

Use of data from Copernicus for project development of offshore aquaculture systems

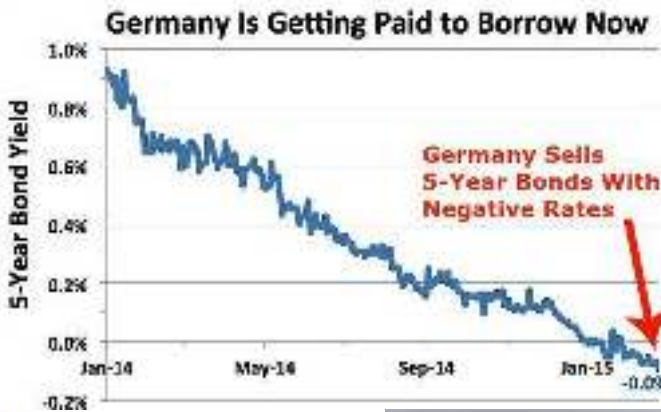
Dr. Karl Strømsem
OffTek as
Nørd AS (Project Developer)

Backdrop



Det tok megleerne kun 29 minutter å hente 90 millioner dollar til Atlantic Sapphire

Hydrogen is a carbon-free energy source



Equinor, SSE win British contract for largest offshore wind project



Deutsche Bank set to add hundreds of staff as it targets ultra-rich clientele

Deutsche Bank is set to add hundreds of staff as it targets ultra-rich clientele. The bank is looking to attract wealthy investors and is planning to open new offices in London and New York. The bank is also looking to expand its private banking services and is planning to add more staff to its wealth management department.





NØRD is a project development company which turns smart ideas for solving today's challenges into solid investment opportunities.

The company was founded in 2016 by Dr. Karl Christian Strømsem Paal Hylén, and Morten Lyssand, all senior executives, with a total of 80 years' combined experience from the international oil & gas-, renewable energy- and marine industries, also including aquaculture.

NØRD identifies, matures and develops business opportunities which are offered to the industry and investor community.

Today the company is involved in international aquaculture projects, development of a construction yard for composite material structures and electrification of marine public transport.





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Aquaculture Projects, Atlantic Salmon, now





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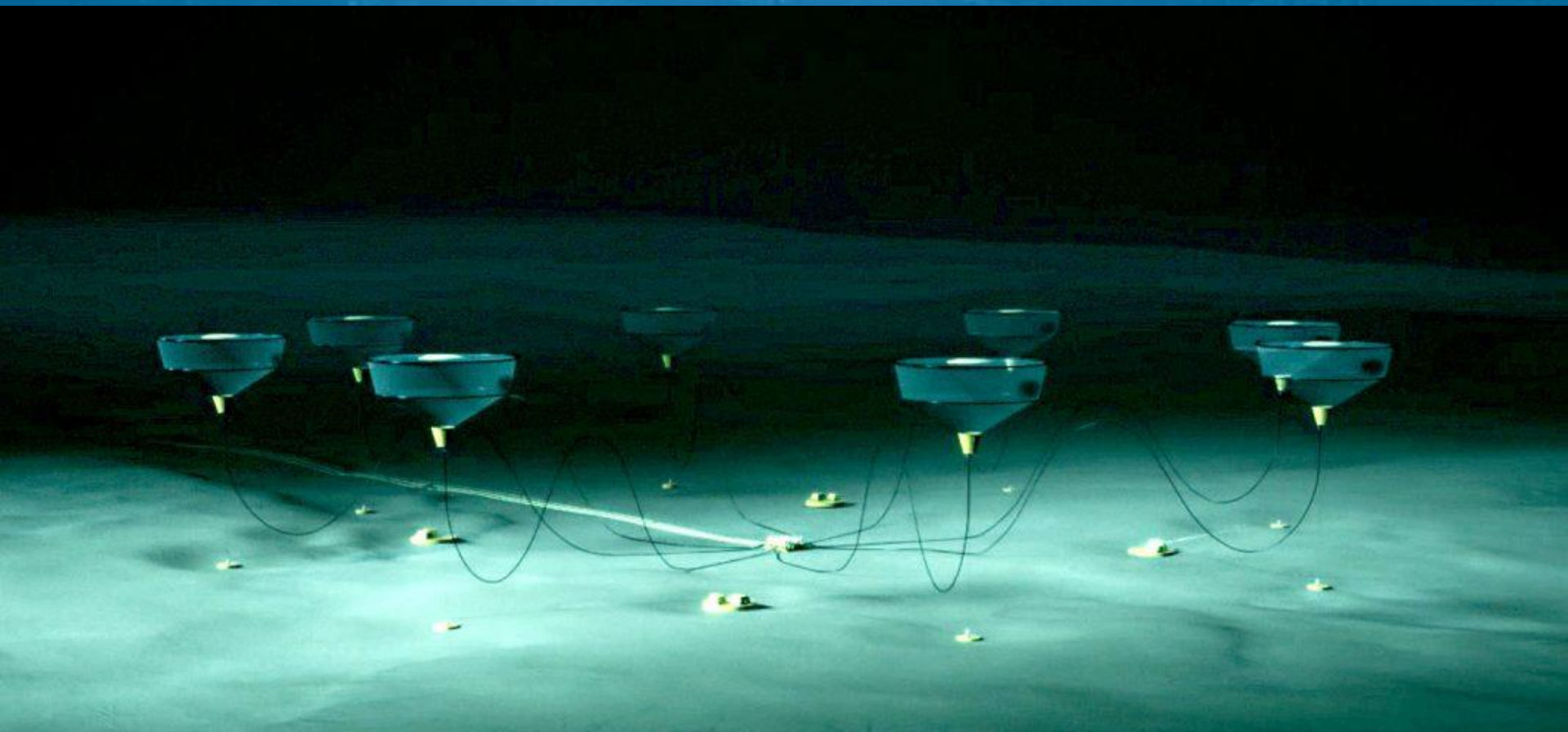
Fjords are «full», offshore the new frontier






