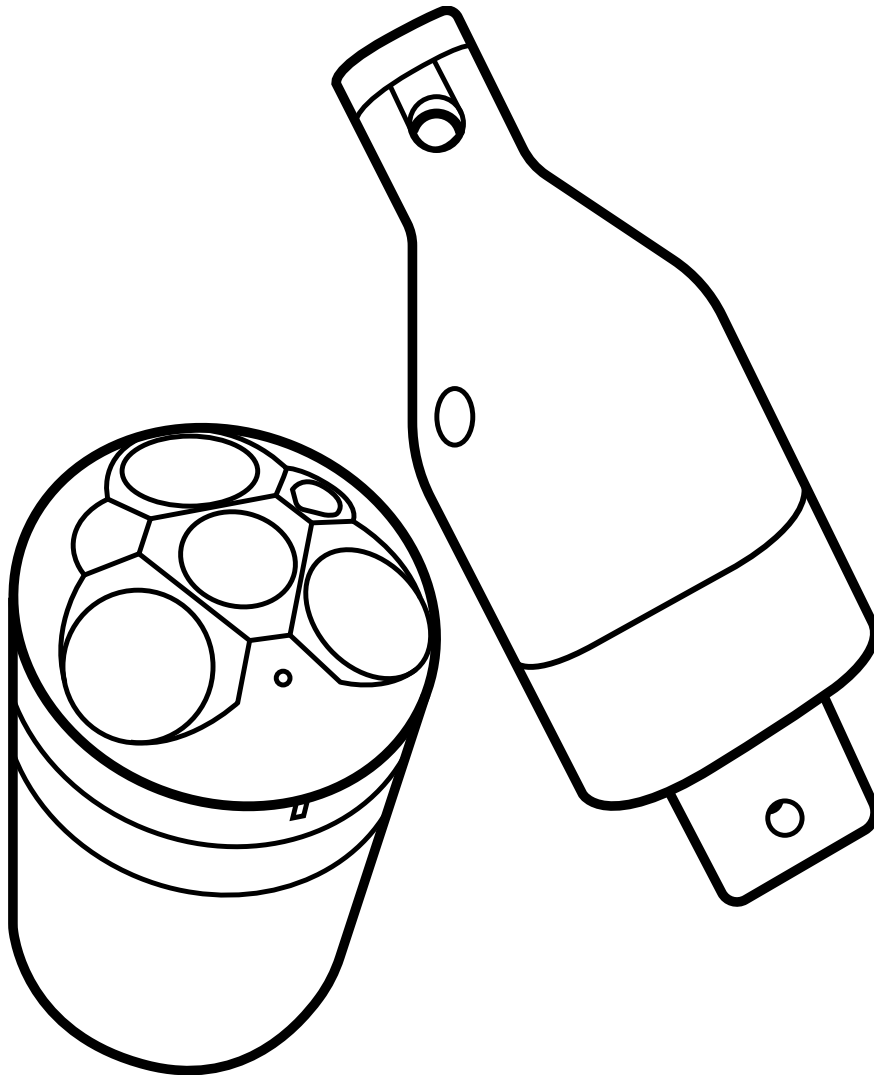
Tilt



Temperature



Eco Deployment Report



Norconsult AS
Karin Raamat
Kjørboveien 22
1337 Sandvika



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Mission

This section contains basic mission information, including information about the instrument used in this deployment mission, a location map and basic data statistics from the mission. All times are referenced to the local time of the device used to configure the Eco. All depths are referenced to the water surface

General info

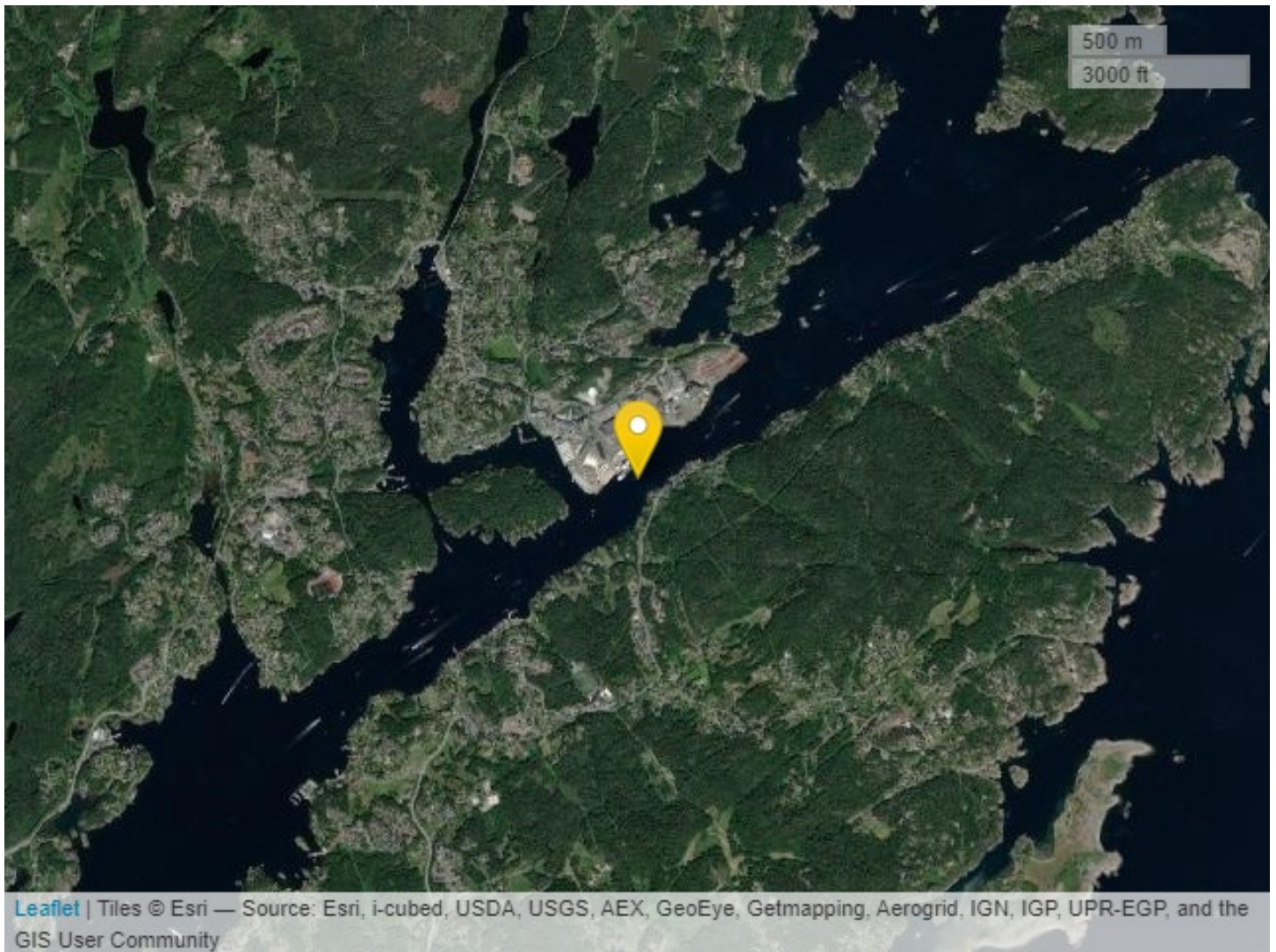
Deployment/File Name: Eco213_20210812081130			
Operator: Karin Raamat			
Full Deployment Date Range: 12.8.2021, 08:11:36 to: 9.9.2021, 12:21:36			
ID	Eco_0213	Firmware	8008.4
Samples	4058	Interval (minutes)	10
Salinity	Salt water	35 ppt	
Latitude	58.495247	Longitude	8.879079
Magnetic declination	3.29788		
Average direction	316.3 deg	Average speed	0.04 m/s
Max Depth Below Surface	11.92 m		
Upper layer depth	5.57 m		
Middle layer depth	7.68 m		
Lower layer depth	9.80 m		
User id	258B34DD-F274-491B-B371-239C53801AFD		
Data id	EC7882FE-5926-47BC-A36C-E4A4691411C2		
Created	9.9.2021, 12:48:08		
Processor version	1.0.22.0		
Processed	9.9.2021, 12:59:31		

Statistics (for Report Date Range only)

		Upper	Middle	Lower	Unit
Speed	Mean	0.05	0.03	0.03	m/s
	Max	0.31	0.36	0.18	m/s
	Min	0.00	0.00	0.00	m/s
	Std. dev	0.04	0.03	0.02	m/s
	Mean	Max	Min	Std. dev	Unit
Temperature	16.8	23.6	15.8	0.5	°C
Pressure	11.7	12.0	0.0	0.6	m
Tilt	1.5	15.3	1.2	0.4	deg

Location

Deployment location: Latitude 58.495247 and Longitude 8.879079.

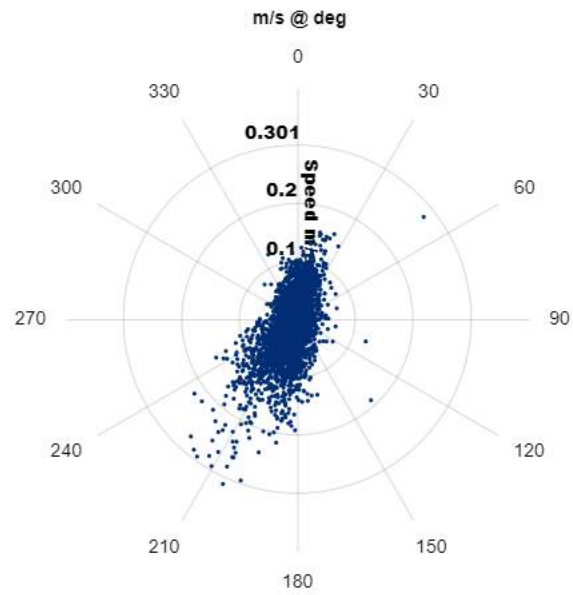


Figures

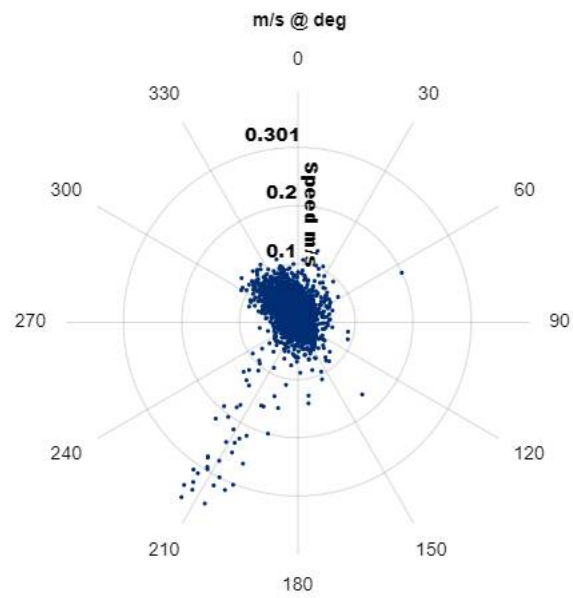
Polar Scatter Plots

These plots show the current speed and direction in a polar coordinate graph (North at the top, 0°) for each of the three depth layers. Data is shown for the Report Date Range. The numbers on the outside of the graph indicate the direction the current is flowing towards for that layer. For example, if a dot is plotted along the 40° line, then it indicates current flowing towards the Northeast. The distance away from the center of the graph indicates how fast the current is flowing: the closer to the center, the slower the water is moving.

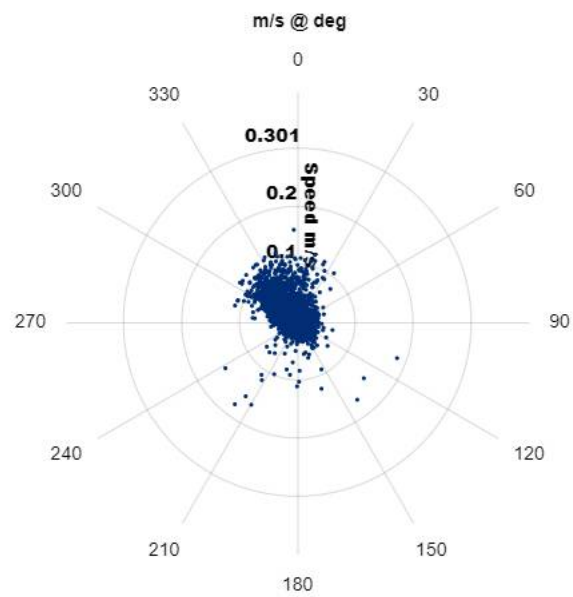
Upper Layer 5.57 m



Middle Layer 7.68 m



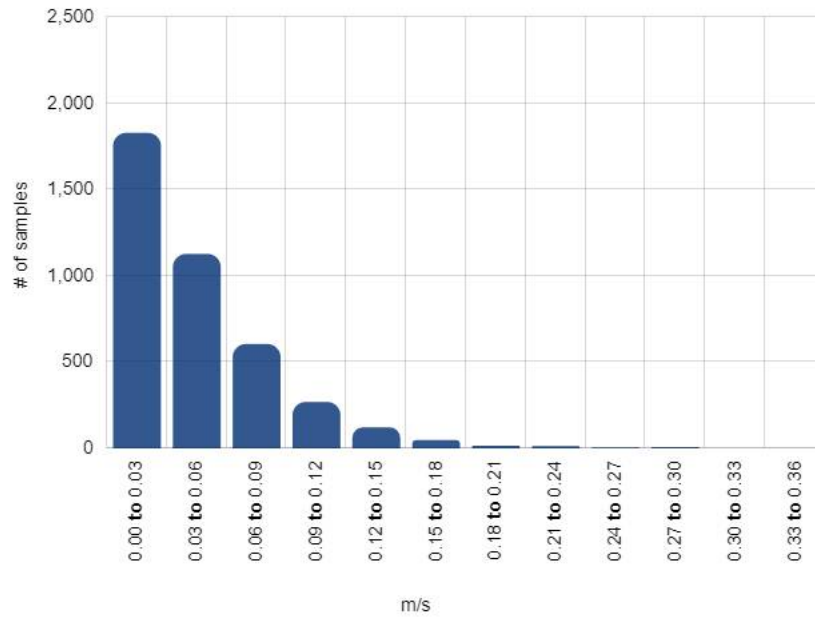
Lower Layer 9.8 m



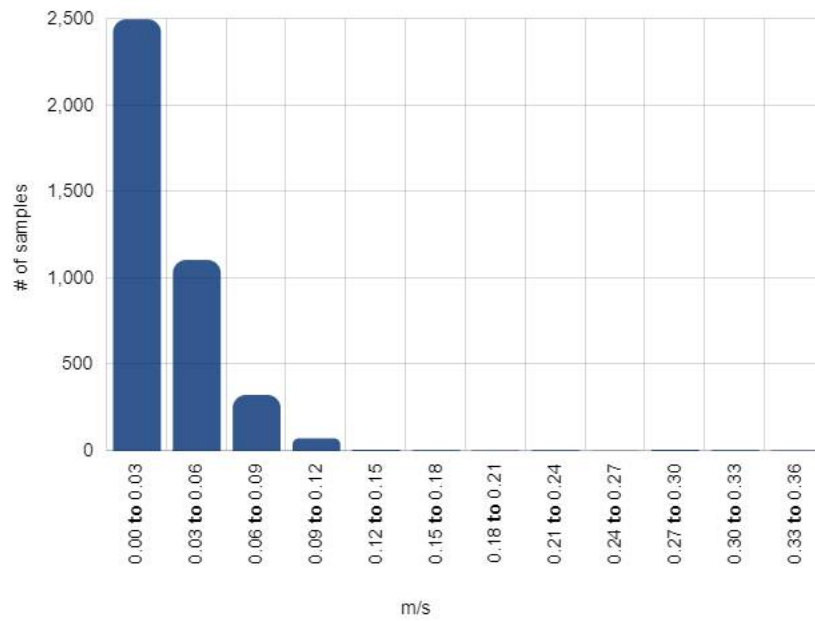
Histogram of Speed

These plots indicate the distribution of current speed for each of the three depth layers. The graph is generated by first taking the current speed data from the Report Date Range and dividing it into intervals of equal size. Then, the number of samples (i.e. an individual measurement interval) in each interval is counted. The numbers on the bottom (X-axis) indicate the speed intervals. The numbers on the left (Y-axis) indicate the number of samples in each interval. For example, if the highest bar on the graph is from the 0.3-0.4 m/s range, then that means that the current speed in this range happens more often than any other speed in the Report Date Range.

