Development of hybrid machine learning approach to determine accurate sea surface heights by utilizing satellites, in-situ and model data

Summary

Several inconsistent sources of marine data/models are used for determining sea level. The geoid (equipotential surface) allows these sources to conform to a common vertical reference datum. The focus of this study is on developing machine learning algorithms that combine different data sets for accurate determination of offshore sea level heights.

Research field:	Building and Civil Engineering and Architecture
Supervisors:	Artu Ellmann Nicole Camille Delpeche-Ellmann
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

Obtaining accurate and compatible sea level data is now more important than ever, especially for navigation, engineering and climate studies. Several sources such as tide gauges (TG), satellite altimetry (SA), hydrodynamic model (HDM) and GNSS (Global Navigation Satellite System) data are often utilized. These sources however suffer from: (i) different resolutions and (ii) dissimilar or unknown vertical reference datum. The utilization of the geoid (equipotential surface of the earth) allows all these sources to now conform to a common vertical reference datum. By synergizing the different data sets it is now possible to obtain accurate sea level data from the offshore to the coastal areas within centimetre accuracy.

Accordingly, the PhD student will develop a method that combines SA, TG, geoid, HDM and GNSS profiles to determine accurate sea level data. This development requires: (i) bringing the various data sets to a common vertical reference datum using the marine geoid; (ii) examining the sea level results especially with respect to inconsistencies and reasons for this, and the errors associated with corrected sea level (iii) identifying the contributors that affect the sea level with a spatial and temporal sea level budget and (iv) using all the sources along with the relevant data on the contributors to perform statistical and machine learning algorithm to predict the real-time sea level and its associated uncertainty.

The PhD student will perform signal processing, statistical and computing techniques (in terms of RMS error, stand. dev, uncertainty estimates, error budgets, machine learning techniques etc.). From these results, a specific model will be developed toward predicting the instantaneous real-time sea level that is essential for engineering and navigation purposes. The PhD student is expected to assist in project related field campaigns.

Applicants should fulfil the following requirements:

- University degree (MSc) in geodesy/geomatics (consideration will be given to applicants with previous degrees in related disciplines, e.g. Earth Sciences, Mathematics, Physics or software engineering)
- Advanced computer literacy and programming skills
- Skills in signal processing, data analysis, mathematical and statistics, machine learning
- Ability for independent research as part of a team, interest in the presentation/publication of scientific results
- Good command of the English language

Funds will be provided for research trainings, conferences and international mobility with durations up to 6 months. The research group wishes to increase the number of women involved in the research. Qualified women are therefore also encouraged to apply.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/253 or scan the the code on the left with your smartphone.