Environmental Big Data Analytics for Climate Services in the Baltic Sea Region

Summary

The PhD project is dedicated to examining oceanographic and atmospheric 4-dimensional data (remote sensing, model re-analysis and climate projections) in the Baltic Sea region with the aim of uncovering hidden patterns and teleconnections of essential climate variables to advance the climate services for the decision support. The project has a scientific and a practical objective: (a) how to retrieve new scientifically sound regional marine climate information using big data analytics and; (b) how to present the relevant climate data to assure effective uptake of the value added information in the decision-making processes.

Research field:	Earth sciences
Supervisors:	Dr. Ilja Maljutenko Dr. Rivo Uiboupin
Availability:	This position is available.
Offered by:	School of Science Department of Marine Systems
Application deadline:	Applications are accepted between June 01, 2023 00:00 and June 30, 2023 23:59 (Europe/Zurich)

Description

There is growing need for climate services for decision support in order to adapt to the climate change and fulfil the global and European climate targets postulated in the UN Agreements, European Green Deal and Fit for 55 plan. Among other activities it is essential to manage maritime space more sustainably and to help tap into the growing potential of offshore renewable energy. The ambitious climate objectives in the Baltic Sea region can be achieved if the decision making is governed by accurate and comprehensive understanding of the climate patterns over the coastal and sea areas, which relies on interpretation of environmental big data records that have been made available. Currently a large amount of oceanographic data is provided by EU programmes (Copernicus, EmodNet) and national authorities. However, the full potential of the available data (remote sensing, model re-analysis, climate projections, forecast services) is not exploited for the benefit of decision-making process.

Current PhD project is targeted at analyzing the environmental geospatial data in the Baltic Sea region with the aim of uncovering hidden patterns and teleconnections of essential climate variables to advance the climate services for the decision support. The rising number of data-journals and open data repositories provide good platform to disseminate the data derivatives of the big data.

Supervisors

Main supervisor: Dr. Rivo Uiboupin
Co-supervisor: Dr. Ilja Maljutenko

Responsibilities and (foreseen) tasks:

- Development and testing of big data analytics methods for statistical analysis (e.g. Correlation analysis, EOF analysis, Wavelet analysis, Clustering) of geospatial 4D oceanographic data.
- Implementation of the data mining and environmental big data multivariate analysis to explore meaningful patterns in the data cubes.
- Development of new geospatial indicators of marine environment, such as Marine Heat Wave / Cold Spells extent and duration during different winter scenarios.
- Development of regional climate products from Earth Observation data products (Sentinel family satellites and their predecessor).
- Investigation of the re-analysis datasets and future climate projections to reveal statistics of extreme events in the marine environment (spatio-temporal extent, frequency, nature of extreme).
- Statistical downscaling of CMIP6 climate scenario projections to analyze future climate patterns and provide corresponding suggestions for sustainable marine space use.

- Preparing research papers and publishing the value-added datasets in data repositories as well as promoting the use of new data products in decision-making process.

Applicants should fulfil the following requirements:

- A master's degree in one of the following subjects: Natural Sciences (Earth Sciences, Oceanography, Physics etc), Data Science or Computer Science.
- A clear interest in the topic of the position.
- Good skills in one of the following computer languages – Python, MatLab, R, Julia.
- Previous experience in analyzing geospatial data (remote sensing imagery, structured- and unstructured model fields).
- Excellent command of English.
- Strong and demonstrable writing and analytical skills.
- Capacity to work both as an independent researcher and as part of an international team.

The following experience is beneficial:

- Knowledge about Linux/Unix systems.
- Previous experience with data bases (i.e Copernicus), data mining, implementation of machine learning methods.

We offer:

- 4-year full time (fully funded) PhD position in an outstanding Baltic Sea research institutions with a large portfolio of ongoing pan-European and national public sector applied research projects.
- Opportunity to participate in applied research projects funded by European Commission (e.g. LIFE programme), European Space Agency (ESA) and European Centre for Medium-Range Weather Forecasts (ECMWF).
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of oceanography.

About the department

Tallinn University of Technology (TalTech), the only technological university in Estonia, is the flagship of Estonian engineering and natural sciences. Here the synergy between different fields (technological, natural, exact, economic and health sciences) is created and new ideas are born.

The Department of Marine Systems at TalTech is a leading oceanographic and meteorological R&D unit in the Baltic Sea region. We focus (1) on oceanographic process research based on scientific analysis to find cause-and-effect relationships and (2) on developing marine monitoring and forecasting services. The implemented methods include machine learning based algorithms for satellite image processing and for model data analysis as well as development of innovative (operational) methods for monitoring the marine environment and analyzing the changes. We have long-term experience in developing applications and methods for operational oceanography, the outputs of which are information products provided to the general public and to various authorities on water level variability, ice conditions and other parameters of marine physics. We are contributing significantly to the pan-European Copernicus program (CMEMS) and Destination Earth (DestinE) initiative.

Additional information

For further information, please contact Rivo Uiboupin rivo.uiboupin@taltech.ee or Ilja Maljutenko ilja.maljutenko@taltech.ee.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/674 or scan the the code on the left with your smartphone.