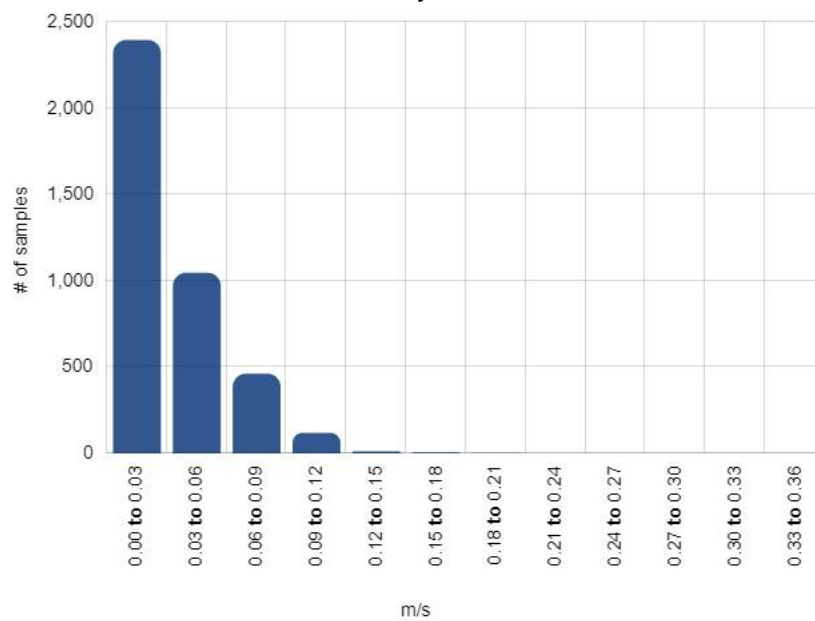
Upper Layer 5.57 m



Middle Layer 7.68 m



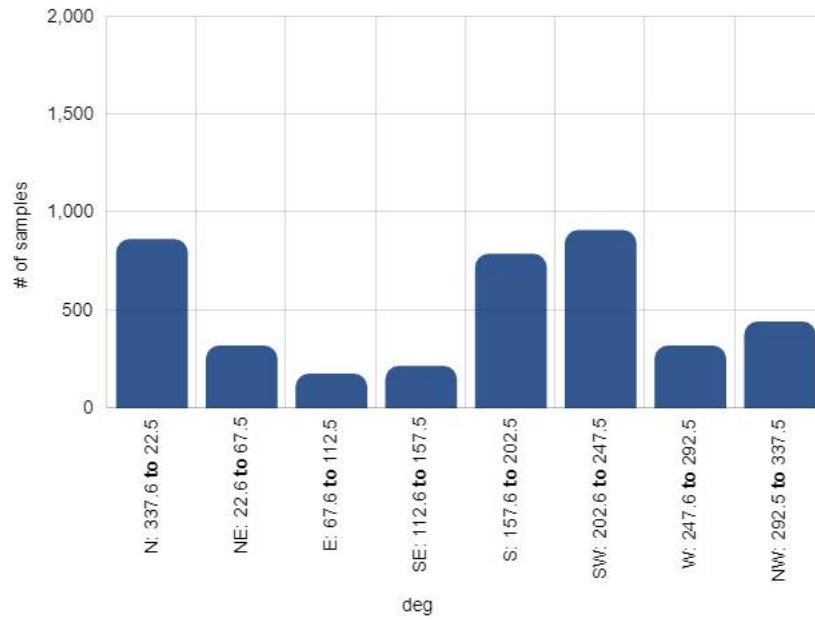
Lower Layer 9.8 m



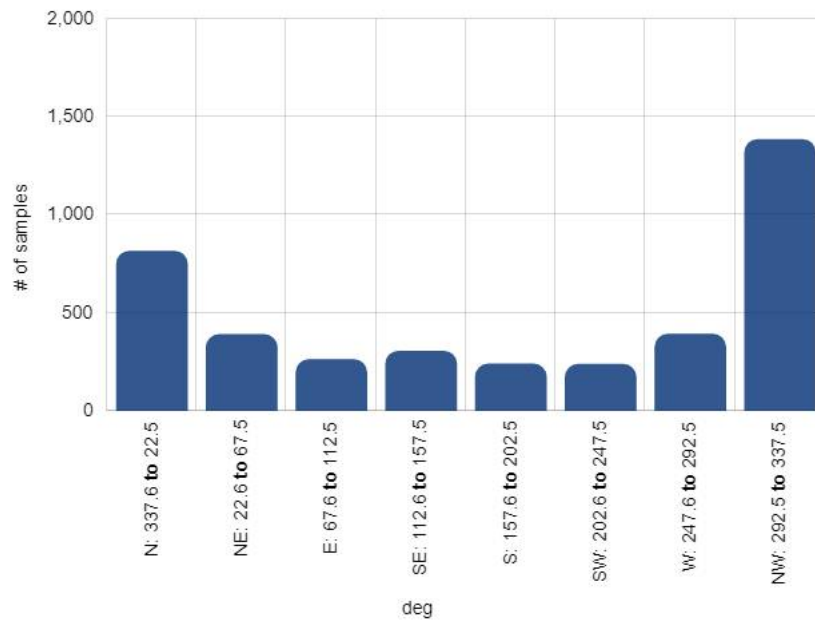
Histogram of Direction

These plots indicate the distribution of current direction for each of the three depth layers. The graph is generated by first taking the current direction data from the Report Date Range and dividing it into ranges of equal size. Then, the number of samples (i.e. an individual measurement interval) in each range is counted. The numbers on the bottom (X-axis) indicate the direction ranges. The numbers on the left (Y-axis) indicate the number of samples in each range. For example, if the highest bar on the graph is from the 90-120° range, then that means that the current direction in this range happens more often than any other direction during the Report Date Range.

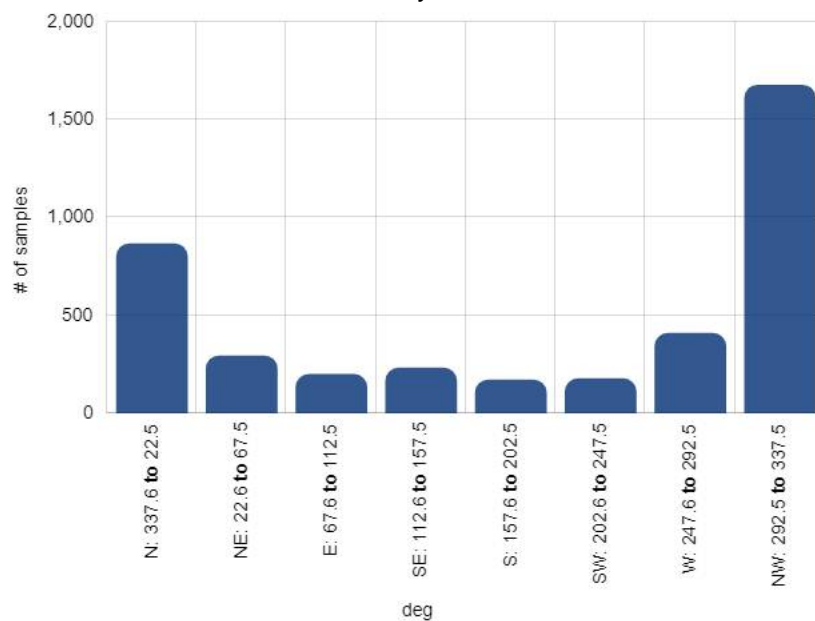
Upper Layer 5.57 m



Middle Layer 7.68 m



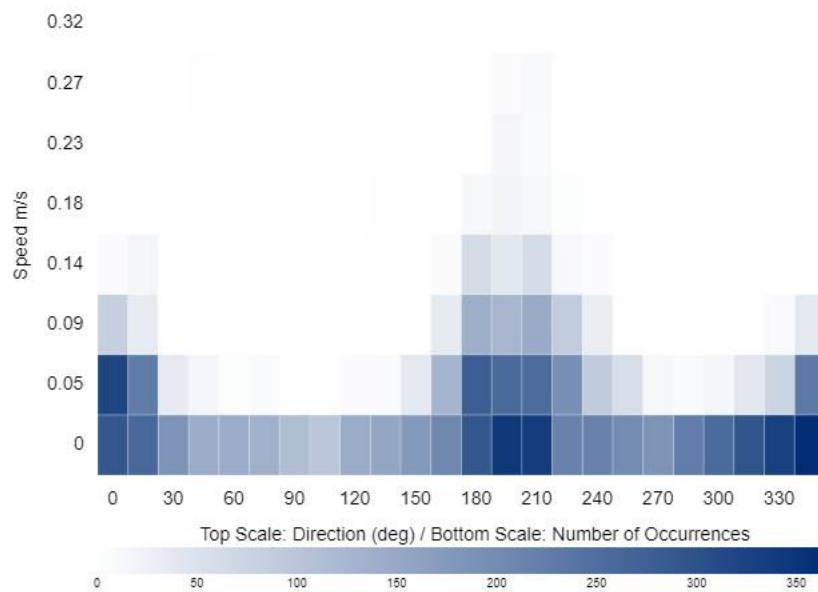
Lower Layer 9.8 m



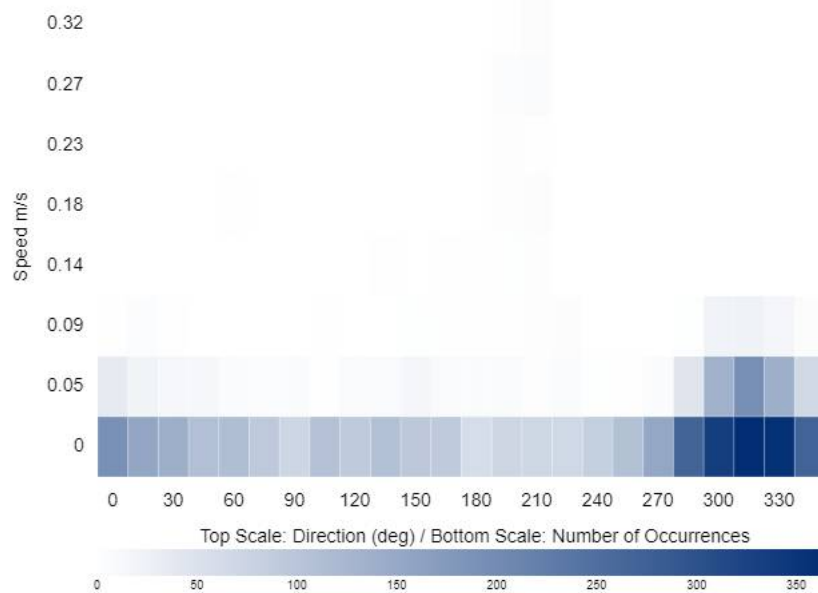
Speed/Direction Occurrence Frequency

These plots combine the speed and direction histograms to show the occurrence frequency of current speed and direction for each of the three depth layers in a cartesian coordinate graph. Data is shown for the Report Date Range. The numbers on the left (Y-axis) indicate the current's speed while the numbers along the lower (X-axis) indicate the direction the current is flowing towards. The color of each block inside the graph indicates the occurrence frequency of that particular speed/direction combination, scaled by the color bar on the bottom. For example, if the block with the darkest color is the intersection of 270° and 0.3 m/s, then that means that the currents are moving at this speed and direction more often than any other speed/direction.

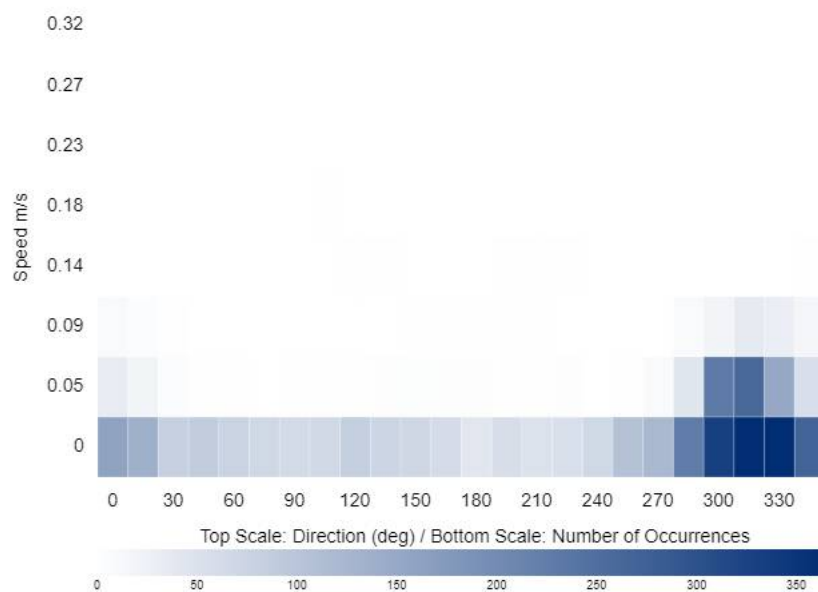
Upper Layer 5.57 m



Middle Layer 7.68 m



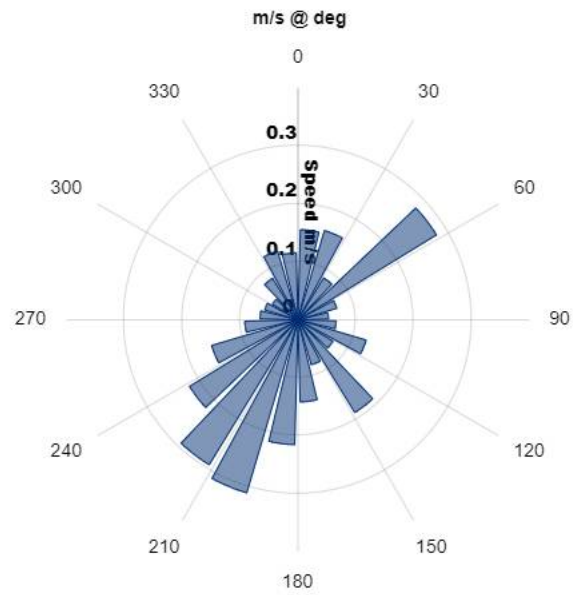
Lower Layer 9.8 m



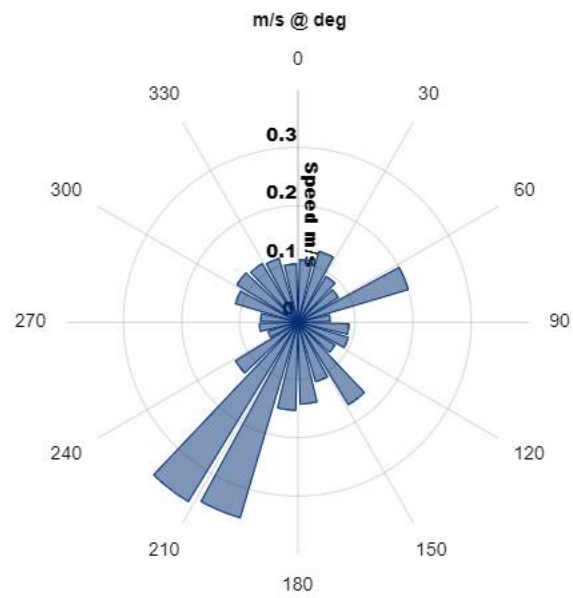
Direction and Maximum Speed

Similar to the Polar Scatter plots, these plots show the current speed and direction in a polar coordinate graph (North at the top; 0°) for each of the three depth layers. However, here only the maximum current speed, and its corresponding direction, are shown. The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 270°, then that means the highest current speed was measured along this direction for this particular depth layer.

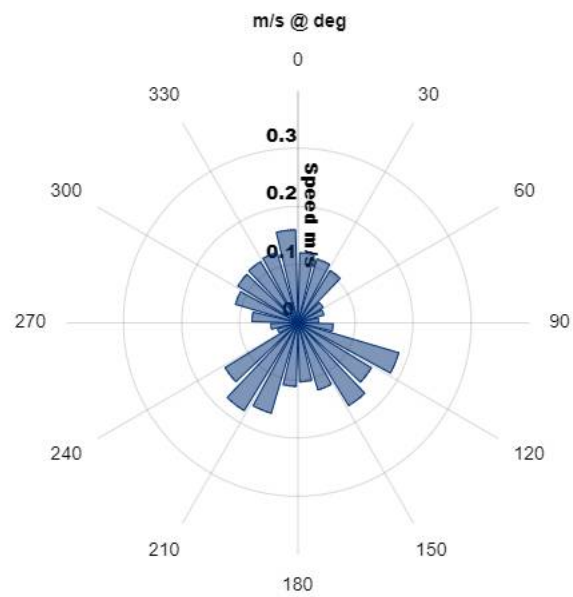
Upper Layer 5.57 m



Middle Layer 7.68 m



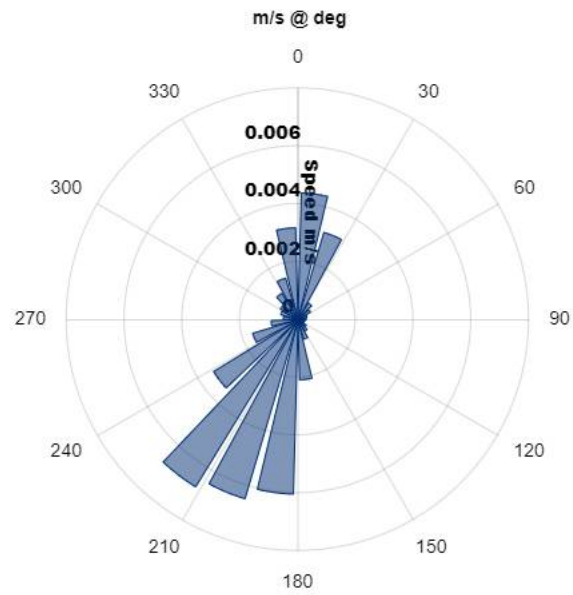
Lower Layer 9.8 m



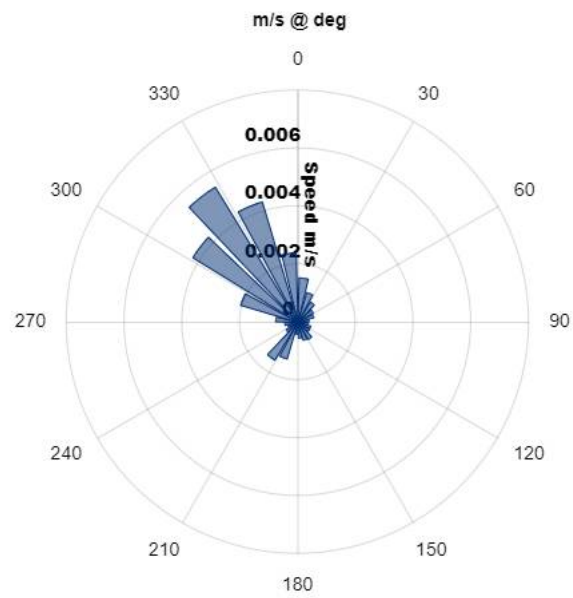
Direction and Mean Speed

Similar to the Polar Scatter plots, these plots show the current speed and direction in a polar coordinate graph (North at the top; 0°) for each of the three depth layers. However, here only the mean current speed, and its corresponding direction, are shown. The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 180° , then that means the mean (average) current speed was measured along this direction for this particular depth layer.

