Meteorologisk institutt

Statens vegvesen
Norwegian Public Roads Administration

Bruk og gjenbruk av data fra Ferjefri E39-prosjektet

Birgitte R. Furevik, Anette Lauen Borg og Lene Østvand
Meteorologisk Institutt

15/11/18 Presentasjon på brukermøte i NorDataNet, Bergen

Muligvis første gang at geofysiske data samlet inn for offentlige midler til et annet formål blir systematisk arkivert, dokumentert og fritt distribuert

Ferjefri E39

De nye fjordkryssingskonsepter som utvikles for E39 er lengre, har mange egenperioder og er komplekse å regne på.

Thredds.met.no

Bruk av observasjonsdata i SVV-E39-prosjektet

Ekstern lenke til Statens Vegvesen: https://www.vegvesen.no/Europaveg/e39sulafjorden/dokumenter

Dataset	Size	Last Modified
11		--
201811_E39_G_Halsafjorden_wind.nc	172.6 Kbytes	2018-11-15T07:15:22Z
201811_E39_G_Halsafjorden_wave.nc	529.2 Kbytes	2018-11-15T07:15:21Z
201811_E39_G_Halsafjorden_raw_wind.nc	73.78 Mbytes	2018-11-15T07:15:27Z
201811_E39_G_Halsafjorden_ctd.nc	31.67 Mbytes	2018-11-15T07:15:41Z
201811_E39_G_Halsafjorden_aquadopp.nc	801.5 Kbytes	2018-11-15T07:15:49Z
201811_E39_G_Halsafjorden_adcp.nc	7.756 Mbytes	2018-11-15T07:15:29Z
201811_E39_F_Vartalsfjorden_wind.nc	172.9 Kbytes	2018-11-15T07:15:44Z
201811_E39_F_Vartalsfjorden_wave.nc	530.5 Kbytes	2018-11-15T07:15:50Z
201811_E39_F_Vartalsfjorden_raw_wind.nc	74.24 Mbytes	2018-11-15T07:15:11Z
201811_E39_F_Vartalsfjorden_ctd.nc	31.77 Mbytes	2018-11-15T07:15:25Z
201811_E39_F_Vartalsfjorden_aquadopp.nc	804.9 Kbytes	2018-11-15T07:15:20Z

OPeNDAP Dataset Access Form

Action: Get ASCII | Get Binary | Show Help

Data URL: http://thredds.met.no/thredds/dodsC/obs/buoy-svv-e39/2018/11/201811_E39_G_Halsafjorden_cl

Global Attributes:

```
title: Wavescan buoys for the E39 Fjord crossing project in North-
Western Norway
summary:
station name: E39 G Halsafjorden
```

Variables:

time: Array of 64 bit Reals [time = 0..114033]

time:

```
standard_name: time
long_name: Time of measurement
units: seconds since 1970-01-01 00:00:00 UTC
axis: T
comment: End of the 10 s sampling period
```

depth: Array of 16 bit Integers [depth = 0..3]

depth:

```
standard_name: depth
long_name: Depth of measurement
positive: down
units: m
axis: Z
```

latitude: Array of 64 bit Reals [time = 0..114033]

Norwegian Meteorological Institute

Catalog http://thredds.met.no/thredds/obs.html

Terms of service

This is a shared public service which may experience overload in traffic from time to time. If you require these datasets for your own operational service please contact us at servicedesk@met.no.

MET Norway's Privacy Policy

Get messages about planned maintenance and incidents from our status page.

Dataset	Size	Last Modified
Observations		--
MET Observation Stations/		--
Aggregated MET observations/		--
Statens vegvesen - E39 - BUOY observations/		--
Statens vegvesen - E39 - MAST observations/		--
Nordic Gridded Climate Dataset/		--
OSI SAF/		--
seNorge/		--
Remotesensing archive/		--

orway Thredds Service at Norwegian Meteorological Institute see Info
DS Data Server [Version 4.6.11-metno2 - 2018-01-26T12:29:34+0100] Documentation

Meteorologisk institutt

Måleprogrammet i Region Midt

Flere fjorder (her eksempel fra Sulafjorden):

Høye met-master med soniske anemometre I flere høyder omkring 100m, 70m and 50m (rød).

I Sulafjorden også trykk, fugtighet, temperatur (flere høyder) og nedbør.

Bølgebøyer med oseanografiske rigger (blå)

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Datainnsamling og deling

SVV → Fugro → MET → andre brukere

Oppdragsgiver

Kontrakt på å utføre målingene sammen med flere under-leverandører.

Skriver data til netCDF og legger på FTP

Samarbeidsavtale med SVV
Rådgir om netCDF
Henter data fra FTP
Aggregerer filer
Overvåger dataflyt
Legger ut på thredds

