Master Thesis at the University Centre in Svalbard (UNIS)

CFD simulation of the flow field around a ship

Description

Meteorological researchers at UNIS are interested in learning more about atmospheric boundary layer effects in Svalbard. For this purpose, the "Iwin" project (https://research.unis.no/iwin/) is establishing a network of weather stations across Isfjorden, including instrumentation on ships to take measurements of key parameters such as wind speed, wind direction, temperature, pressure, and relative humidity. The ships are small tourist cruise vessels that are going for day-trips in the fjords around Longyearbyen.

The objective of this thesis is to investigate the interference of one of the ship's hull on the meteorological measurement station using computational fluid dynamics (CFD) simulations. The aim is to obtain an estimate how wind speed, wind direction, and cruise speed will affect the measurements (primarily wind). In addition, the simulations will be used to correct the measurements and remove the effects of the ship's flow field.

The first step in this thesis will be to generate a 3D model of the ship with computer aided design (CAD). The basis for this will be construction drawings and a 3D model that will be obtained from a drone-based structure-from-motion method. The 3D model needs to be cleaned up into a watertight model that can be used for CFD. The second step will be to generate a 3D CFD mesh of the vessel and to ensure that the grid resolution is adequate. The third step will be to conduct CFD simulations with ANYSYS Fluent for several wind speeds and wind directions. Finally, a function to correct the measurements will be derived and the results discussed critically.

This work will be conducted in cooperation with the UNIS and the Norwegian University of Science and Technology (NTNU). The candidate will have the opportunity to be located in Longyearbyen.

Fig. 1: The small touristic cruise boat.

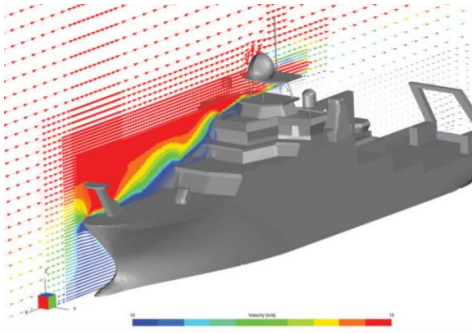

Fig.2: Conceptual results (on a different research vessel).

Tasks

- Literature review on meteorological measurements on ships and CFD simulations.
- Generation of a 3D model of the ship.
- Meshing of the ship with Pointwise.
- CFD simulation with ANSYS Fluent.
- Developing a correction function to remove the effect of the ship's flow field on the measurement station.
- Critical discussion of results.

Requirements

- Basic interest in fluid dynamics and meteorology.
- Basic skills in CFD and CAD.
- Independent and reliable work style with a detail-oriented mindset.

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