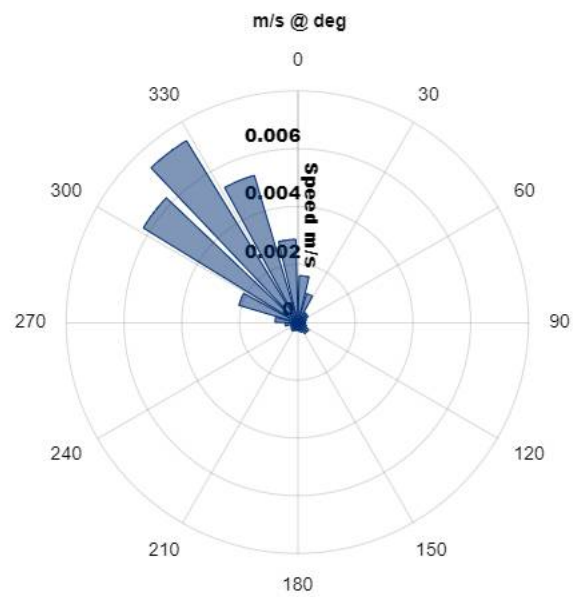
Upper Layer 5.57 m



Middle Layer 7.68 m



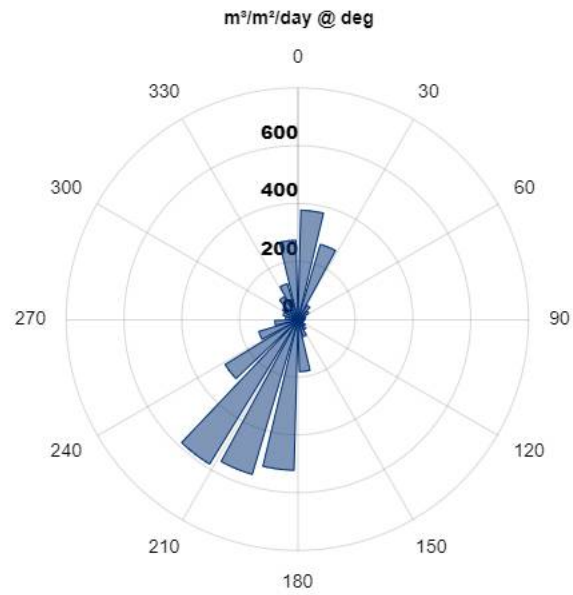
Lower Layer 9.8 m



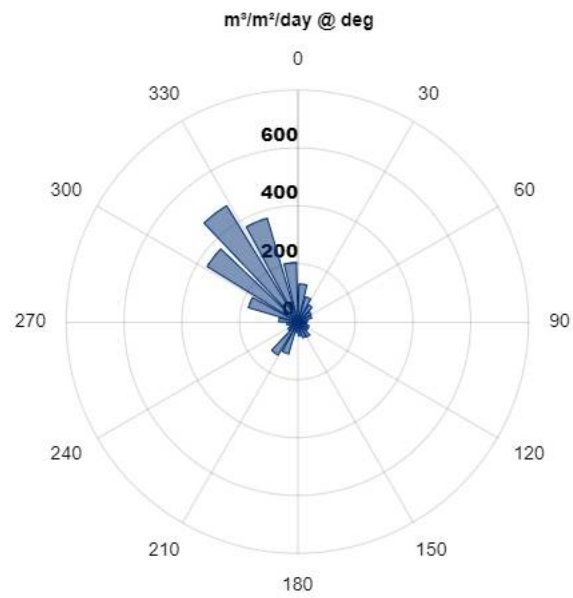
Direction and Flow

These plots show the average volume of water per day (flow) over the cross sectional area of the acoustic cone above the instrument. Data has units of $\text{m}^3/\text{m}^2/\text{day}$ (cubic meter per square meter per day). The data are plotted as bars extending from the center of the graph. For example, if the longest bar (the one extending the farthest from the center of the graph) is at 320° , and the distance from the center of the graph is along the 10,000 inner circle, that means that an average of 10,000 m^3 of water per day flows across the acoustic cone of the instrument for that particular depth layer.

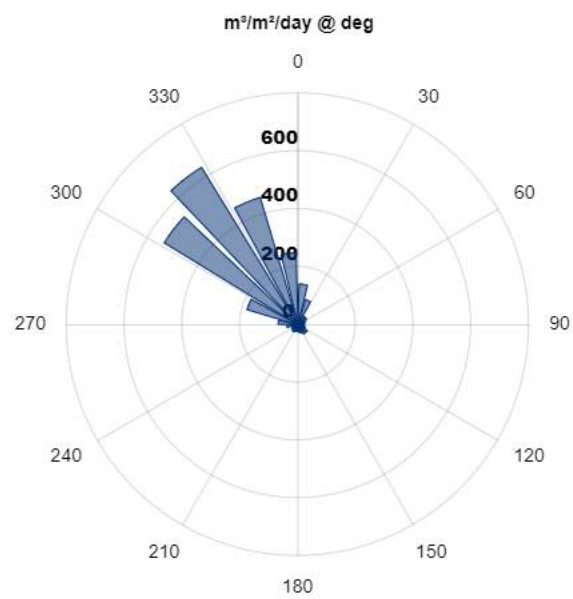
Upper Layer 5.57 m



Middle Layer 7.68 m



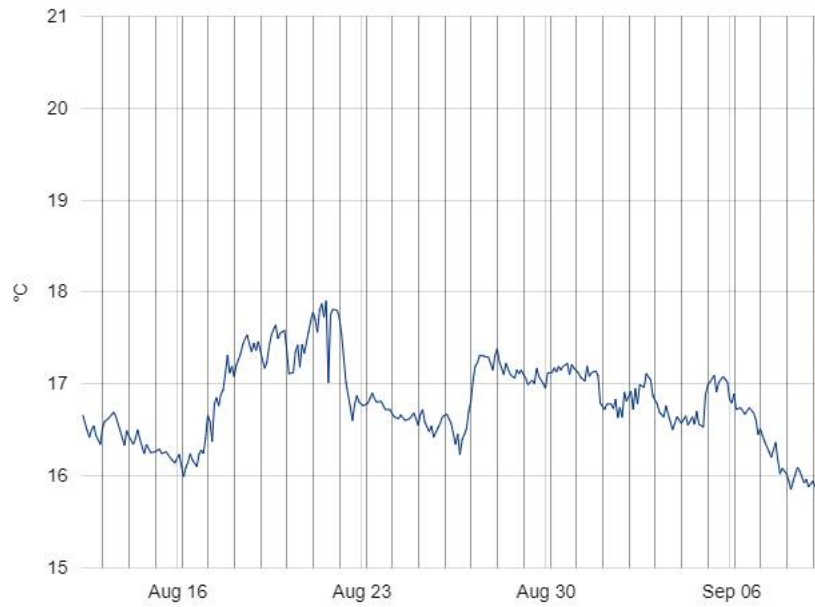
Lower Layer 9.8 m



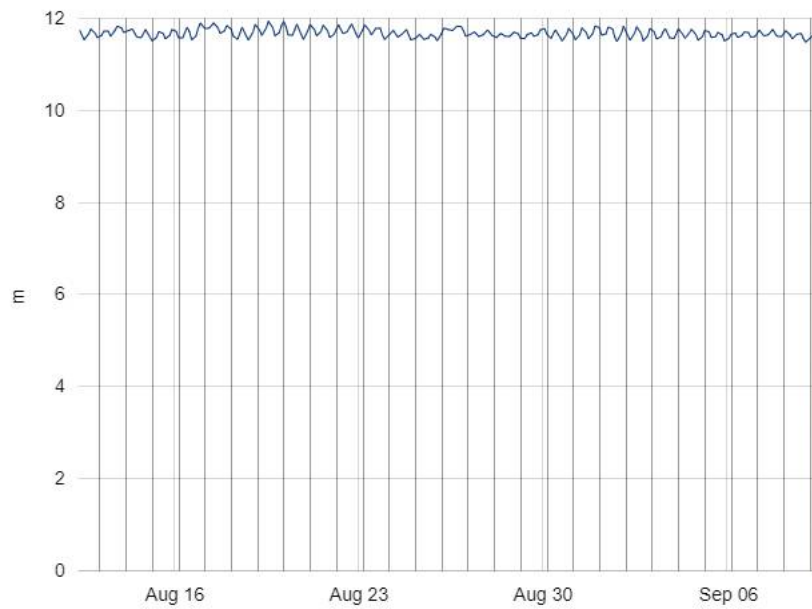
Enviroment

Three plots provide details about the environment over time (i.e. a time-series). These include: water temperature, water pressure (depth) and instrument tilt angle. Data is shown for the Report Date Range. The number on the bottom (X-axis) indicate the date/time while the numbers of the left (Y-axis) indicate the respective data value.

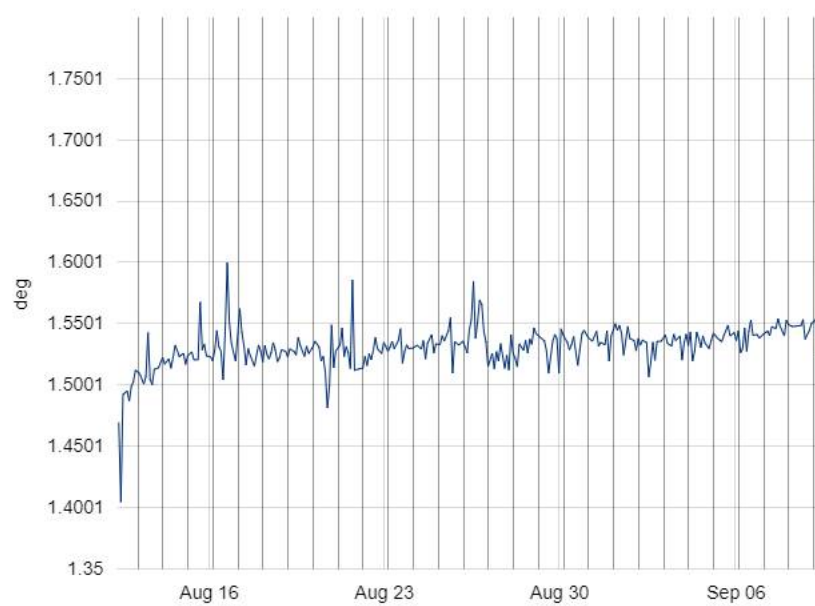
Temperature



Pressure



Tilt

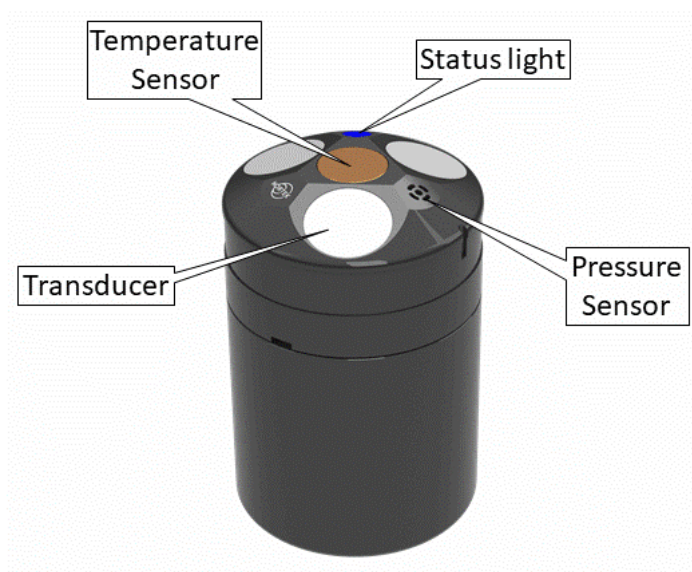


Nortek Eco

Nortek designs, develops and produces scientific instruments that apply the Doppler principle to underwater acoustics in order to measure water in motion, such as currents and waves. We provide truly innovative, robust, and accurate instruments, backed up by advanced software and comprehensive support to ensure customers maximize value from their measurements. To learn more about Nortek, please visit our website at

www.nortekgroup.com.

The Nortek Eco is a class of oceanographic instruments called Acoustic Doppler Current Profilers (or ADCPs). As the name suggests, an ADCP uses the acoustic Doppler principle to measure current speed and direction at different depths, all from a single instrument. The Nortek Eco is the world's first portable ADCP and it was designed specifically to measure currents in shallow waters (up to 20 m depth).



The Nortek Eco and its main components.

Measurement principle

To measure water speed, the Nortek Eco transmits acoustic pulses that propagate upward through the water column. These pulses reflect off the particles in the water, generating echoes that are detected by the instrument. From this detection, the Eco uses the Doppler principle to compute the current's speed and direction. The acoustic pulses transmitted by the Eco originate from the three white circles (called transducers) on the instrument's top.

How to interpret the data

Data from the Nortek Eco can be read directly from the graphs generated in this report. All of the data have already been processed so no further processing is required. The Nortek Eco has a maximum profiling range of 20 m. This means that it can detect the current speed and direction as far as 20 m above it.

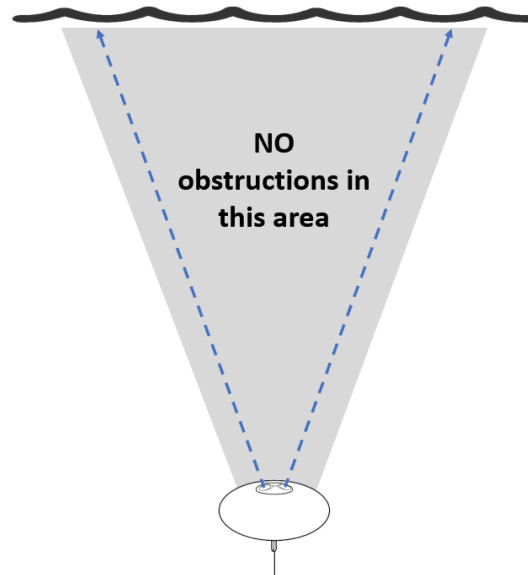
The water column above the Eco is divided into three layers: Upper, Middle and Lower. The Lower layer is the one closest to the Eco and the Upper layer is the one farthest from the Eco (that is, closest to the surface). Both the WebApp and this report provide the depth for each layer. For further details, see the next Section.

The velocity inside each layer is referenced to Earth coordinates, with direction being the direction that the current is flowing to. So for example, a velocity of 0.6 m/s at 90° for the upper layer means the top of the water column is flowing to the East at 0.6 m/s.

The Nortek Eco also records water pressure (depth), water temperature and its own tilt. These data are provided as time series along with the current speed data.

Sources of error

The Nortek Eco automatically processes all data collected, excluding data that do not meet quality standards, so you can be sure you are getting valid data for your deployment missions. Despite this robust internal processing, some conditions may increase the chances of collecting low quality data and should be avoided. These include: high tilt, blocked pressure sensor and blocked transducer. To minimize these effects, please ensure the following conditions are met for each Eco deployment mission:



Gray area (acoustic cone) must be free from obstructions during a mission. Angle of cone is 40°.