Forskning og undervisning

Meteorologisk institutt

Overvåking av dataflyt

Eksempel fra datarapport som lages månedlig

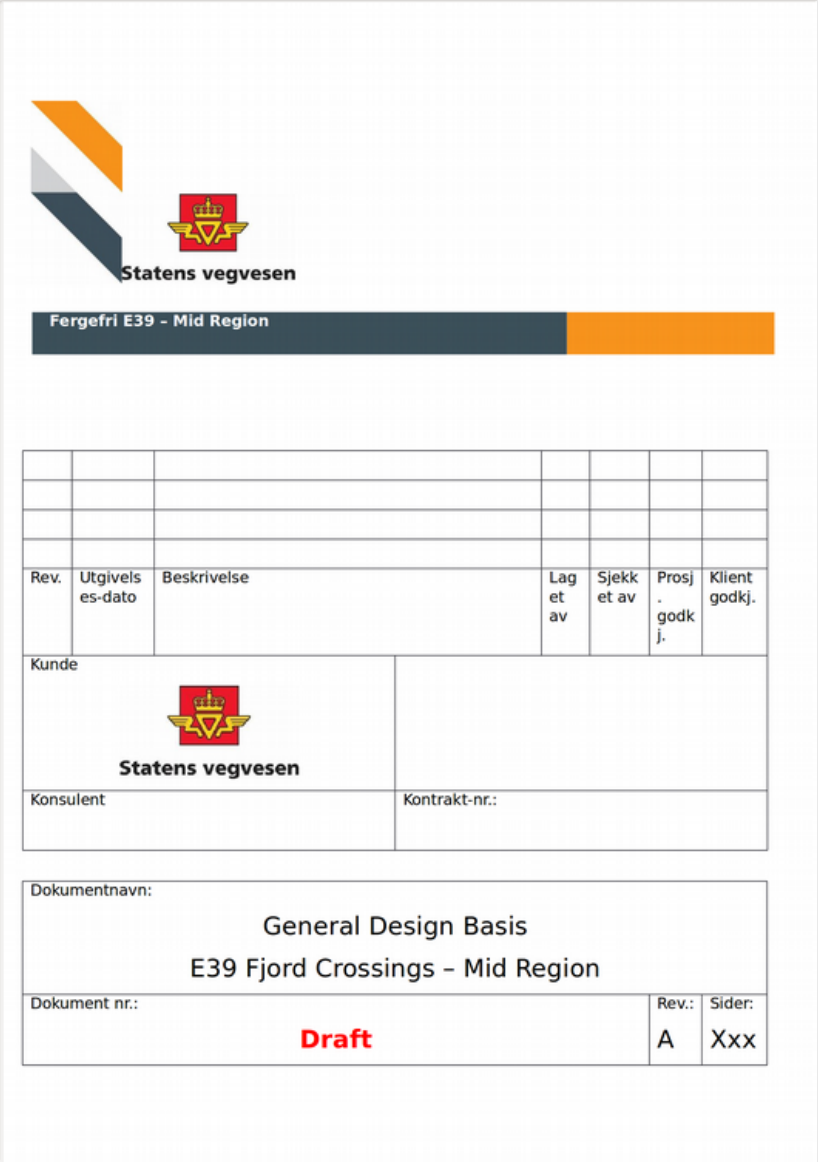
Vindmast Kvitneset

måned	filtype	filer mottatt, % av forventet	filer mottatt som inneholder data, % av forventet	filer som mangler tidssteg	tidssteg mottatt,% av forventet	høyde i meter	tidssteg uten feil mottatt, % av forventet
201808	10min	100,0%	100,0%	0,0%	100,0%	92.5m 71.5m 44.5m	100,0% 100,0% 100,0%
	10hz	100,0%	100,0%	0,5%	100,0%	92.5m 71.5m 44.5m	100,0% 100,0% 100,0%
201809	10min	100,0%	100,0%	0,0%	100,0%	92.5m 71.5m 44.5m	100,0% 100,0% 100,0%
	10hz	100,0%	100,0%	1,3%	100,0%	92.5m 71.5m 44.5m	99,2% 99,5% 99,6%
201810	10min	99,2%	99,2%	0,1%	99,1%	92.5m 71.5m 44.5m	99,1% 99,1% 99,1%
	10hz	99,2%	99,2%	1,2%	99,1%	92.5m 71.5m 44.5m	98,7% 98,8% 99,0%

Databortfall for målesensor over løpende 3-månedersperiode	10min	0,3%
Databortfall for målesensor over løpende 3-månedersperiode	10hz	0,3%

rologisk
itt

Bruk



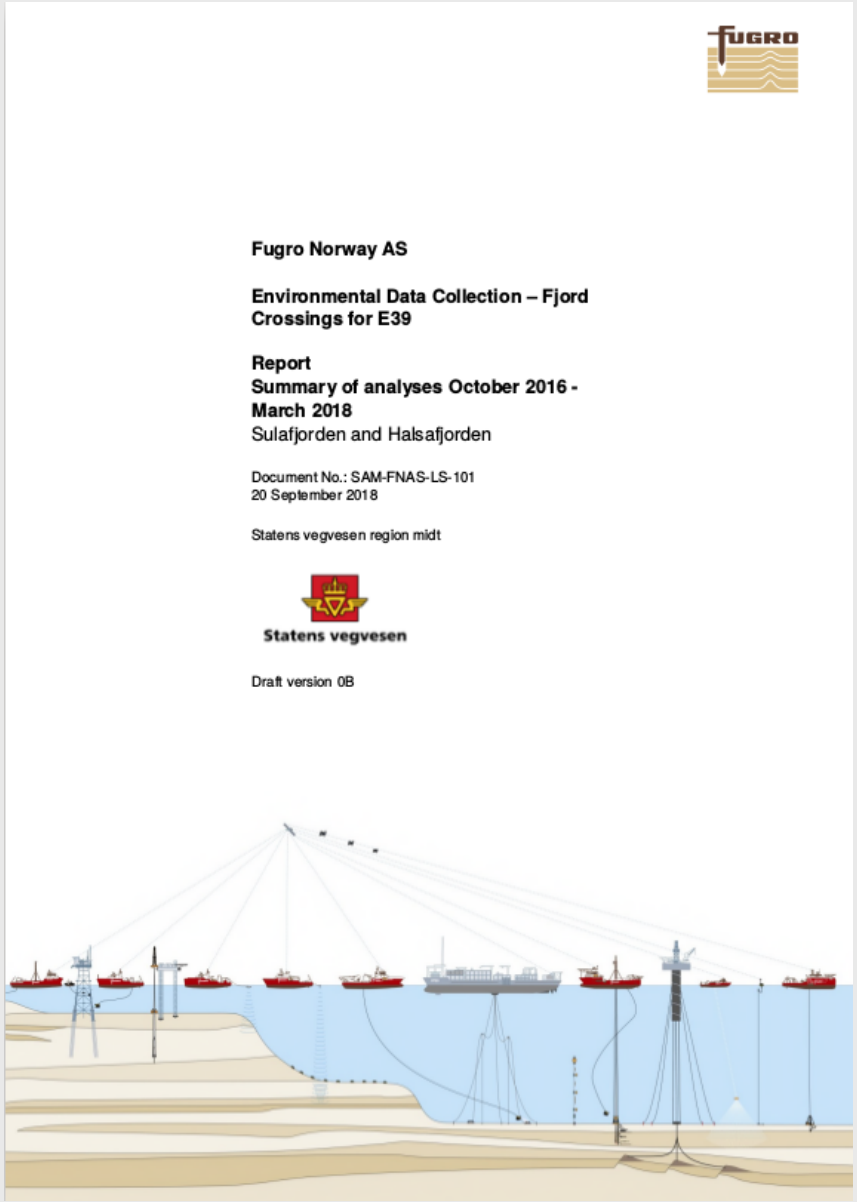
Statens vegvesen

Fergefri E39 - Mid Region

Rev.	Utgivelses-dato	Beskrivelse	Laget av	Sjekket av	Prosj. godkj.	Klient godkj.