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Mowi Subsea, but Nørd has already done this



- Salmon farming is efficient way of producing food
- Optimal water temperatures up to 14/16 deg
- Oxygen levels in the water need to be adequate
- Current not too strong but strong enough
- Waves should be limited or as Nørd go subsea!
- Salmon need to jump at least every 2 week to fill swim bladder
- Operation of a fish farm in new waters may be challenging



Protein Retention	31%	21%	18%	15%
Energy Retention	23%	10%	14%	27%
Feed Efficiency	63%	46%	52%	42%
Feed Conversion Ratio (FCR)	1.1	2.2	2.0	4.10
Feed Intake (g/100 g wet)	40 kg	21 kg	17 kg	4-10 kg
Carbon Footprint (kg CO ₂ e/kg wet)	2.9 kg	2.7 kg	5.9 kg	33 kg
Water Consumption (m ³ /kg wet)	2,000 (low)	1,000 (low)	5,000 (low)	15,000 (low)

Marine Harvest, Salmon Farming Industry Handbook



Moving projects into new frontiers requires DATA to make them bankable
Hence Copernicus of very high value



- IBI_ANALYSIS_FORECAST_PHYS_005_001
- IBI_ANALYSIS_FORECAST_WAV_005_005
- IBI_ANALYSIS_FORECAST_BIO_005_004
- IBI_REANALYSIS_PHYS_005_002
- IBI_REANALYSIS_WAV_005_006
- IBI_REANALYSIS_BIO_005_003

- T, Temperature
- S, Salinity
- $U_{x,z}$ Current in two directions
- H_s, T_p — Significant wave height and peak period
- O2- Dissolved oxygen

At surface and bottom and at 50 depth levels
Forecast and Hindcast
Low and high resolution

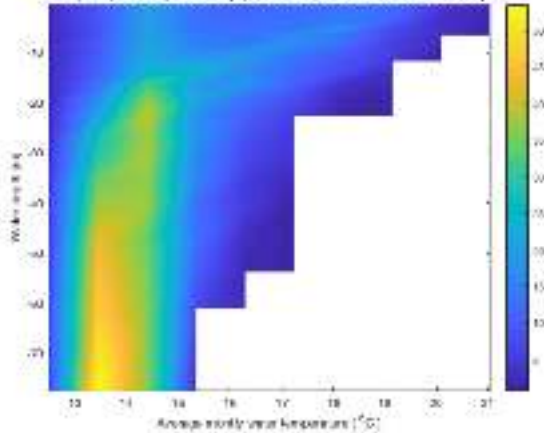
NB: Forecast can be used as historic data



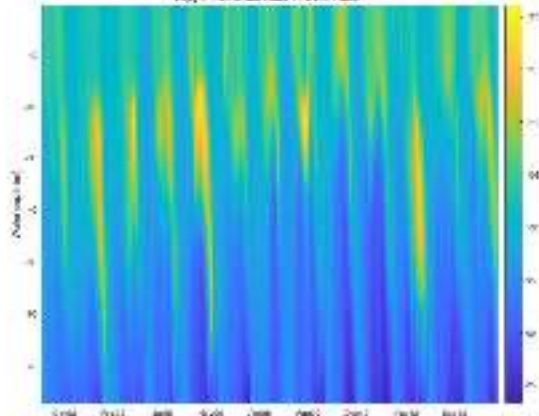
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Case: Examples of processed data, Aveiro