END OF REPORT

Strømmålinger Eydehavn dumpeområde

Innseiling Arendal

10/14/2021

Norconsult AS

Karram

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Details

Instrument

Head Id	102819
Board Id	I-3
Frequency	500

Configuration

File	S102819A004_Eydedeponi_avgd.ad2cp
Start	11.08.2021 21:44
End	09.09.2021 19:04
Data Records	4161
Longitude	8° 53.46' E
Latitude	58° 29.99' N
Orientation	UP
Cells	25
Cell Size [m]	2
Blanking Distance [m]	0.5
Average Interval [sec]	00:02:00
Measurement Interval [sec]	00:10:00

Quality

Low Pressure Threshold	0
HighTilt Threshold	30
Expected Orientation	UP
Amplitude Spike Threshold	70
Velocity Spike Threshold	5
SNR Threshold	3
Correlation Threshold	50

Post processing

Selected Start	12.08.2021 10:25
Selected End	09.09.2021 10:35
Selected Records	4033
Reference	Water Surface
Top Depth [m]	10
Top Invalid Data	0
Middle Depth [m]	25
Middle Invalid Data	0
Bottom Depth [m]	42
Bottom Invalid Data	4

Statistics

Top [10.0m]

Mean current [m/s]	0.05
Max current [m/s]	0.19
Min current [m/s]	0.00
Measurements used/total [#]	4033 / 4033
Std.dev [m/s]	0.04
Significant max velocity [m/s]	0.09
Significant min velocity [m/s]	0.02
10 year return current [m/s]	0.312
50 year return current [m/s]	0.350
Most significant directions [°]	225°, 240°, 210°, 255°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20
Most flow	1740.89m ³ / day at 210-225°
Least flow	8.41m ³ / day at 120-135°
Neumann parameter	0.67
Residue current	0.03 m/s at 223°
Zero current [%] - [HH:mm]	5.93% - 01:00

Middle [25.0m]

Mean current [m/s]	0.05
Max current [m/s]	0.38
Min current [m/s]	0.00
Measurements used/total [#]	4033 / 4033
Std.dev [m/s]	0.05
Significant max velocity [m/s]	0.10
Significant min velocity [m/s]	0.01
10 year return current [m/s]	0.628
50 year return current [m/s]	0.704
Most significant directions [°]	45°, 60°, 240°, 255°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20
Most flow	1224.26m ³ / day at 30-45°
Least flow	11.78m ³ / day at 135-150°
Neumann parameter	0.38
Residue current	0.02 m/s at 32°
Zero current [%] - [HH:mm]	11.23% - 01:00

Bottom [42.0m]

Mean current [m/s]	0.02
Max current [m/s]	0.12
Min current [m/s]	0.00
Measurements used/total [#]	4029 / 4033
Std.dev [m/s]	0.01
Significant max velocity [m/s]	0.03
Significant min velocity [m/s]	0.01
10 year return current [m/s]	0.191
50 year return current [m/s]	0.214
Most significant directions [°]	240°, 195°, 60°, 75°
Most significant speeds [m/s]	0.05, 0.10, 0.15, 0.20

Most flow	79.16m ³ / day at 225-240°
Least flow	41.92m ³ / day at 120-135°
Neumann parameter	0.02
Residue current	0.00 m/s at 32°
Zero current [%] - [HH:mm]	20.58% - 00:40

Sensors

	Mean	Min	Max
Pressure [dbar]	44.05	43.85	44.34
Temperature [°C]	10.46	10.23	11.09
Heading [°]	137.44	131.55	138.45
Pitch [°]	-2.98	-3.04	-2.68
Roll [°]	-1.68	-1.79	-1.27

Direction with return period

Top [10.0m]

Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.029	0.120	0.048	0.198	0.053	0.223
45	0.043	0.136	0.071	0.225	0.079	0.252
90	0.019	0.058	0.032	0.095	0.036	0.107
135	0.018	0.177	0.030	0.292	0.034	0.327
180	0.038	0.150	0.062	0.247	0.070	0.277
225	0.066	0.189	0.109	0.312	0.122	0.350
270	0.033	0.115	0.054	0.190	0.061	0.213
315	0.019	0.158	0.031	0.261	0.035	0.293

Middle [25.0m]

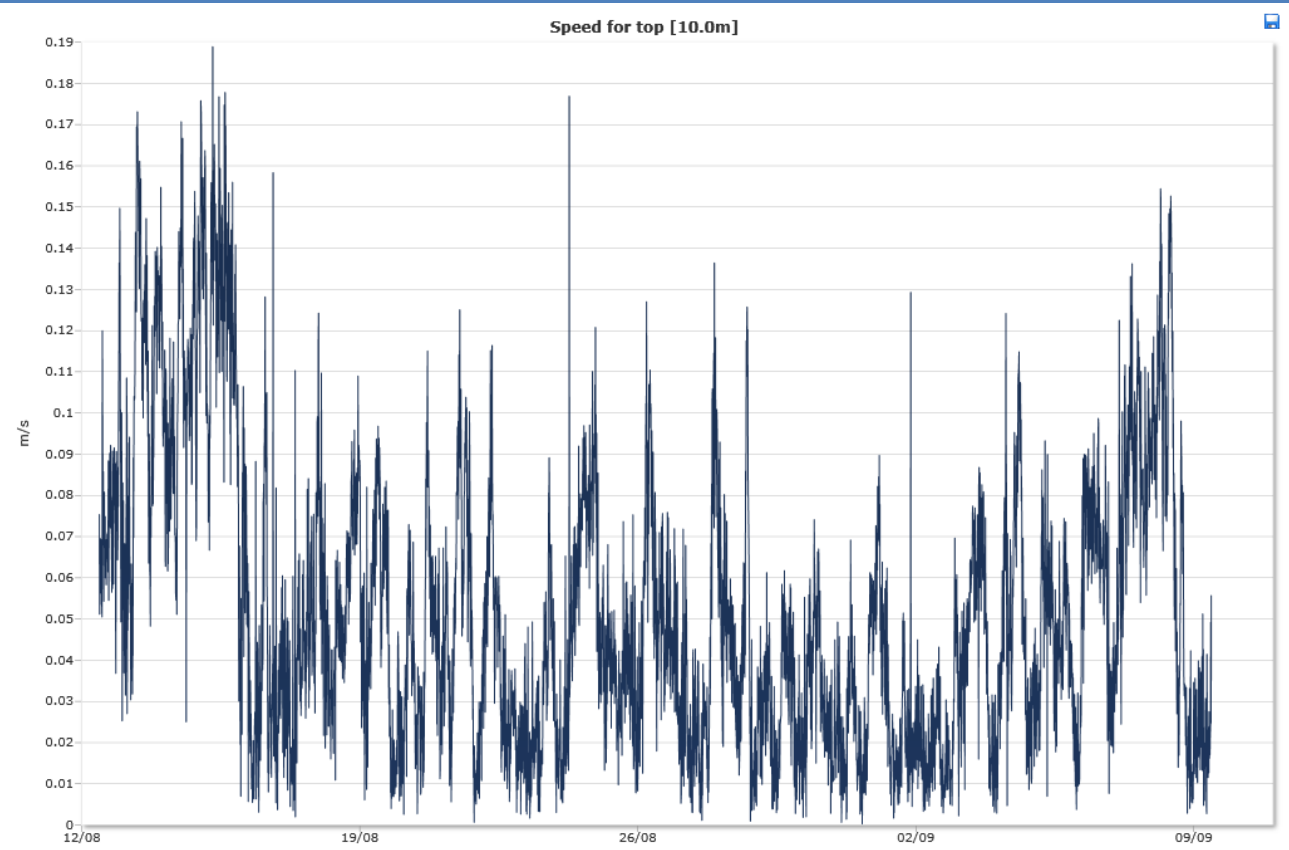
Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.033	0.235	0.054	0.388	0.060	0.435
45	0.073	0.381	0.120	0.628	0.135	0.704
90	0.027	0.167	0.045	0.276	0.051	0.309
135	0.019	0.092	0.031	0.152	0.035	0.170
180	0.018	0.062	0.029	0.102	0.033	0.115
225	0.043	0.162	0.071	0.268	0.080	0.300
270	0.028	0.134	0.046	0.222	0.052	0.249
315	0.017	0.052	0.028	0.085	0.031	0.095

Bottom [42.0m]

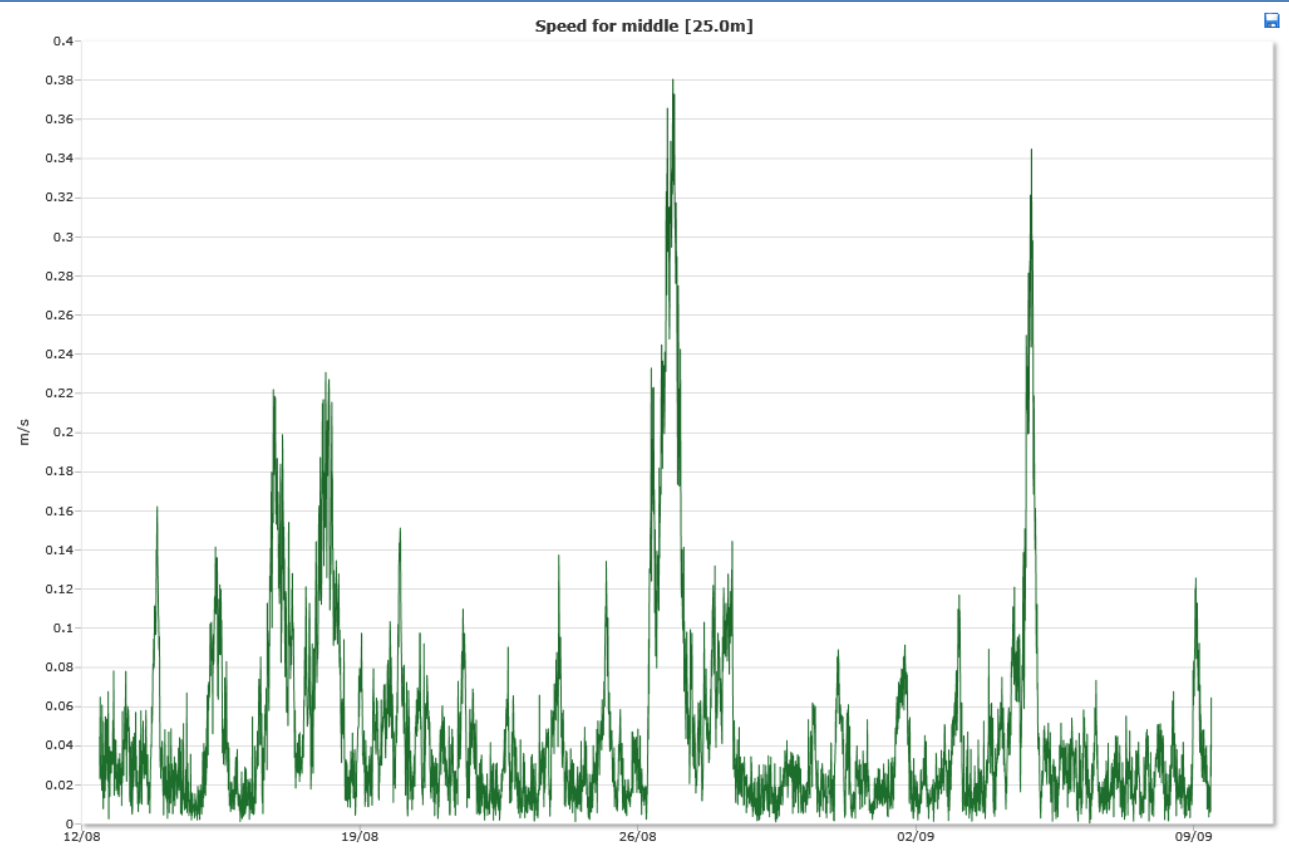
Direction	Mean	Max	Mean 10y	Max 10y	Mean 50y	Max 50y
0	0.018	0.052	0.030	0.086	0.033	0.097
45	0.018	0.070	0.030	0.115	0.033	0.129
90	0.018	0.046	0.029	0.075	0.033	0.084
135	0.018	0.054	0.029	0.089	0.033	0.100
180	0.018	0.073	0.029	0.121	0.032	0.136
225	0.019	0.116	0.031	0.191	0.035	0.214
270	0.018	0.064	0.029	0.106	0.033	0.118
315	0.019	0.074	0.031	0.122	0.034	0.137

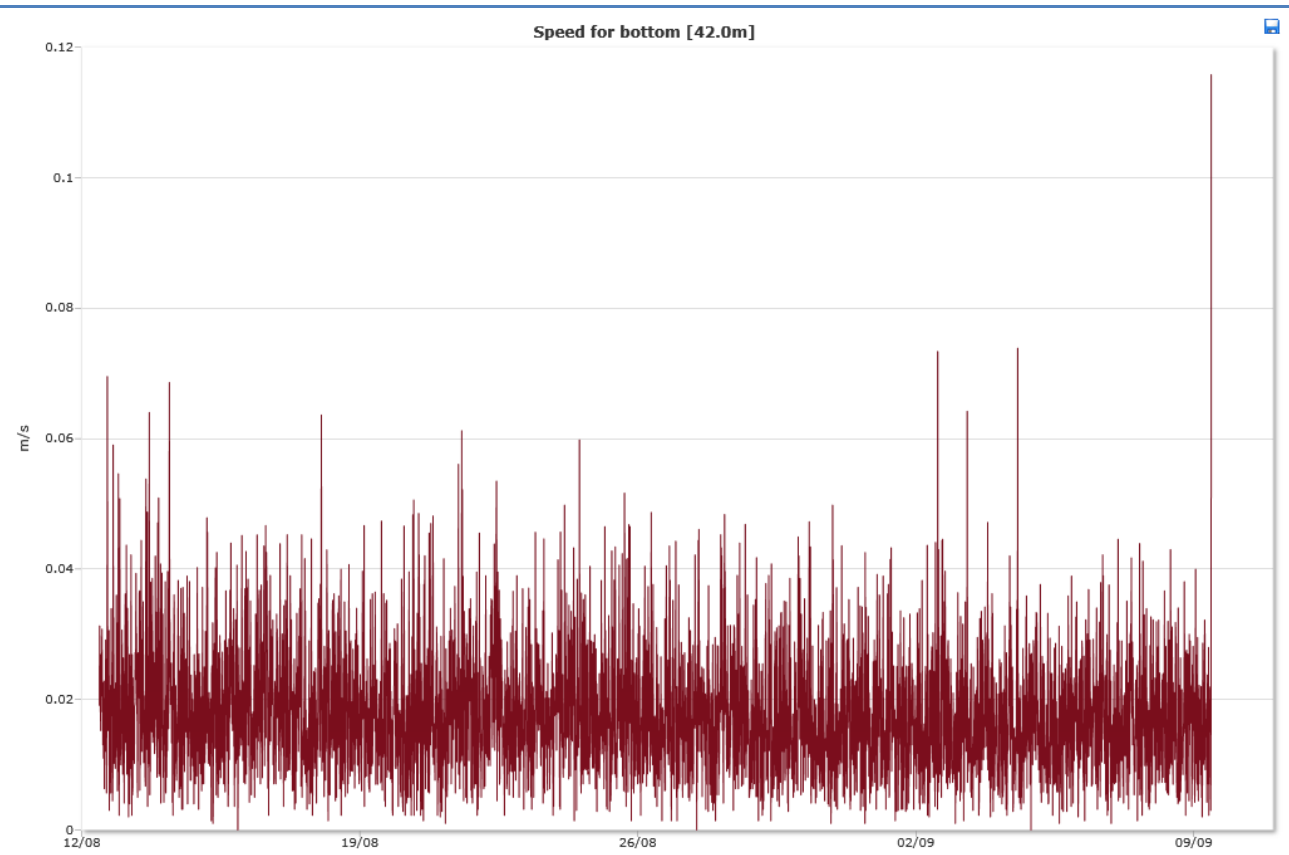
Time series

Top [10.0m]



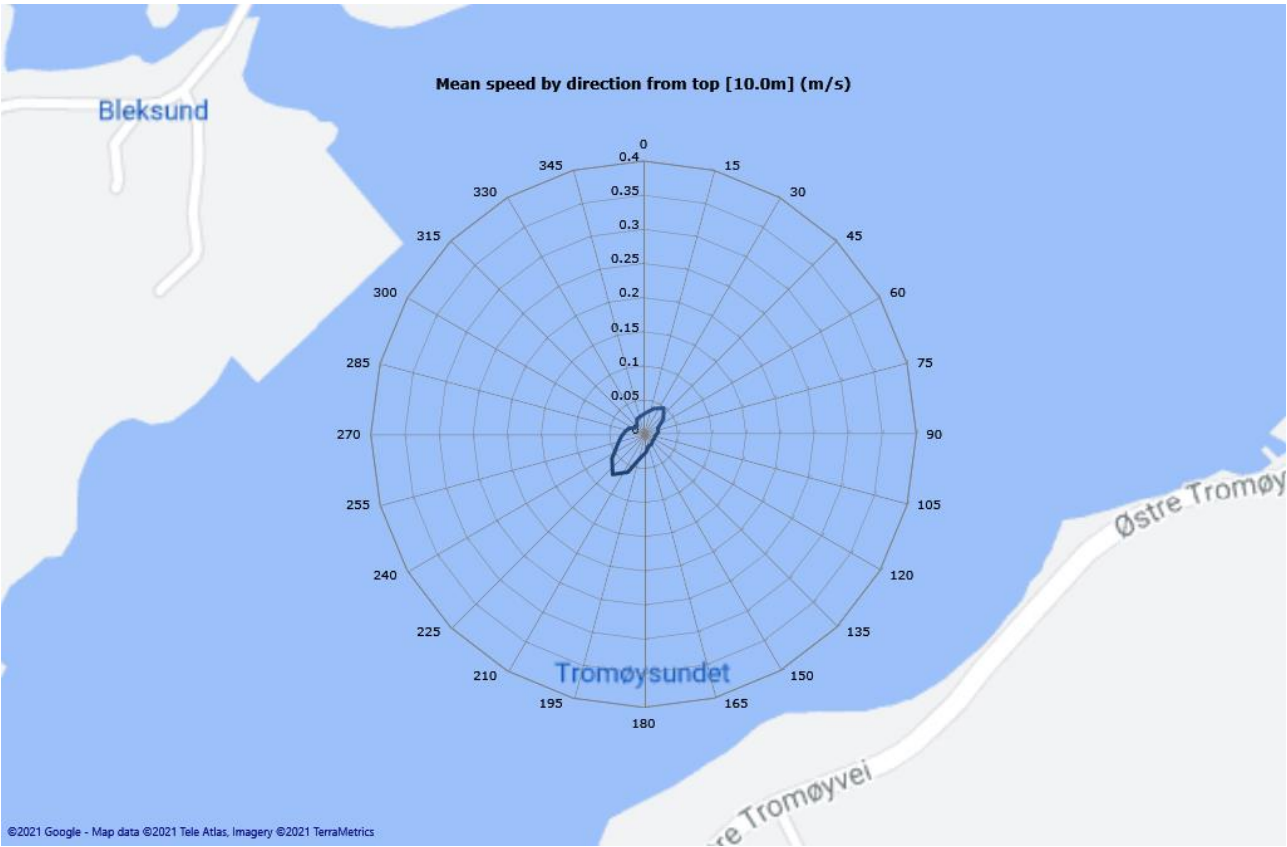
Middle [25.0m]