Kunde	
Statens vegvesen	
Konsulent	Kontrakt-nr.:

Dokumentnavn:		
General Design Basis E39 Fjord Crossings – Mid Region		
Dokument nr.:	Rev.:	Sider:
Draft	A	Xxx



FUGRO

Fugro Norway AS

Environmental Data Collection – Fjord Crossings for E39

Report
Summary of analyses October 2016 - March 2018
Sulafjorden and Halsafjorden

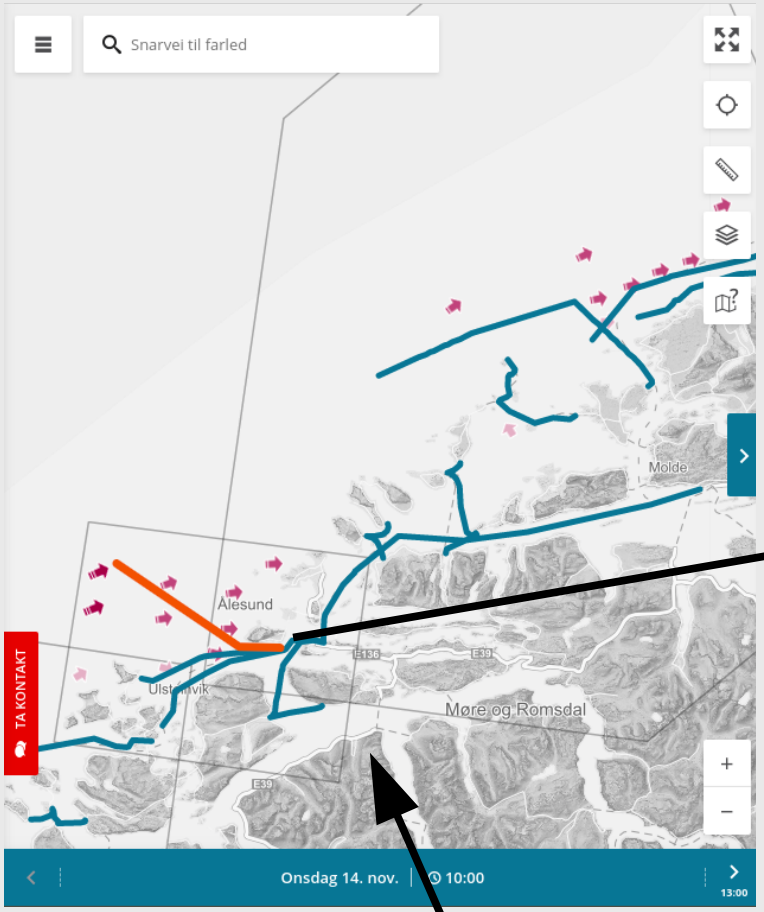
Document No.: SAM-FNAS-LS-101
20 September 2018

