Business need

Problem Statement

Denmark Strait Overflow (DSO) is a dense cold current that flows through a sill between Greenland and Iceland into the Atlantic Ocean. Because of its density, it sink onto the ocean floor. [1] This brings great difficulty in measurement and monitoring. However, there is an urgent need for scientist and environmental agency to study the current.

The ocean is an extremely complex system where a small change will snowball into great impacts. It is known that increase in temperature, even by 1°C, can greatly impact ecology[2]. Data have been collected 20 m from seabed near 5 different mooring sites. However these data are meaningless without analysis and modelling. This gap in understanding may not have immediate effect, but in a larger time frame can cost humans greatly due to its complexity and our dependence on the ocean.

The data collected are over a 17 years' timeframe, from 1998 to 2015. The DSO have shown annual salinity variance in the past [1], analysing the salinity and temperature cycles may give us insight on how and how much global warming have affected ocean currents. A starting point would be to show the trend of change in temperature, salinity, and density in different location along the time axis. Further analysis and exploration can be done with more complex mathematical model.

Persona 1 :

Name: Marina Ocean

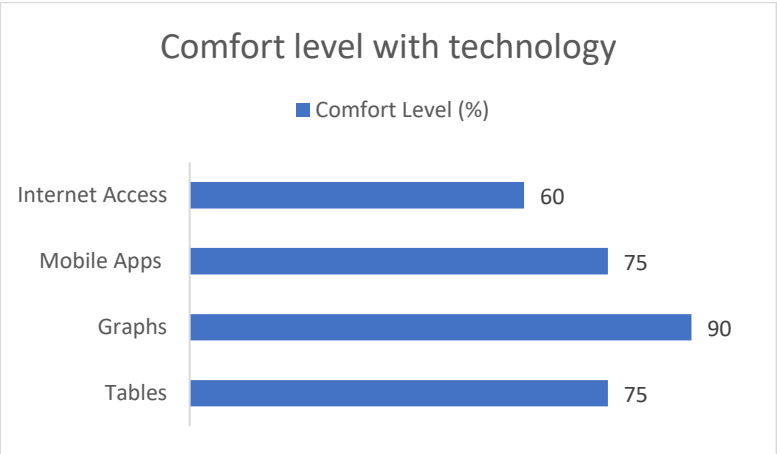
Age: 35

Job: Marine ecologist

Location: Greenland

User story: Marina is a researcher employed at a environmental agency. Her job is to monitor the ocean and provide suggestions and insight on living organism in it. She notices that there is a lack of understanding on the DSO. She wants to analyse data but lack the means and knowledge on oceanography to do so. She is comfortable with datas and visualisations. However, she is often on field trip and have no reliable internet access.

Quote: " I love the ocean and all that depends on it, including us human"



Goals:

- Understand and be able to draw insight on data from DSO
- Make sense of large dataset such as the one from DSO

Needs:

- Be able to access data without internet
- Be able to call up graphs when she needs them without internet
- Be able to "zoom in" into part of the data to inspect more closely

Frustrations:

- She is not working mainly with ocean currents. She have some but insufficient background knowledge
- She would not have reliable internet access sometime

Questions

- How much have the temperature of the current changed in the past 15 year? Is the temperature increasing or decreasing faster?
- Did the DSO change direction? If yes how is that changing
- Is the annual salinity consistent in the past 15 year? Does the pattern of change coincide with the temperature change?
- Can we predict how the current is going to change in the next 5 years and present it to users, such as environmental agencies and marine services?

Bibliography

[1]

J. G. Opher et al., "The Annual Salinity Cycle of the Denmark Strait Overflow," Journal of Geophysical Research: Oceans, vol. 127, no. 4, Mar. 2022, doi: 10.1029/2021jc018139.

[2]

G. V. Ashton, S. A. Morley, D. K. A. Barnes, M. S. Clark, and L. S. Peck, "Warming by 1°C Drives Species and Assemblage Level Responses in Antarctica's Marine Shallows," Current Biology, vol. 27, no. 17, pp. 2698-2705.e3, Sep. 2017, doi: 10.1016/j.cub.2017.07.048.