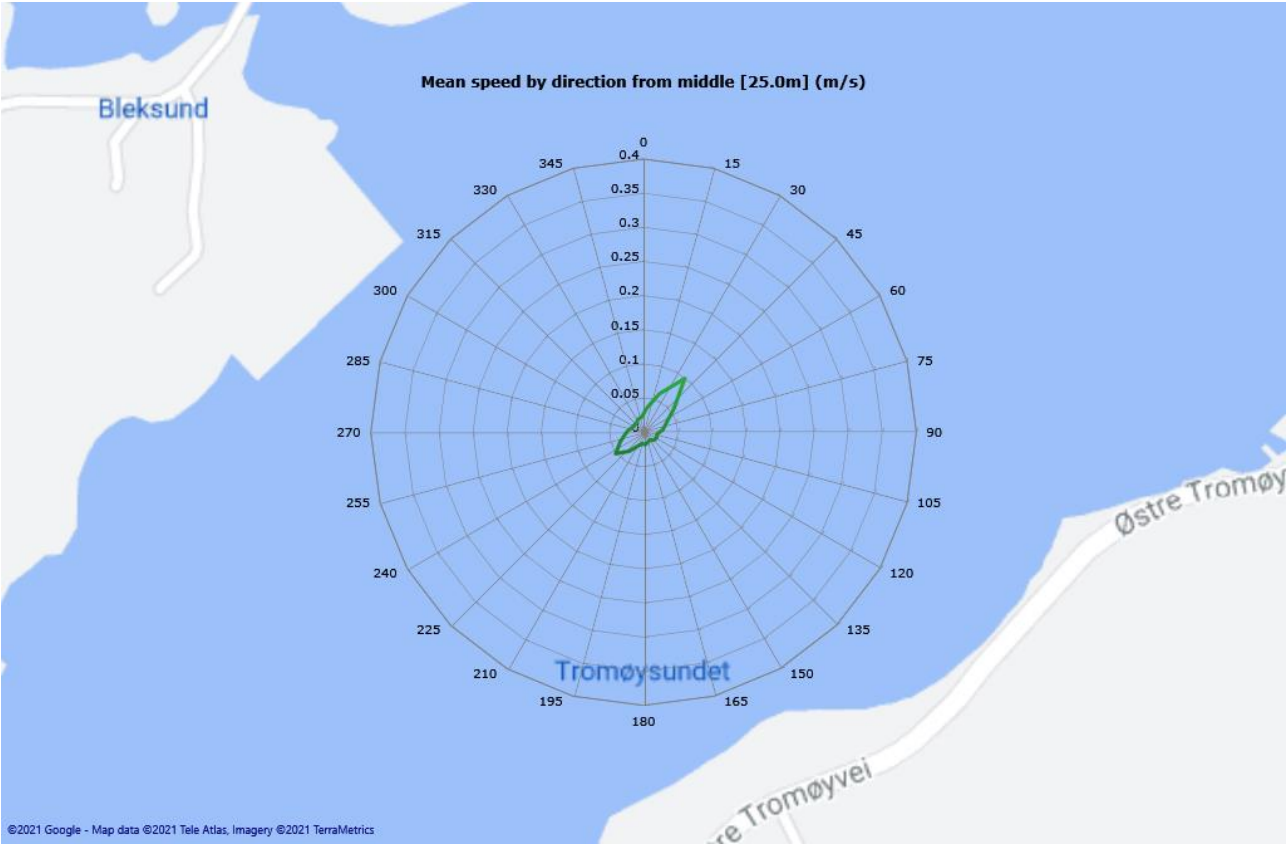


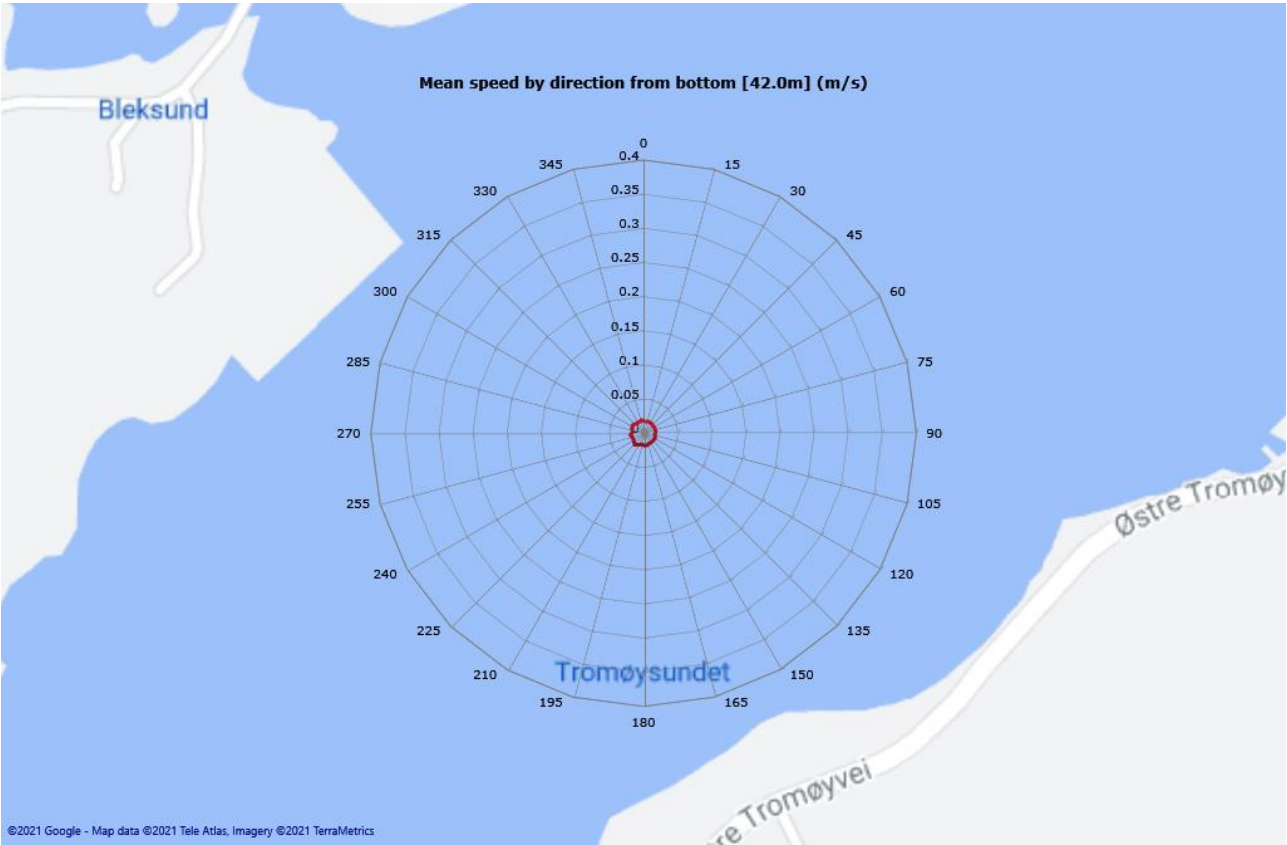
Mean speed - roseplot

Top [10.0m]



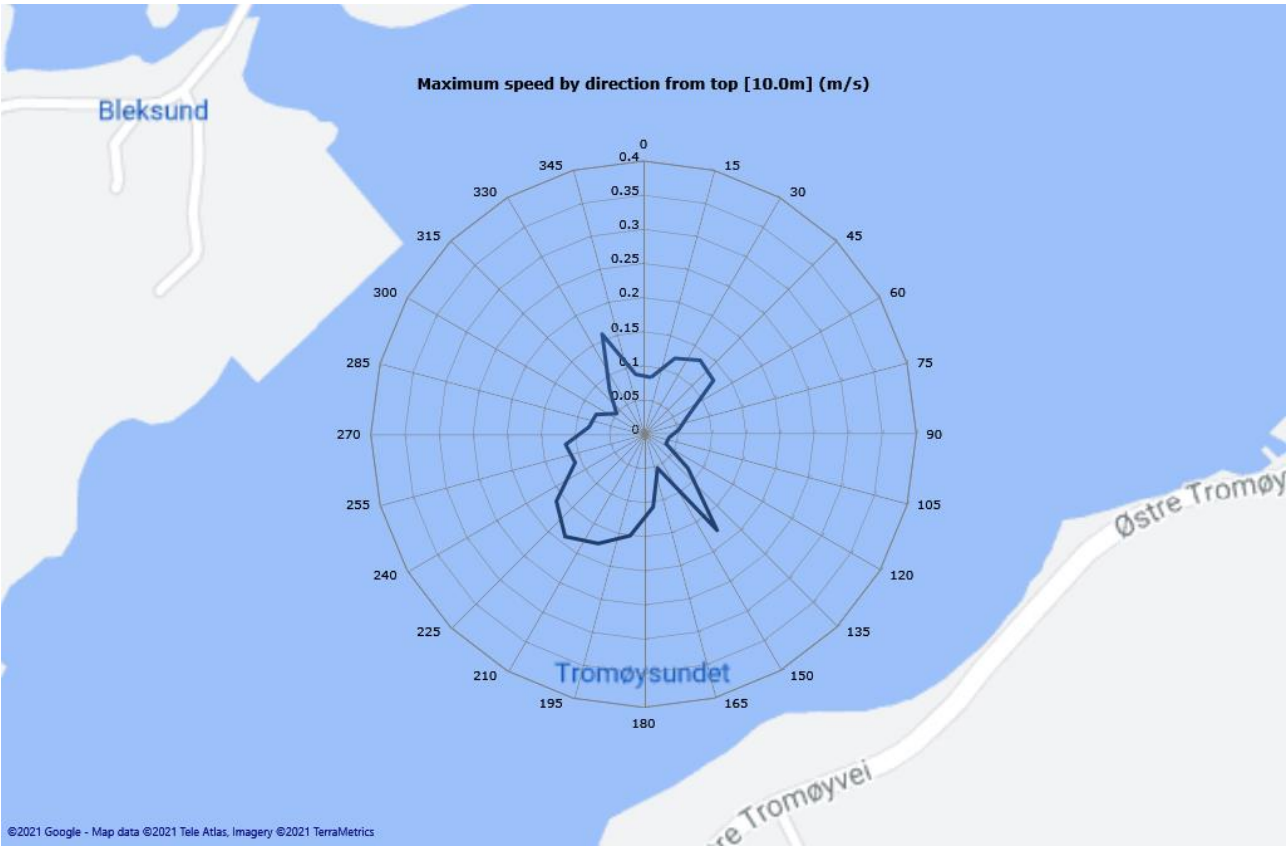
Middle [25.0m]



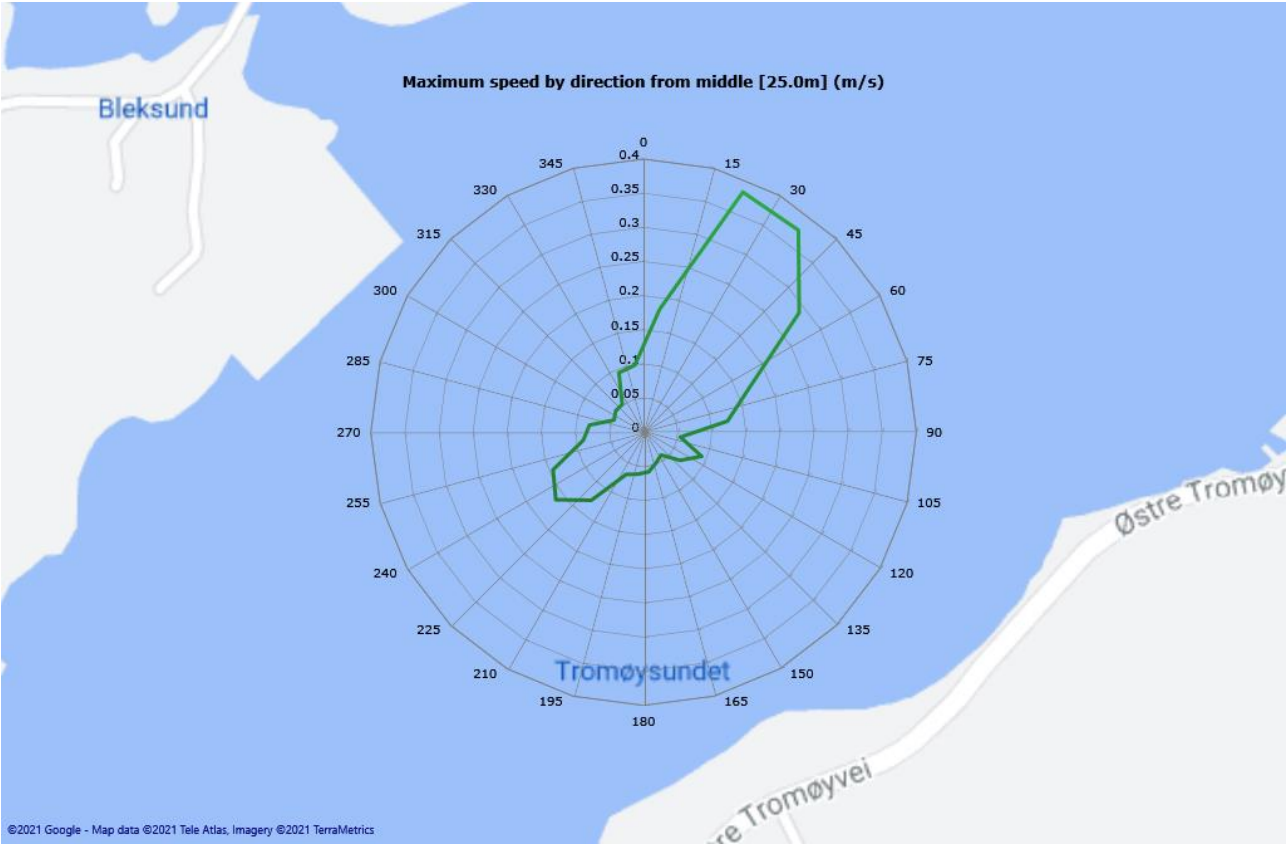


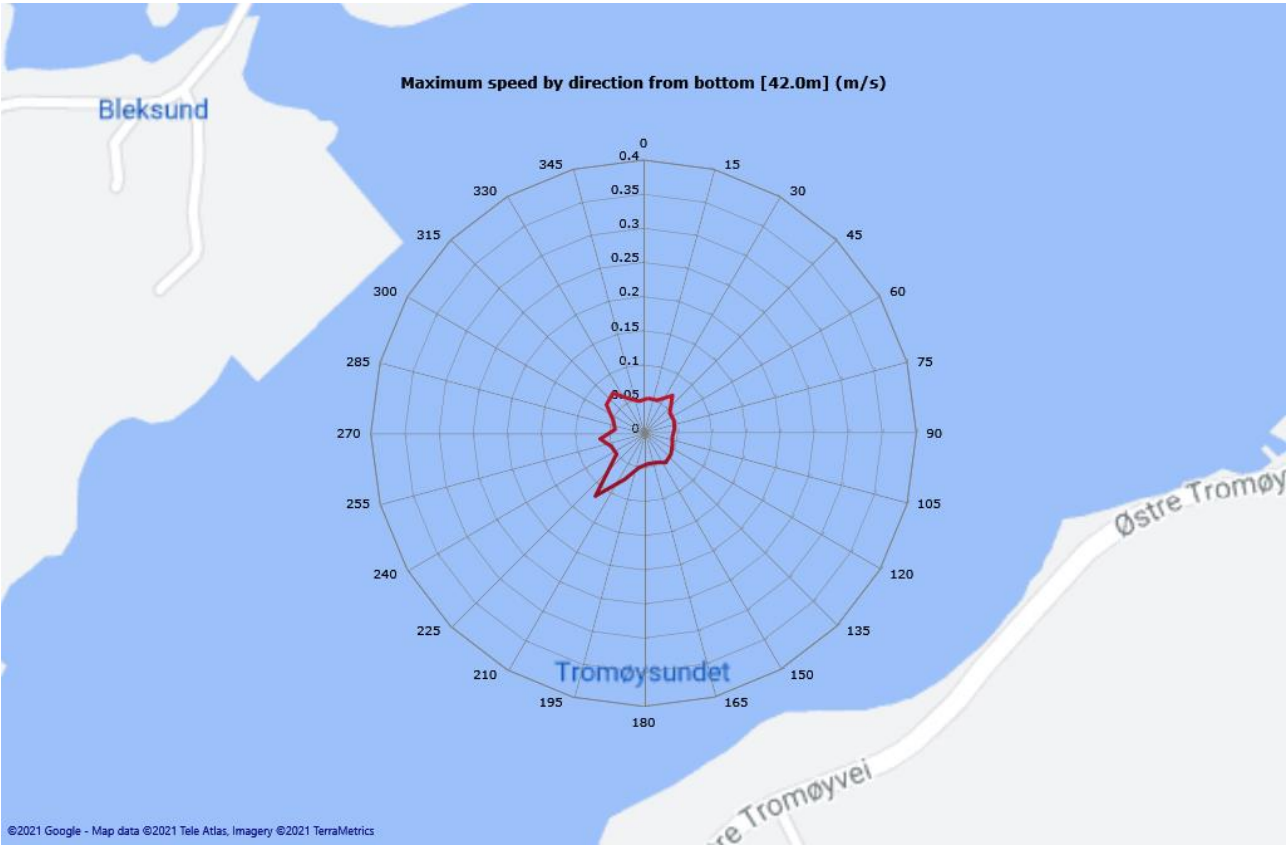
Max speed - roseplot

Top [10.0m]