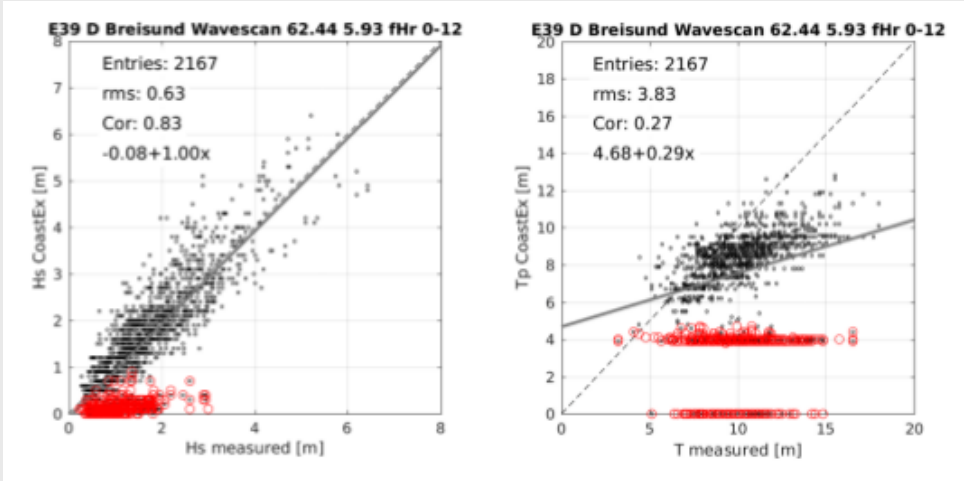
Statens vegvesen region midt

Statens vegvesen

Draft version 0B

Gjenbruk





Norwegian Meteorological Institute

METreport

No. 14/2017
ISSN 2387-4201
Oceanography

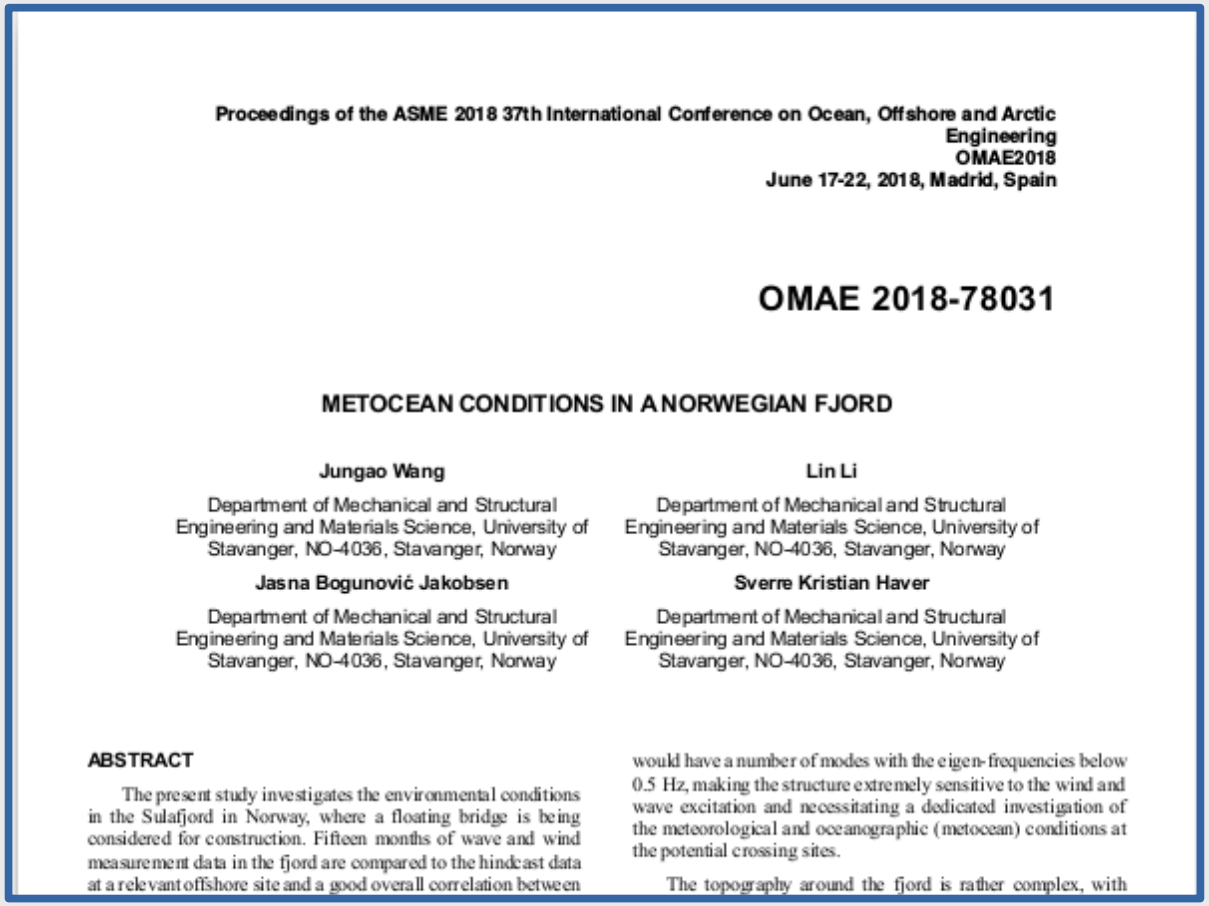
Kystnære bølgevarsler på Barentswatch og yr

Birgitte Rugaard Furevik

Verifikasjon av Kystverkets bølgevarsling på Barentswatch.no

Meteorologisk institutt

Gjenbruk



Proceedings of the ASME 2018 37th International Conference on Ocean, Offshore and Arctic Engineering
OMAE2018
June 17-22, 2018, Madrid, Spain

OMAE 2018-78031

METOCEAN CONDITIONS IN A NORWEGIAN FJORD

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Lin Li
Department of Mechanical and Structural Engineering and Materials Science, University of Stavanger, NO-4036, Stavanger, Norway

Jasna Bogunović Jakobsen
Department of Mechanical and Structural Engineering and Materials Science, University of Stavanger, NO-4036, Stavanger, Norway

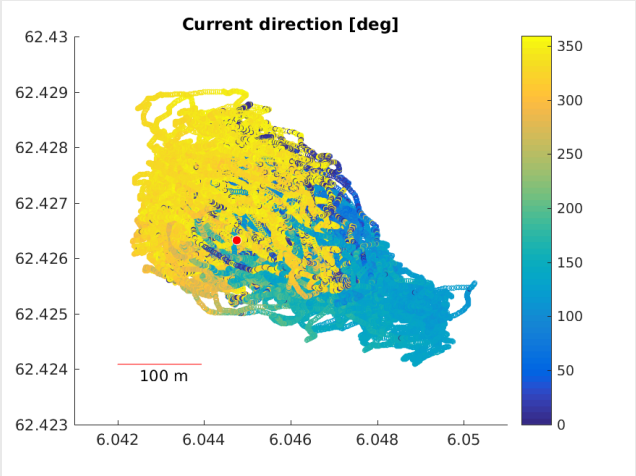
Sverre Kristian Haver
Department of Mechanical and Structural Engineering and Materials Science, University of Stavanger, NO-4036, Stavanger, Norway

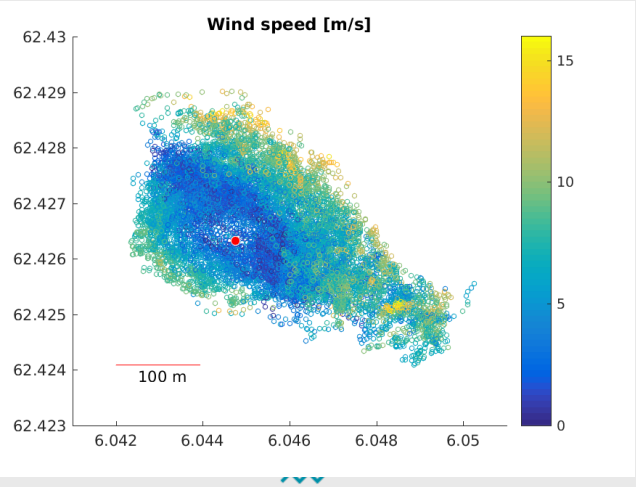
ABSTRACT

The present study investigates the environmental conditions in the Sulafjord in Norway, where a floating bridge is being considered for construction. Fifteen months of wave and wind measurement data in the fjord are compared to the hindcast data at a relevant offshore site and a good overall correlation between

would have a number of modes with the eigen-frequencies below 0.5 Hz, making the structure extremely sensitive to the wind and wave excitation and necessitating a dedicated investigation of the meteorological and oceanographic (metocean) conditions at the potential crossing sites.

