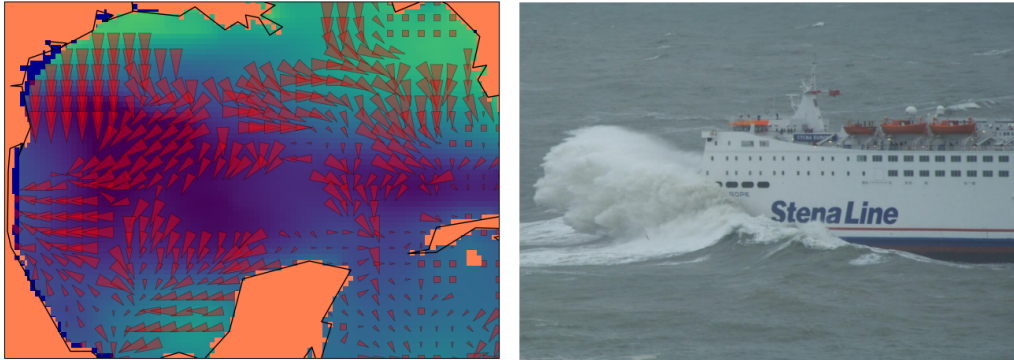


Master's thesis project: Model flow of ocean wave characteristics in space-time



Introduction

The sea state ("wave weather") is of great concern to shipping. Large waves with certain properties might destroy a ship. However, even for less severe sea states, the fuel consumption, accumulated fatigue damage, discomfort of passengers, and time to arrival will be strongly affected by the encountered sea states. Therefore, knowledge of the sea state is needed when designing ships, when choosing the route to travel between origin and destination, and when making (or planning for) operational decisions on board. Unfortunately, often knowledge of the future sea states are needed. It is generally impossible to make exact predictions into the future. In lack of perfect information, decisions have to be based on predictive probability distributions representing the uncertainty in the future sea states.

The project

At the department of Space, Earth and Environment we are developing a probabilistic space-time model to explain the uncertainty in sea states. So far, the flow (transportation) of sea states are not included in this model.

The objective of this thesis project will be to develop a prediction model of the flow into the present probabilistic space-time model, and evaluate the amount of predictive and explanatory improvement. The work can be carried out following one- or both of the following approaches:

- Develop a flow model based on the physics behind ocean waves and wind interaction.
- Develop, and train, a machine-learning/statistical model that can learn to predict the flow based on patterns in historical data.

The developed model should be able to make predictions of future flow given data of current and past sea states.

Prerequisites

This is a master's thesis project for 1-2 person(s) and require an interest in ocean wave physics, statistics, programming, machine-learning, and data analysis. It is appropriate that the student(s) enjoy and have completed courses in multivariate calculus, statistics. It would also be useful to have taken, at least, some course in subjects such as machine-learning, image analysis, or equivalent.

The current code in this project is written in Python and the student(s) will need to interact with this code to some extent. The student should therefore be experienced enough to quickly be ready to work in a Python environment. This does not necessarily mean that the student(s) have to be experienced with Python, but at least some similar language such as Matlab, R, or Julia.

Keywords: Ocean wave modeling, Gaussian processes, Data analysis, Machine-learning, Statistics.

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