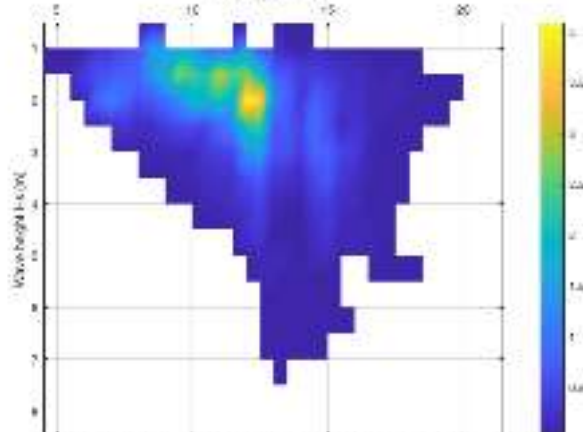
Aveiro: Temperature prob. dist. (%) from 2022 to 2094 as func. of water depth



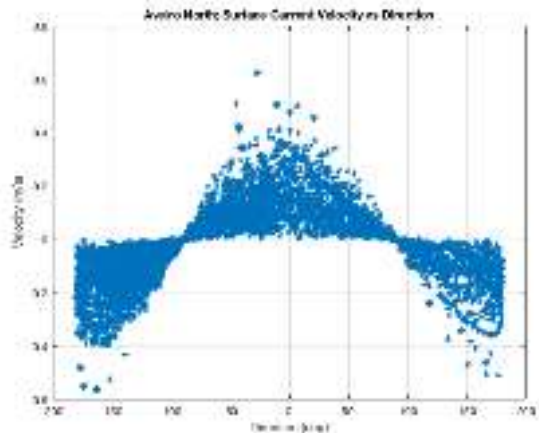
Depth of water mean in Aveiro, Aveiro

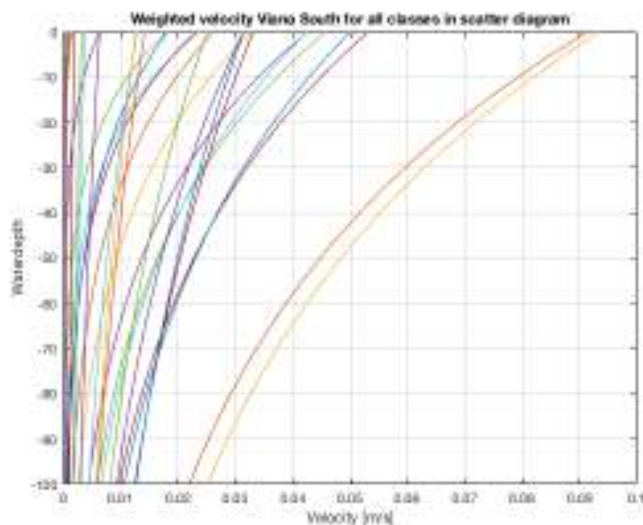


Peak period Tp (h)



Aveiro North: Scatter diagram, probability distribution of the Tp (h)





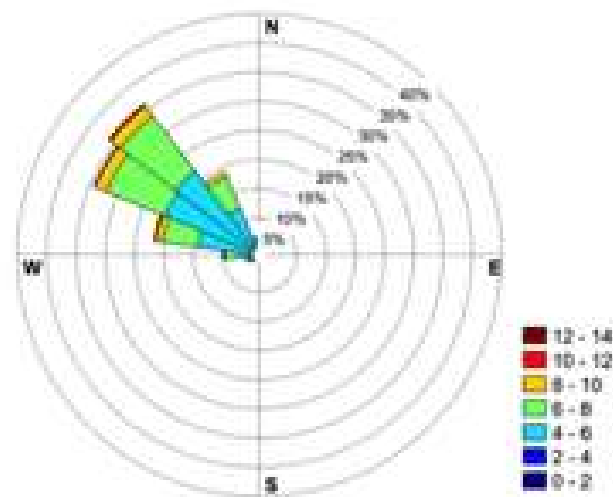
Aveiro: Design data

Maximum design conditions for Pilot 1

Condition	Hs (m)	Tp (s)
1 year extreme condition	9	15
1 year maximum shorter period	7	13.5

Temperature degC

Depth	Max	Mean	Min	Std
0	22.0	16.9	13.0	2.3
-10	20.5	16.4	13.0	1.9
-20	19.3	15.3	13.0	1.2
-30	19.3	14.7	12.7	1.0
-40	18.6	14.4	12.3	0.9
-50	17.3	14.2	12.2	0.8
-60	16.3	14.1	12.2	0.7
-70	15.4	14.0	12.1	0.6





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Final system under deployment





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Installed and being submerged



Thank you for your attention