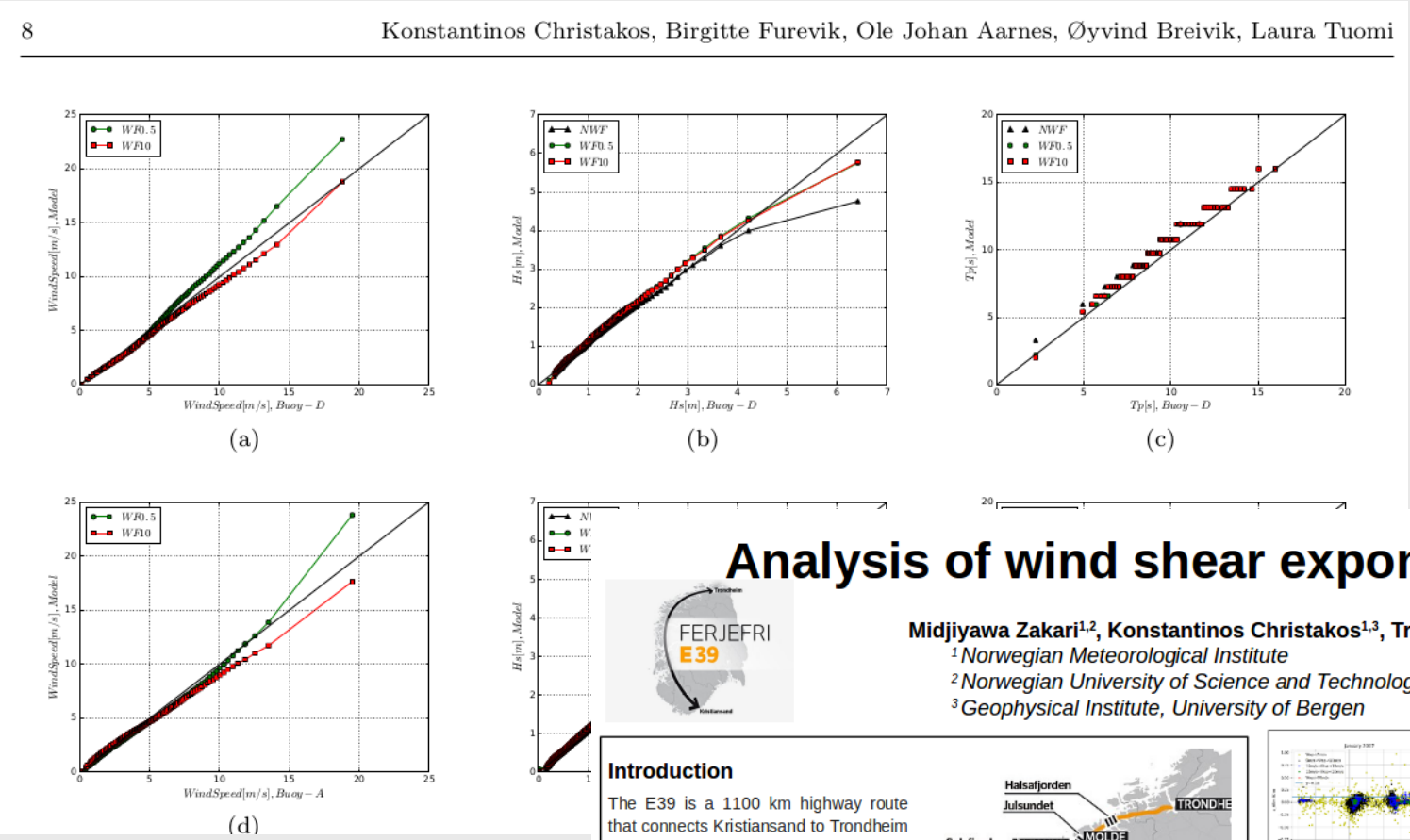
The topography around the fjord is rather complex, with





Bøyers posisjon avhengig av strøm og vindforhold

PhD studier



Forbedret forståelse og modellering av overflatebølger i kyst- og fjordstrøk (K. Christakos)

Integrering av numeriske simuleringer og målinger for mer nøyaktige vindestimater (M. Zakari)

Analysis of wind shear exponent in Sulafjorden

Midjiyawa Zakari[1,2], Konstantinos Christakos[1,3], Trond Kvamsdal[2], Birgitte R. Furevik[1]

[1] *Norwegian Meteorological Institute*

[2] *Norwegian University of Science and Technology*

[3] *Geophysical Institute, University of Bergen*

Introduction

The E39 is a 1100 km highway route that connects Kristiansand to Trondheim (Figure 1). The E39 connects some of the biggest norwegian cities such as Kristiansand, Stavanger, Bergen, Ålesund, Molde and Trondheim.

The purpose of Ferjefri E39 project is to design a ferry-free highway route. Analysis of wind conditions and wind flow characteristics are essential for bridge design. The present study investigates monthly variability of the wind shear in Sulafjorden (Figure 1), a norwegian fjord that E39 crosses. The analysis is based on one year of wind measurements.

Figure 1. E39 highway route (Source: vegvesen.no)

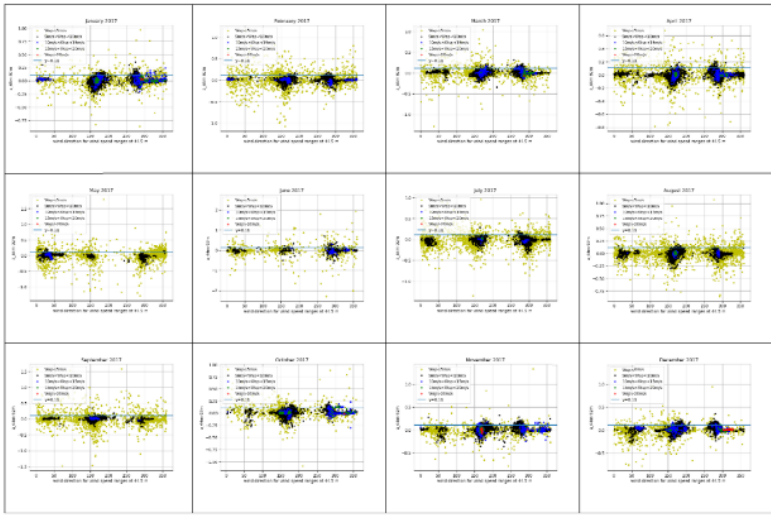


Figure 3. Wind shear exponent as function of wind direction for January, 2017 (Top left) to December, 2017 (Bottom right) in Sulafjorden

Theory and Results

The wind profile power law equations is :

Verifikasjon av modeller

Comparison of observations and modelled wind variables

This site is under development by Lene Ostvand. E-mail:leneo@met.no.