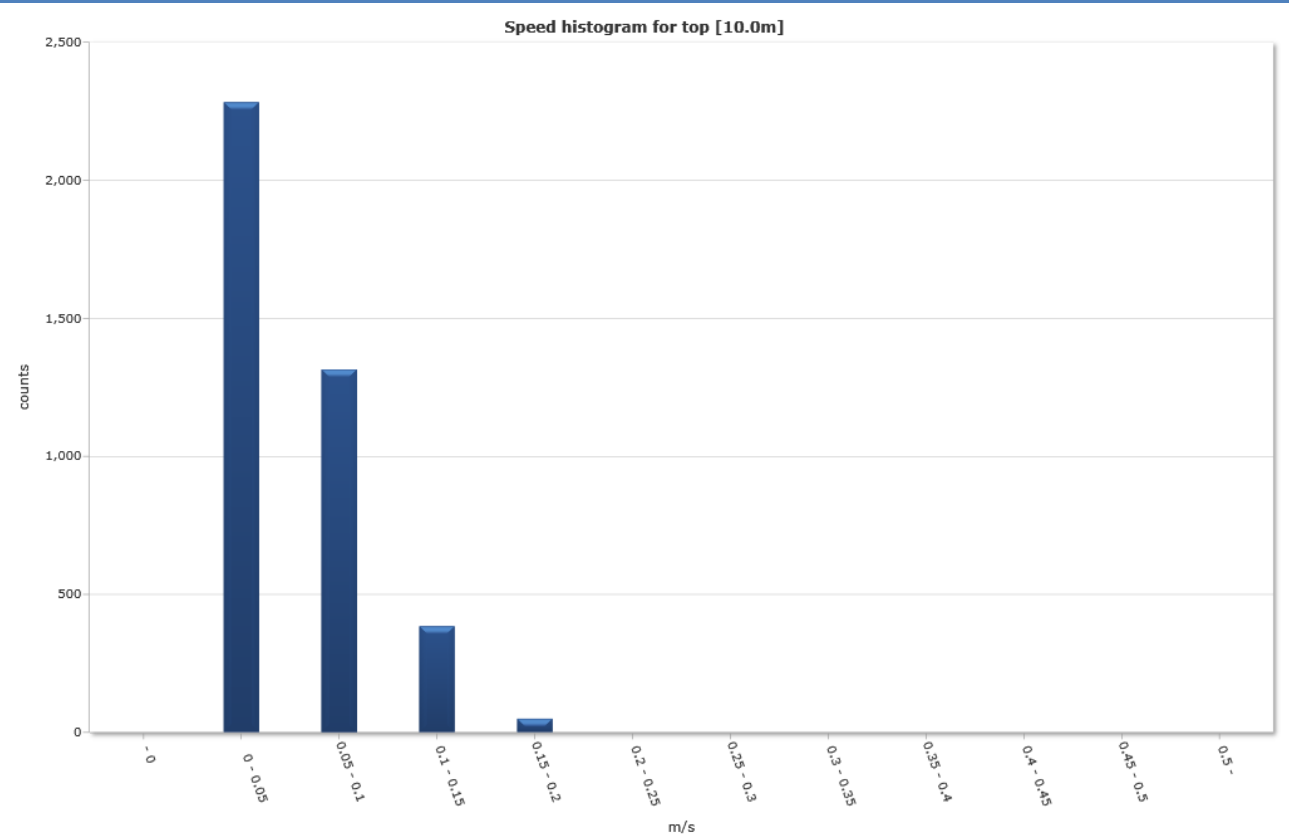
Middle [25.0m]



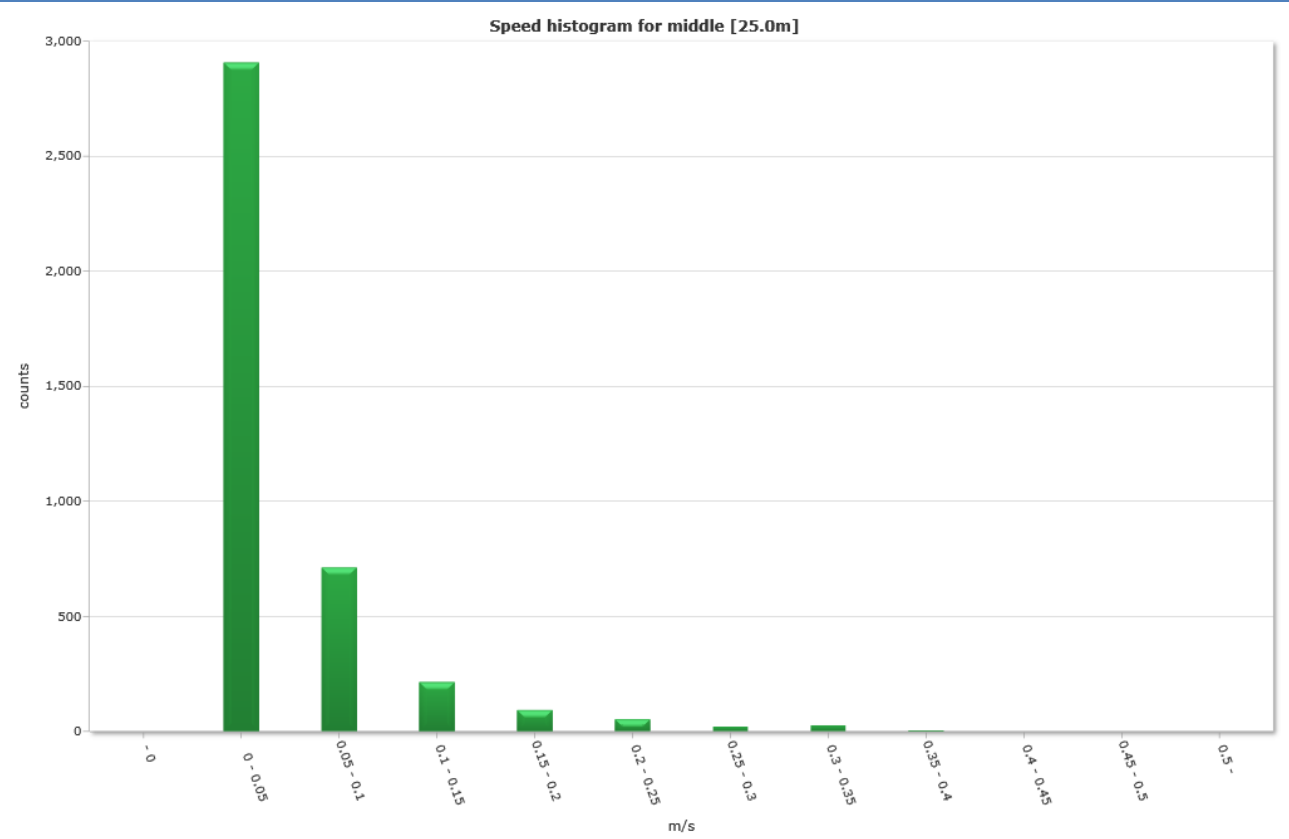


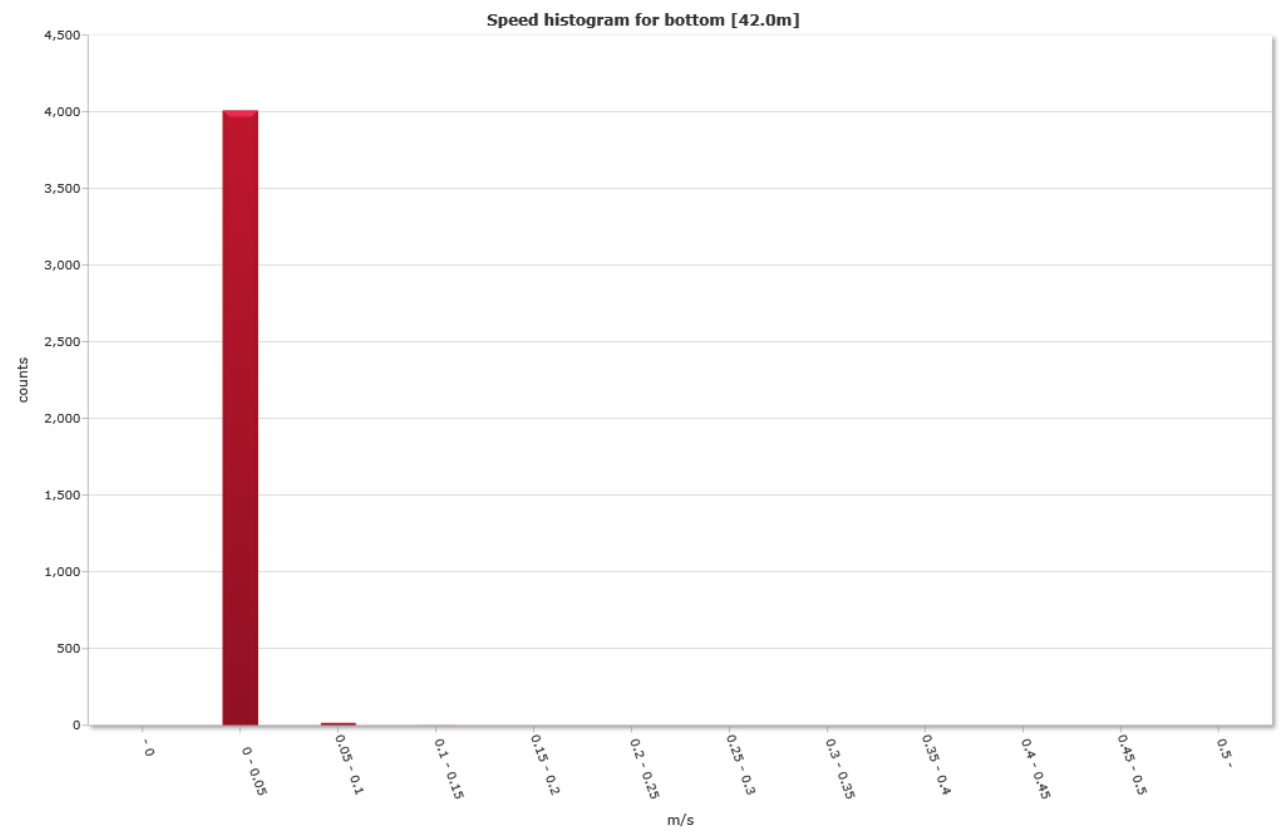
Speed histogram

Top [10.0m]



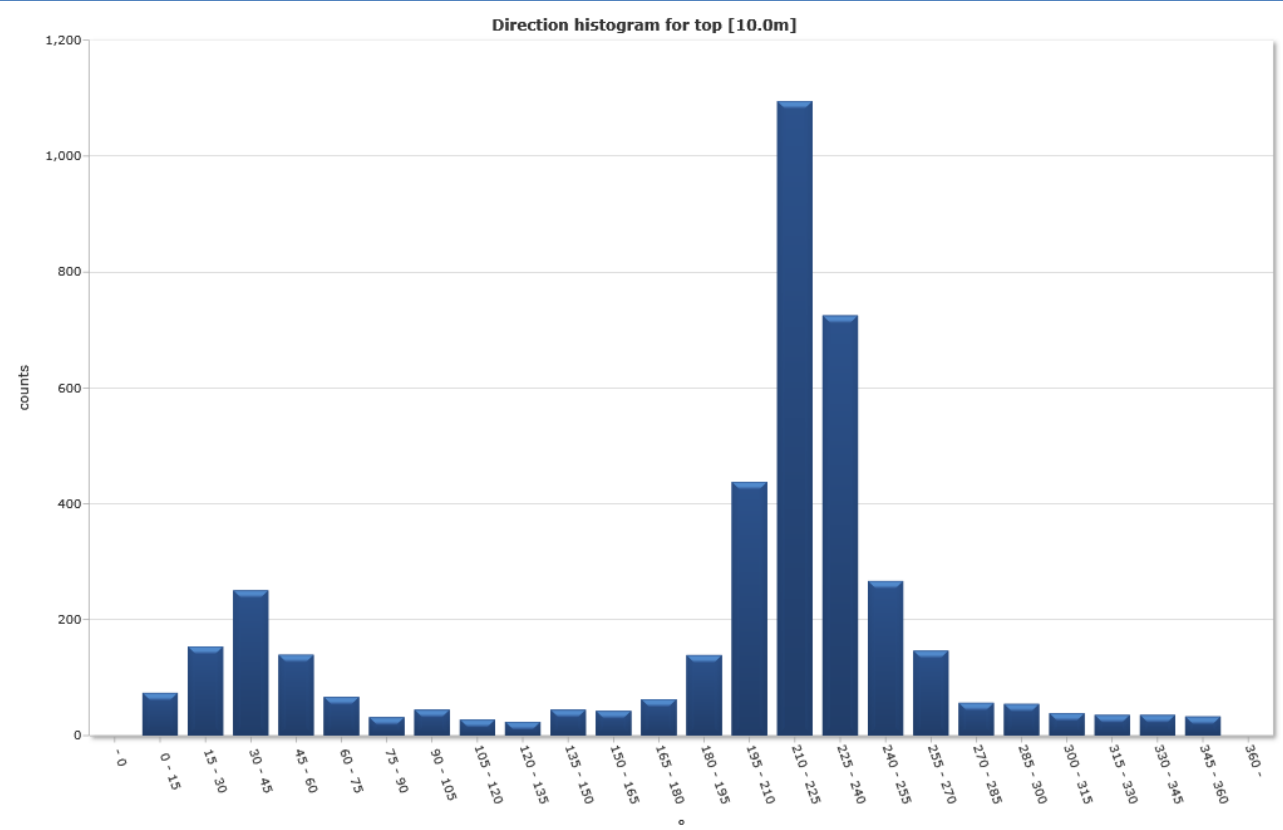
Middle [25.0m]



