Coastal wave fields for energy, engineering and safety in the Baltic Sea

Summary

Advancing and extending the Baltic Sea wave information to coastal scales.

Research field:	Earth sciences
Supervisors:	Victor Alari Sander Rikka
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

The Baltic Sea (BS) coastal zone is heavily exploited by various stakeholders, who at the same time need to acknowledge the met-ocean conditions like wind, water level, ice, currents and waves. Among these parameters, waves stand out for two reasons - waves are the dominating power shaping coastlines, but also act as a source of recreational activities and risk simultaneously. For instance, surfing in the coastal sea or sailing on gentle waves can serve as a form of amusement, but high sea-states pose a threat to almost all activities in the coastal zone. Information on coastal waves in particular is needed for infrastructure design (e.g. harbours, wind farms) and to raise situational awareness (e.g. shipping, dredging operations). Therefore, accurate and relevant information on waves is required, in order to guarantee safety for humans as well as the environment.
In line with the safety issues, a question arises: can we actually make good use of waves? A very active research topic at this point is wave energy, i.e. where, how, how much and at which cost (also for the environment) can we extract energy out of waves. As the very minimum, the knowledge of wave conditions at multiple scales is needed. For the BS, the offshore wave climate has been mapped to a satisfying degree and the operational models have been accurately established. However, we still know very little about the coastal zone and the existing information is often inaccurate. It only takes one look at the BS coastline to understand why a special effort is needed to map the coastal wave fields.
The main objective is to advance and extend the Baltic Sea wave information to coastal scales. In order to achieve this objective, the applicant will consider in situ measurements, remote sensing, numerical modelling and big data. The specific aims are (not limited to the list): (1) make use of a newly developed wave measurement device to map coastal wave fields and gather representative data for validation; (2) conduct a multi-scale hindcast on unstructured meshes with the state-of-the-art wave model SWAN; (3) form a synergical coastal wave database combining in situ measurements, simulations and remote sensing data; (4) estimate the wave energy potential and wave induced risk; (5) put the newly acquired knowledge into practice, e.g. by determining wave energy converter types best suited for specific locations and wave conditions. Depending on the interests of the applicant and the first year results, specialization in in situ technology, modelling or remote sensing is possible.

Responsibilities and tasks:

- conducting numerical simulations
- data analysis
- publishing results

Qualifications: MSc in Earth Sciences, Engineering, Physics, Mathematics or related field.

Requirements for the applicant:

- Curiosity to find things out; proactivity
- Independence as well as fine communication skills
- Broad interest in earth sciences, engineering, mathematics and physics, and particular skills in one of those

- IT skills (Python or Matlab, Linux)

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