Go to waves

Mast location

Aakvik

Sensor level (m above ground)

17

Model

MEPS full ml

Wind variable

Wind speed

Start year

2018

Start month

Jan

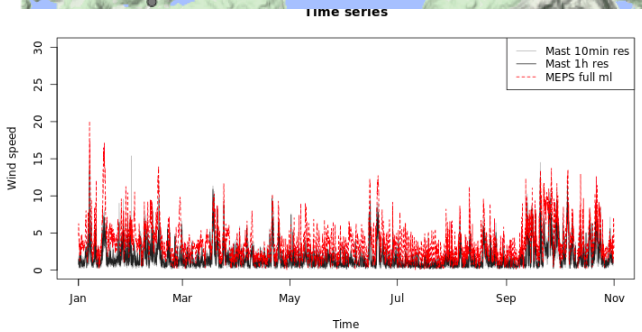
End year

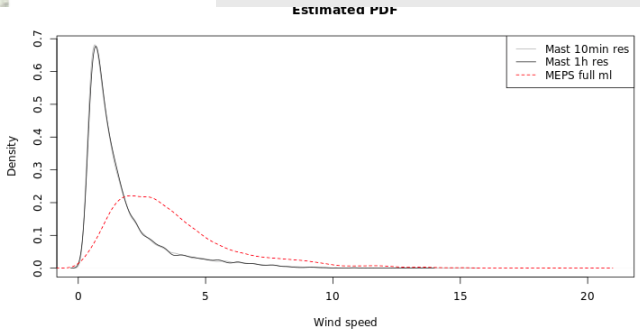
2018

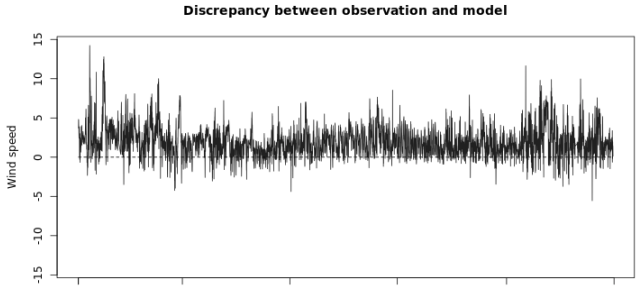
End month

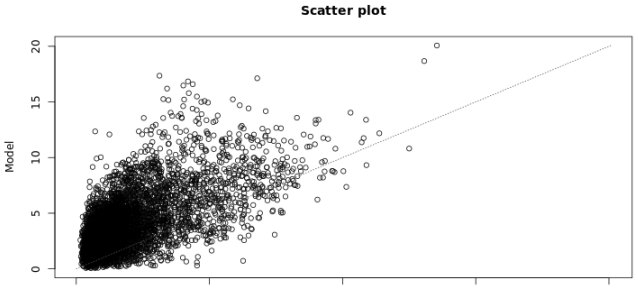
Oct

Verification using Pearson correlations for grid points near Aakvik









Online system som sammenligner modeller med observasjonene

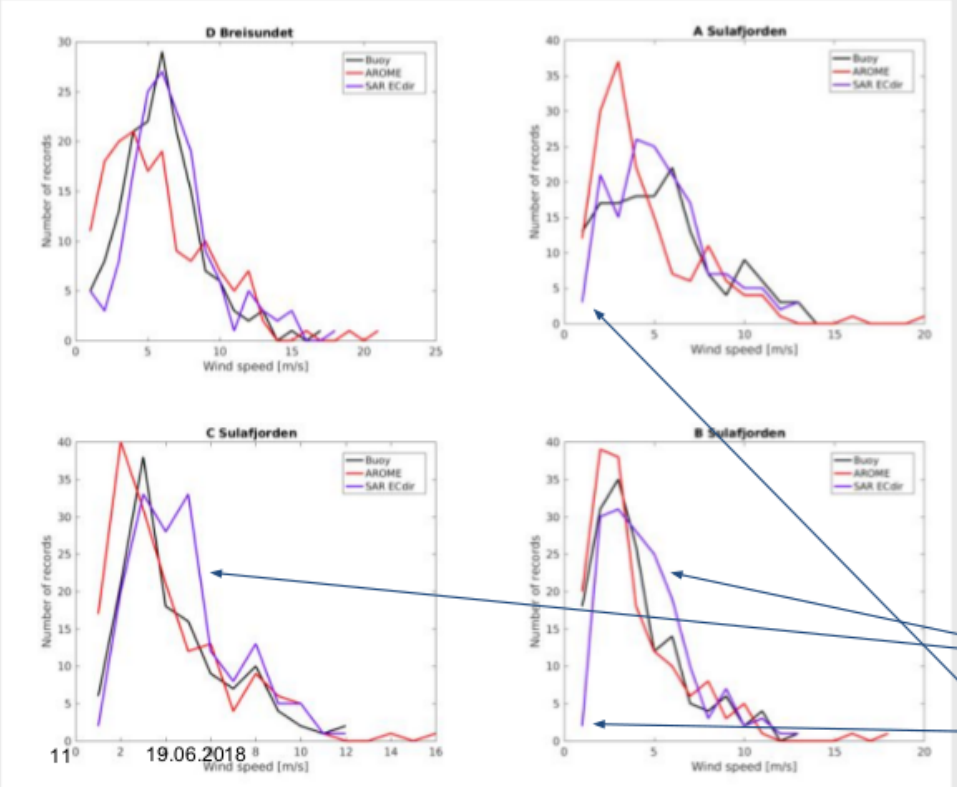
Vind fra satellitt (SAR)

SAR - black
AROME - red

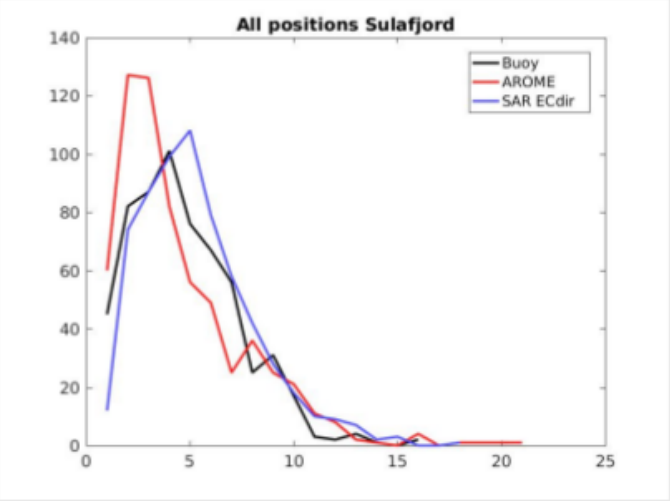
Verifikasjon av SAR og AROME (rødt) mot justerte bøyemålinger (justert til estimert 10m vind).