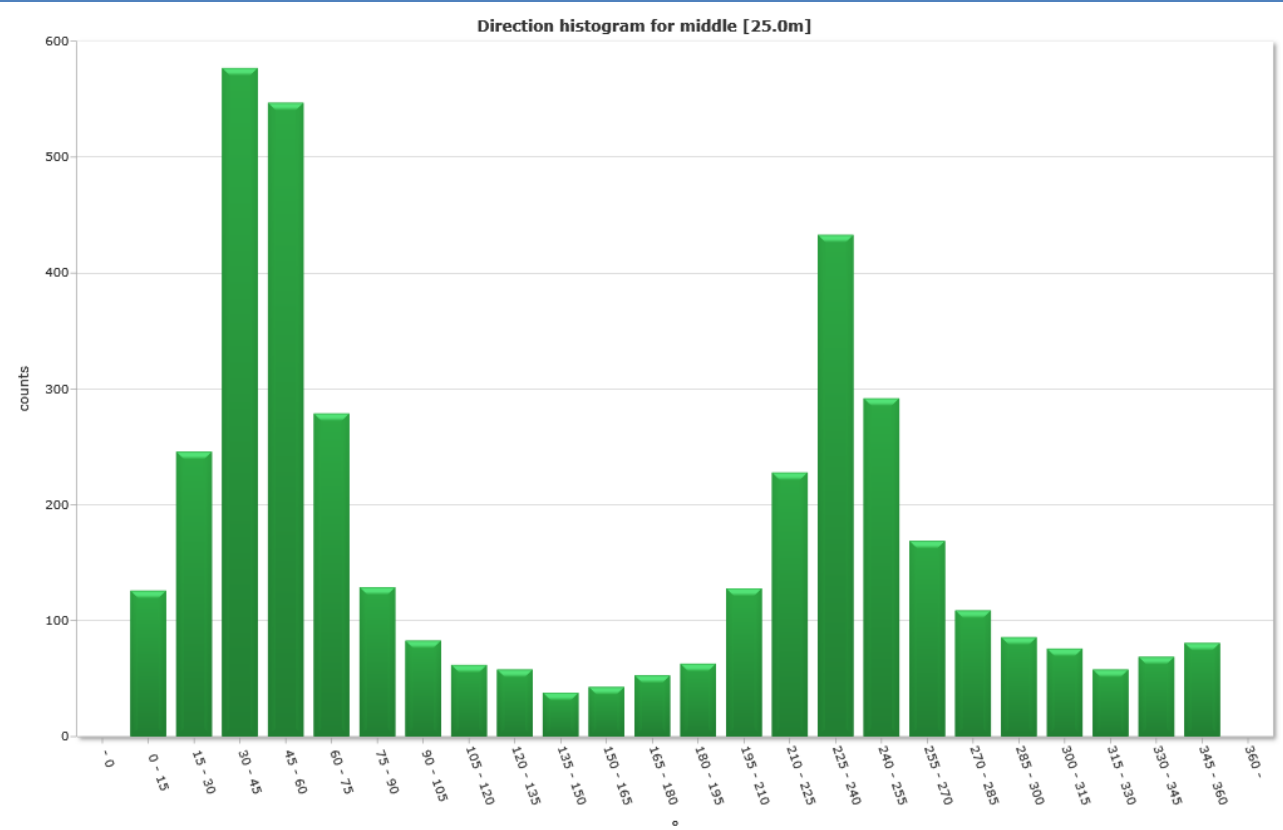


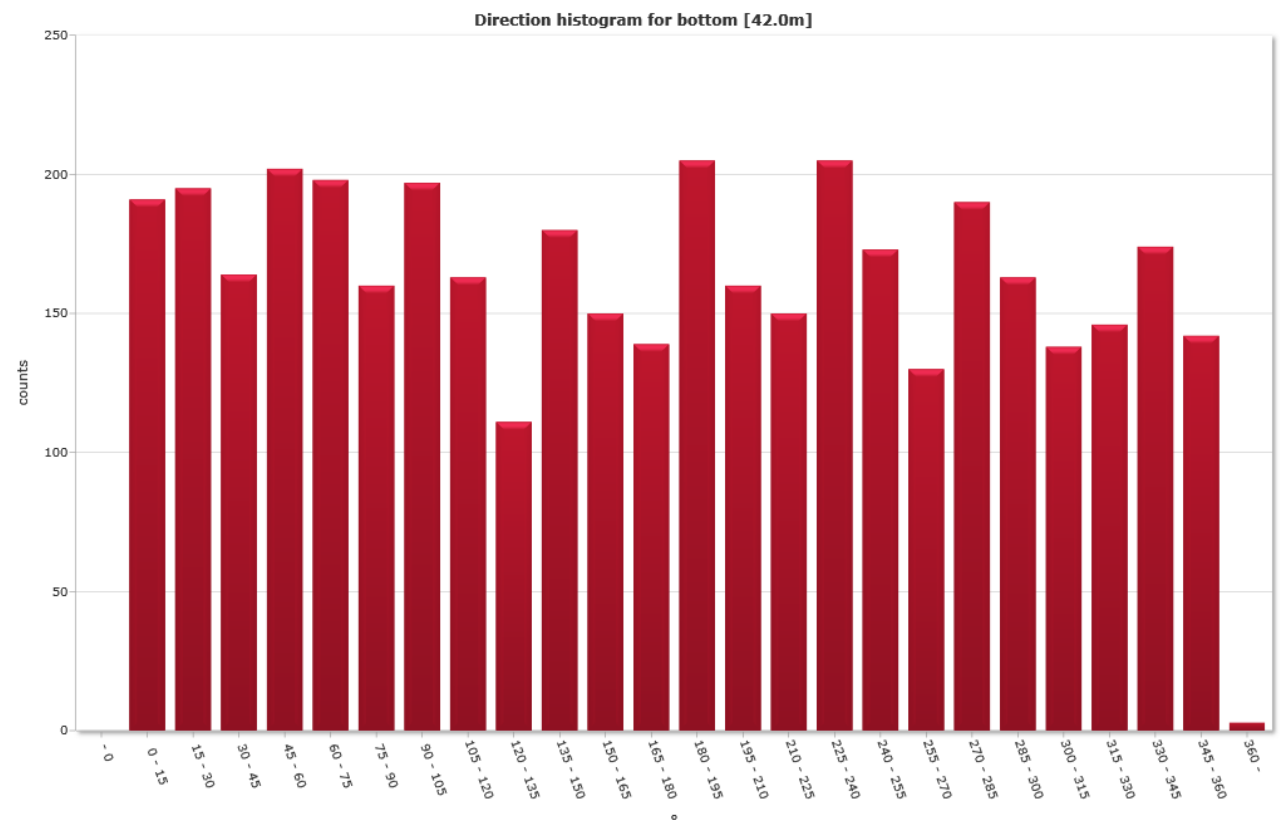
Direction histogram

Top [10.0m]



Middle [25.0m]





Direction/Speed histogram

Top [10.0m]

° m/s	Direction/speed matrix for top [10.0m]																								%	Sum
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	%	Sum
0.05	62	106	152	107	63	31	45	28	23	44	42	57	108	212	337	328	182	119	51	52	39	34	33	28	56.6	2283
0.10	12	43	81	32	4	1	0	0	1	0	1	5	27	165	491	325	82	27	6	3	0	2	2	5	32.6	1315
0.15	0	5	18	1	0	0	0	0	0	0	0	1	4	46	236	70	3	1	0	0	0	0	0	0	9.5	385
0.20	0	0	0	0	0	0	0	0	0	1	0	0	0	15	31	2	0	0	0	0	0	0	1	0	1.2	50
0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
%	1.8	3.8	6.2	3.5	1.7	0.8	1.1	0.7	0.6	1.1	1.1	1.6	3.4	10.9	27.2	18.0	6.6	3.6	1.4	1.4	1.0	0.9	0.9	0.8	100.0	100.0
Sum	74	154	251	140	67	32	45	28	24	45	43	63	139	438	1095	725	267	147	57	55	39	36	36	33	100.0	4033

Middle [25.0m]

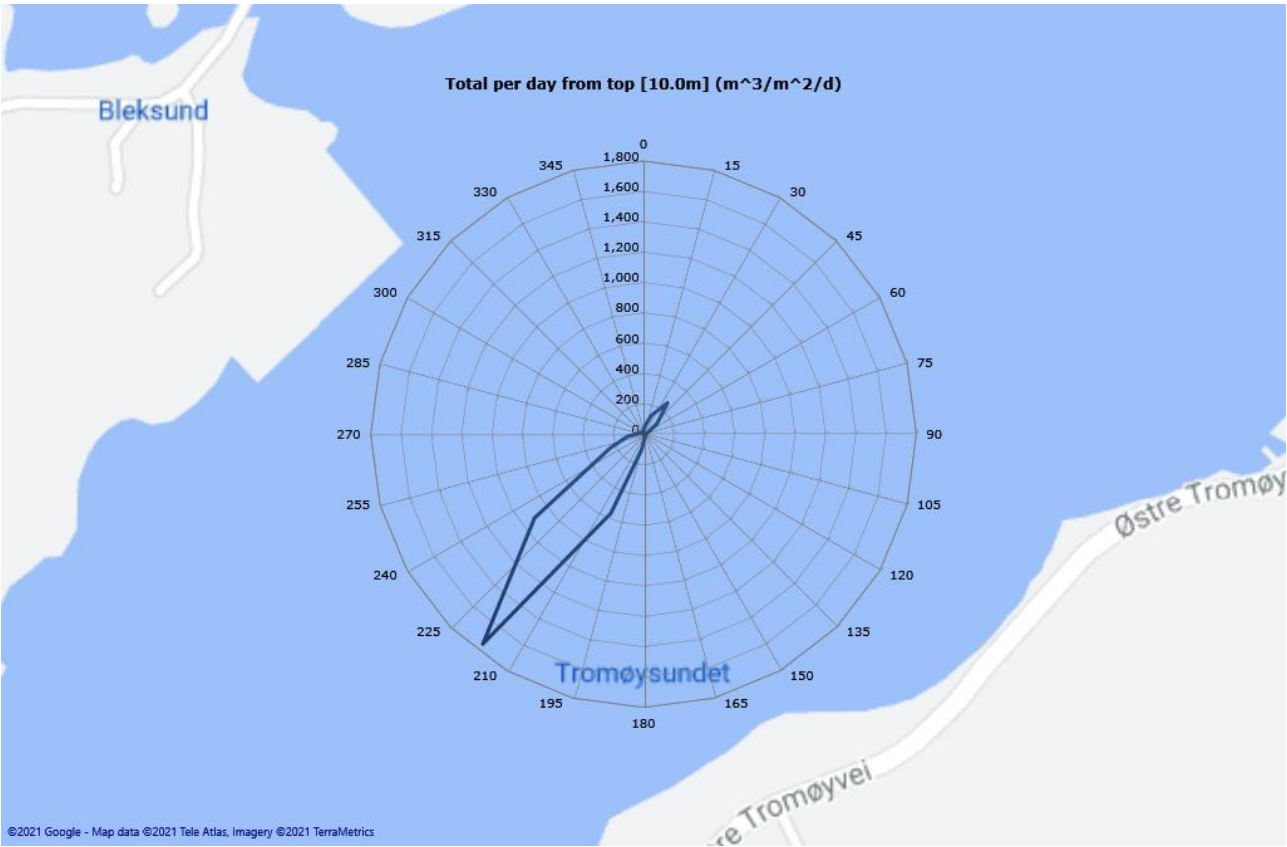
° m/s	Direction/speed matrix for middle [25.0m]																								%	Sum
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	%	Sum
0.05	99	152	237	313	213	116	82	57	56	38	43	52	61	123	183	255	220	149	103	86	75	57	64	73	72.1	2907
0.10	19	40	130	164	61	11	1	5	2	0	0	1	2	5	41	126	64	20	6	0	1	1	5	8	17.7	713
0.15	6	28	72	41	4	2	0	0	0	0	0	0	0	0	4	49	8	0	0	0	0	0	0	0	5.3	214
0.20	2	17	54	16	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2.3	93
0.25	0	5	37	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	53
0.30	0	2	17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	21
0.35	0	1	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	27
0.40	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	5
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
%	3.1	6.1	14.3	13.6	6.9	3.2	2.1	1.5	1.4	0.9	1.1	1.3	1.6	3.2	5.7	10.7	7.2	4.2	2.7	2.1	1.9	1.4	1.7	2.0	100.0	100.0
Sum	126	246	577	547	279	129	83	62	58	38	43	53	63	128	228	433	292	169	109	86	76	58	69	81	100.0	4033

Bottom [42.0m]

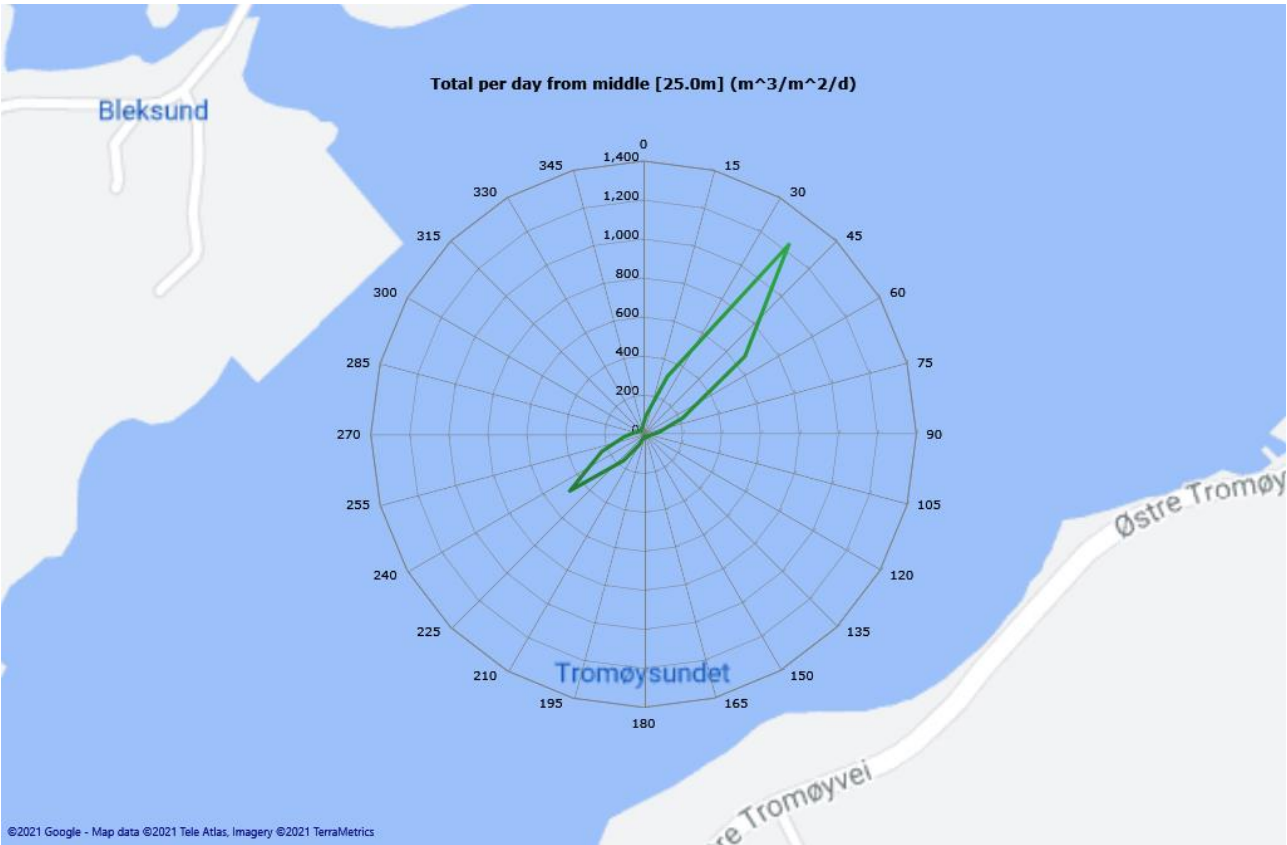
• m/s	Direction/speed matrix for bottom [42.0m]																									
0.00	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	%	Sum
0.05	190	194	162	202	198	160	197	163	110	179	150	139	204	157	147	205	172	129	190	163	136	144	173	142	99.5	4006
0.10	1	1	2	0	0	0	0	0	1	1	0	0	1	3	2	0	1	1	0	0	2	2	1	0	0.5	19
0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.0	1
0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
%	4.7	4.8	4.1	5.0	4.9	4.0	4.9	4.0	2.8	4.5	3.7	3.5	5.1	4.0	3.7	5.1	4.3	3.2	4.7	4.0	3.4	3.6	4.3	3.5	100.0	100.0
Sum	191	195	164	202	198	160	197	163	111	180	150	139	205	160	150	205	173	130	190	163	138	146	174	142	100.0	4026

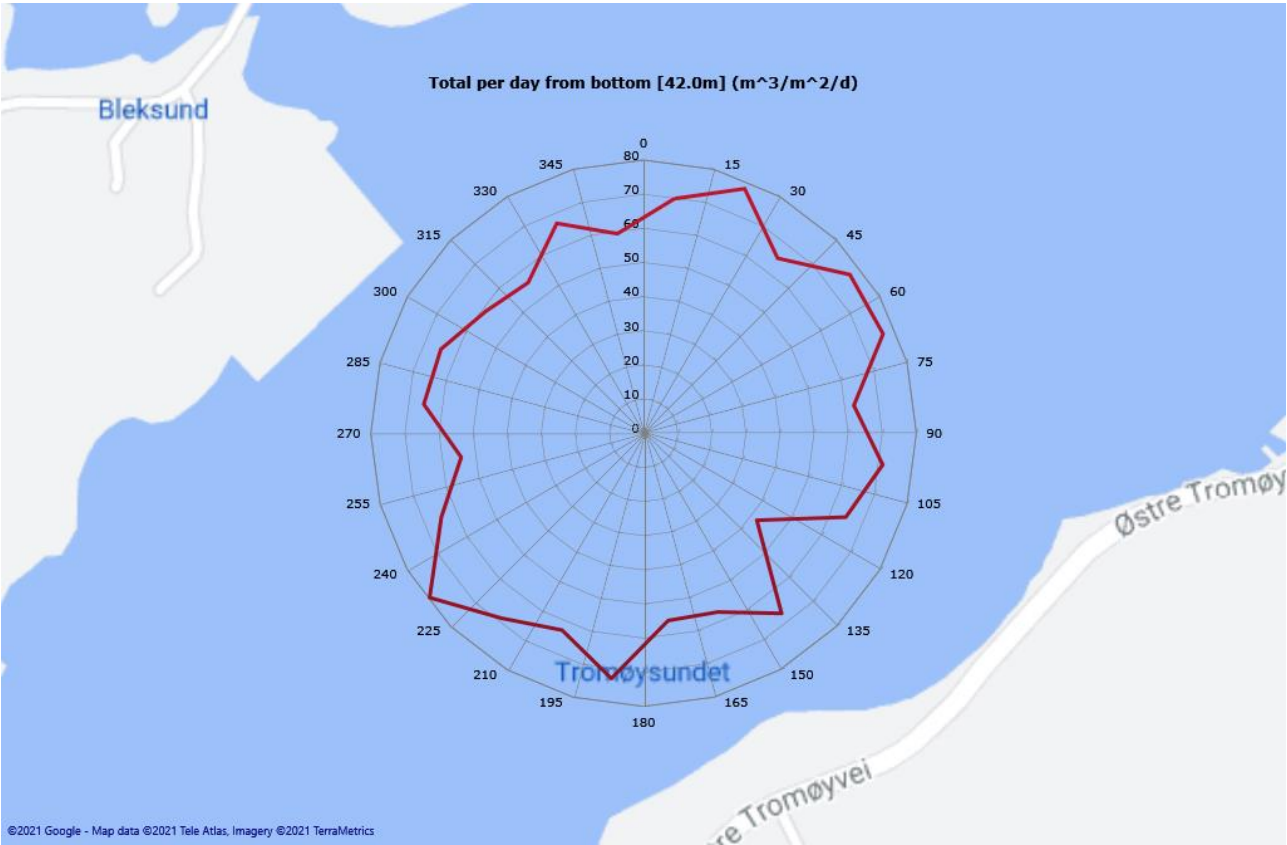
Flow

Top [10.0m]



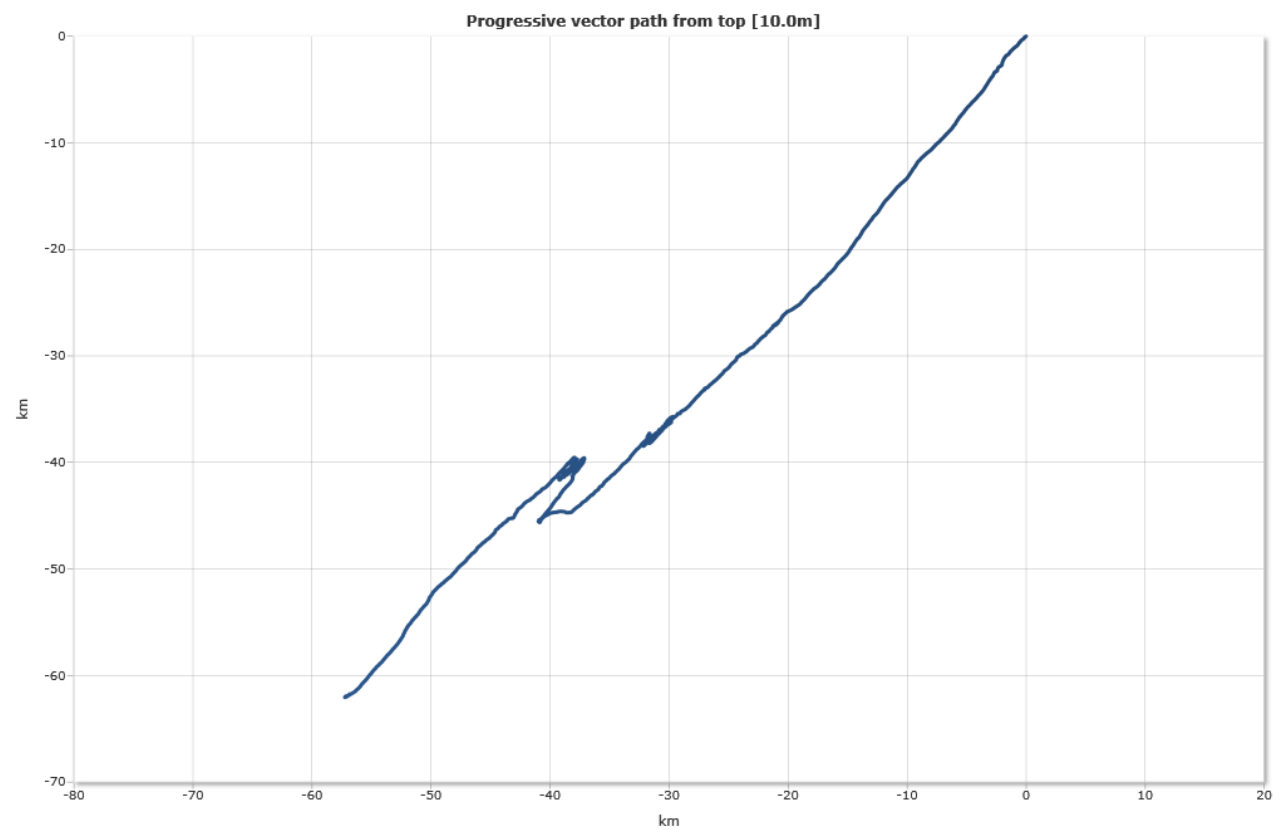
Middle [25.0m]



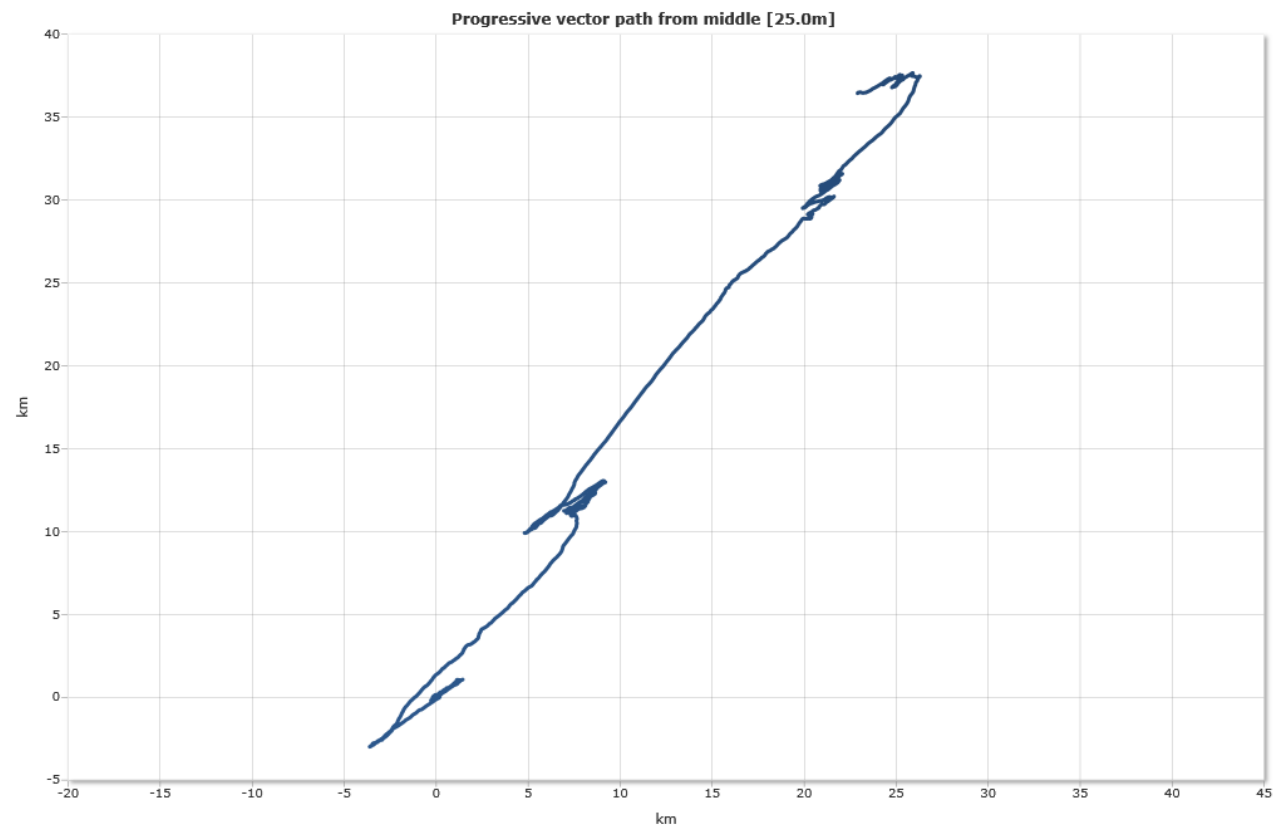


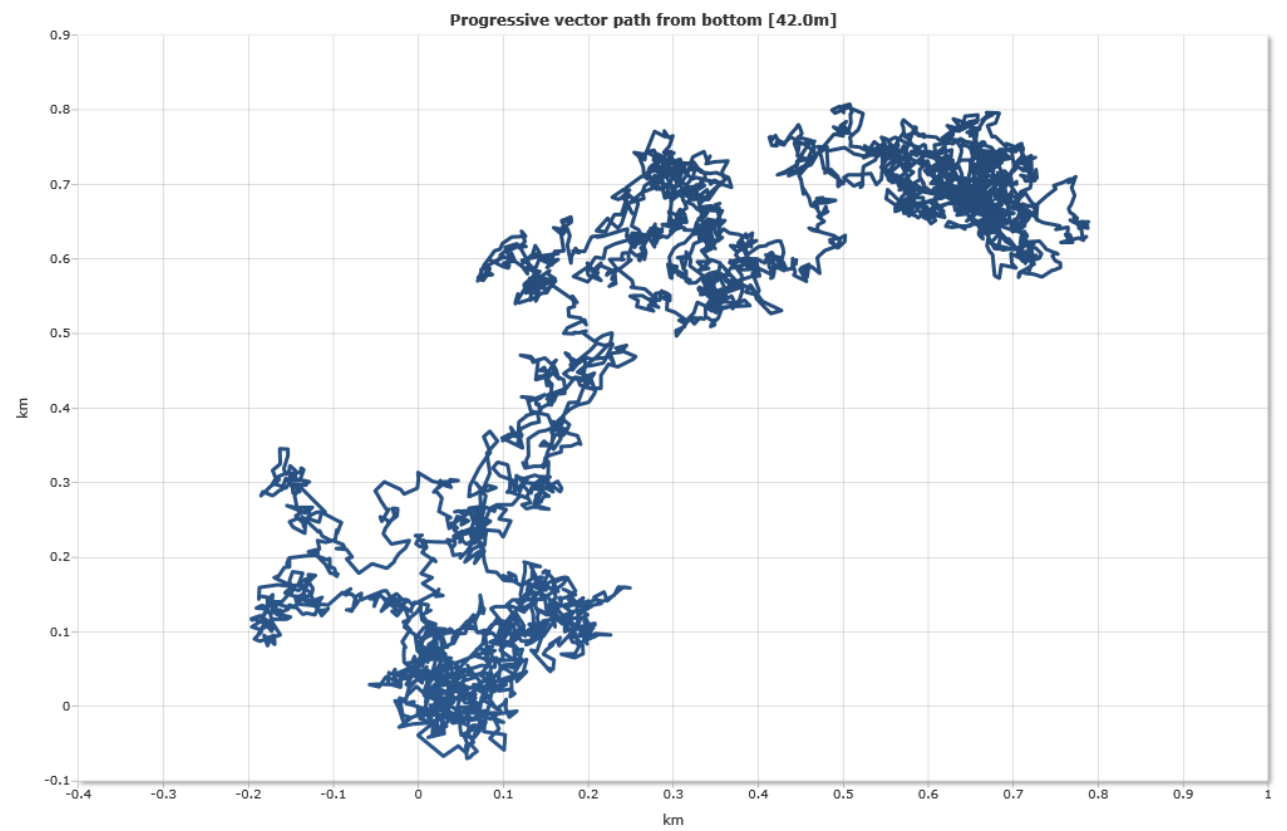
Progressive vector

Top [10.0m]



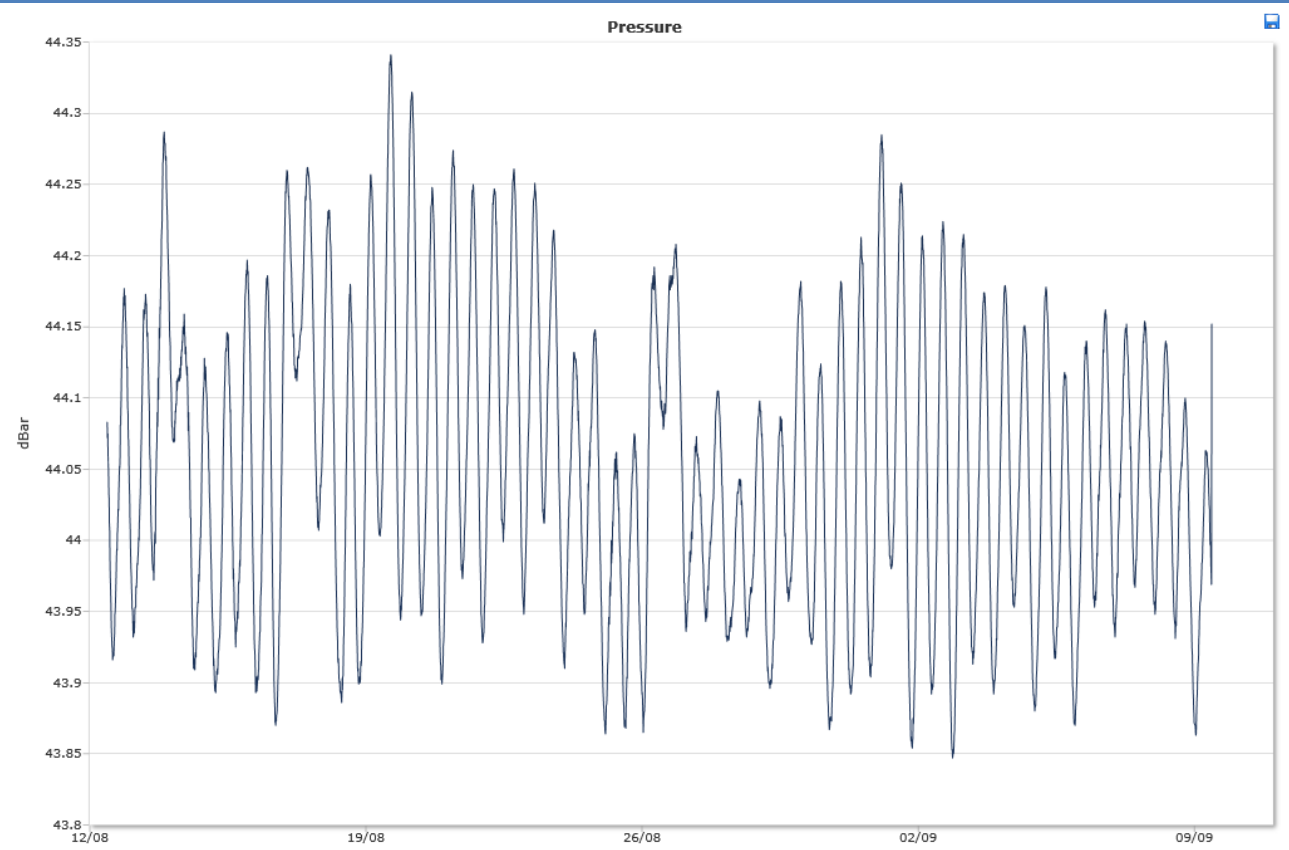
Middle [25.0m]



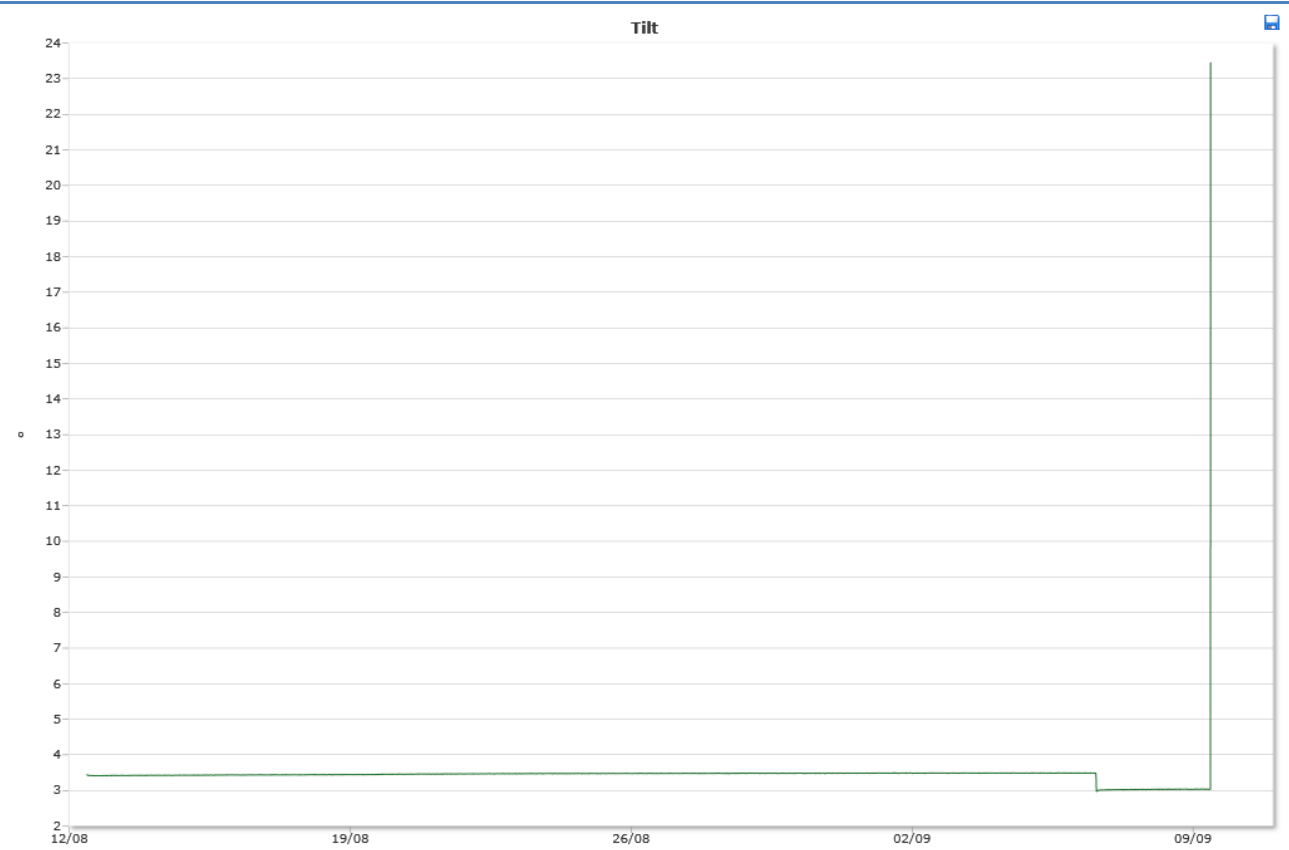


Sensors

Pressure



Tilt



Temperature