BØYE	Sula A	Sula B	Breisundet D	Halsafjorden G1	Halsafjorden G2*	Halsafjorden G
RMSE	1.9 (2.7)	2.1 (2.4)	1.9 (2.7)	1.6 (2.1)	1.7 (1.6)	1.7 (2.1)
COR	0.8 (0.7)	0.6 (0.5)	0.8 (0.7)	0.8 (0.6)	0.8 (0.7)	0.8 (0.7)
STDERROR	1.9 (2.1)	1.8 (2.3)	1.7 (2.5)	1.4 (1.8)	1.2 (1.4)	1.5 (1.9)
BIAS	0.1(-1.7)	1.1(-0.5)	0.9(-0.8)	0.8(-1)	1.3(-0.8)	0.8(-0.9)

*Kortere tidsserie med observasjoner tilgjengelig for Halsafjorden G2.



Sentinel 1A IW-scener



too many

too few

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Dessverre problem med geolokaliseringen

Uncorrected image

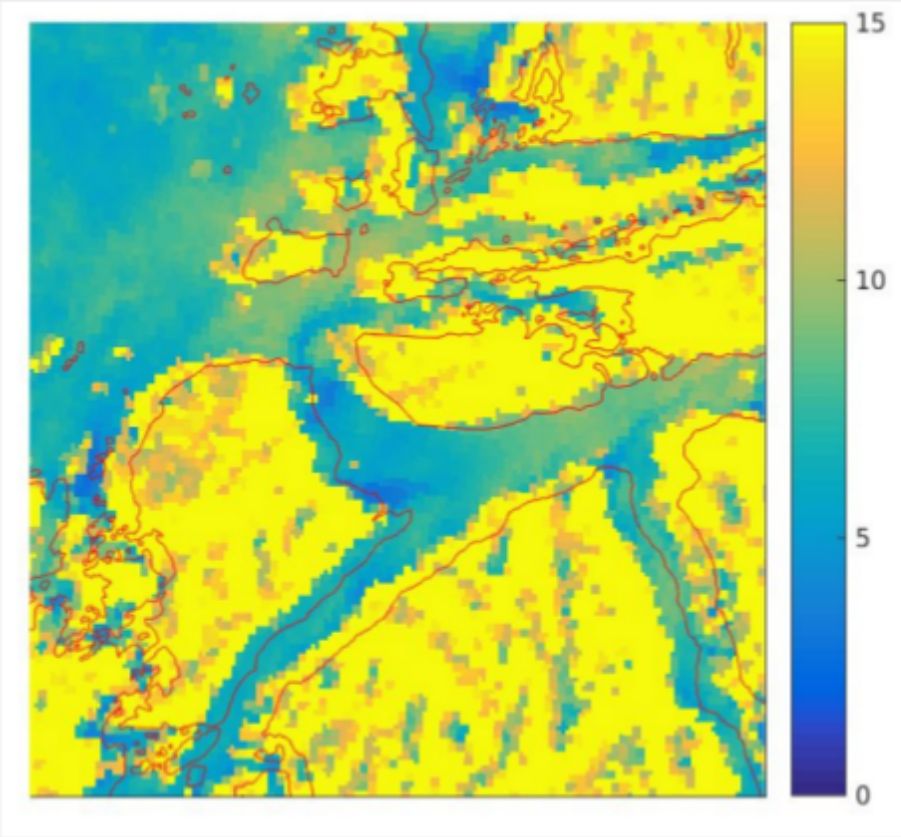
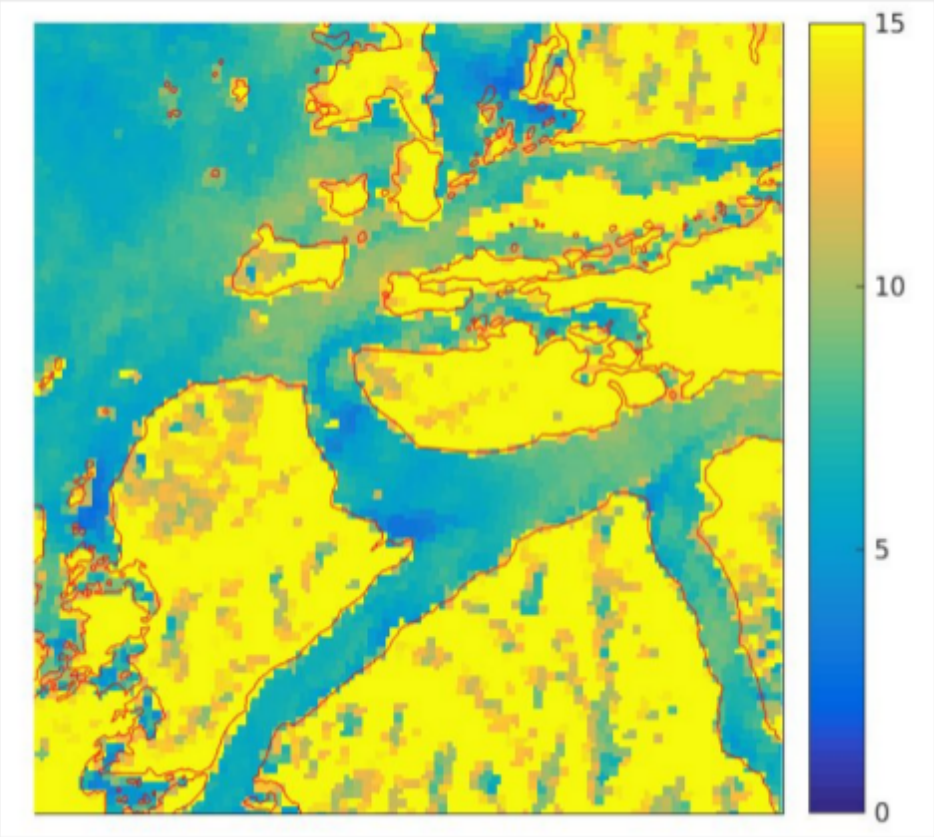


Image moved 3km to the east



Fra presentasjon på Nordisk Meteorologmøte, Reykjavik, 2018

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Noen utfordringer og spørsmål

- NetCDF CF er ikke en standard?

  ...og ukjent i ingeniørverdenen
- Ikke laget for tidsserier – visningsverktøy mangler
- I prosjektet har vi hatt mye arbeid med kontroll av data som kommer inn – brukerveiledning som man kan henvise til, ville vært nyttig
- Veiledning til hvordan man oppnår DOI og publiserer sitt datasett
- Finnes det noen retningslinjer for prosesseringsnivå på samme måte som innen satellitt – level 0, 1, 2 data osv.
- Hva bør stå under licence? "Freely distributed. Must credit the source of data, e.g. \"Data from the Norwegian Meteorological Institute\", \"Based on data from the Norwegian Meteorological Institute\". Data and products are licensed under Norwegian license for public data (NLOD) and Creative Commons Attribution 3.0 Norway. See

  http://met.no/English/Data_Policy_and_Data_Services/."

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Spin-off

- Kystverket ny bøye ved Fauskane
- Aanderaa Xylem leverer bøye og sender data
- Data håndteres etter samme modell
- KyV → Xylem → MET → API → thredds
- Hente sanntidsdata fra frost.met.no (API) til visning I app og på virtuel-AIS

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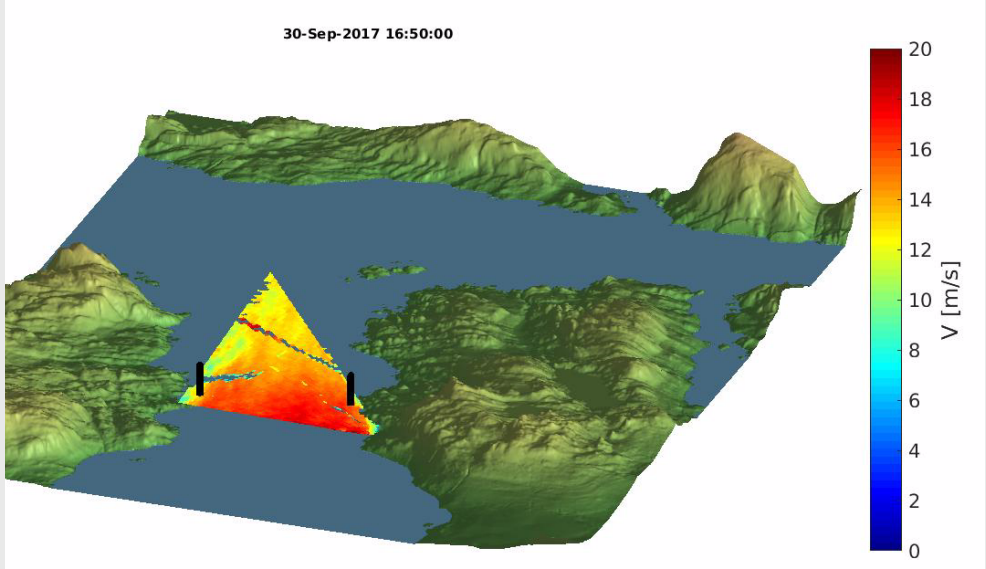
Utfordringer med nye datatyper

- Lidar *(figurene er fra Kjeller Vindteknikk)*
- Skal vi ha inn
  - Rådata (faktisk uaktuellt)
  - Scan som bildefiler
  - Geofysiske variable – vind, turbulens osv
- Igjen: det er behov for å kunne formidle prosesseringsnivå



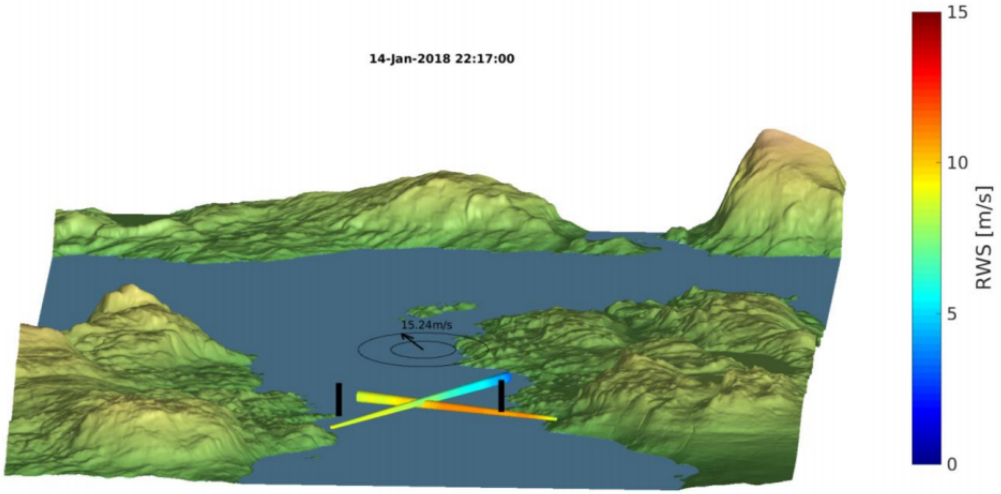


Figure 4-4: 10-minute mean radial wind speed from LIDARs Mikke & Minni on 2018-01-14 22:17 UTC, in Halsafjorden at the height of the bridge deck. Terrain height is exaggerated and bridge tower location indicated by black cylinders. Wind speed and direction at the fjord centre location is also indicated.