

Looking from space to map the coastal ecosystem in Oman

Combining Artificial Intelligence and Remote Sensing

Department: Physical Geography

Research group: Landscape processes and Geocomputation

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Project description

Shallow seas with large tidal flats are extremely productive and provide forage and breeding habitat to millions of migratory birds and nursing grounds for fish. Benthic macrofauna (shells, crabs, worms, etc) are a key part of these ecosystems as they process organic matter, recycle nutrients and are an important food source. Monitoring these species and their local environmental situation is time consuming and complicated due to the tides and the often muddy circumstances.

Within an NWO project we work on monitoring environmental conditions and benthic macrofauna on tidal flats with remote sensing. To enhance the information extraction from satellite images, we developed an Artificial Intelligence (AI; deep learning) algorithm for the Dutch Wadden Sea. It enhances the information extraction from satellite images by providing features that describe the image next to the spectral bands. These features improved the prediction of sediment characteristics up to 20 %-points.

The next step is to test the algorithms in a tropical region. Barr al Hikman, Oman, is a tropical peninsula surrounded by pristine tidal flats. On these tropical flats, seagrass is a common appearance, which creates an attractive habitat for many species in the lower part of the foodweb. During extensive field campaigns during four winters between 2012-2015 geocoded data were collected on seagrass, sediment characteristics and crabs. With the AI algorithm we aim to enhance the models for the mapping of these variables from satellite imagery.

During the project you will apply the AI algorithm to Landsat imagery, acquired in periods matching the field surveys at Barr al Hikman. By doing so, the number of variables per pixel increases from four spectral bands to around 40 features plus four spectral bands. With these variables you will run Random Forests (statistical machine learning technique) to predict sea-grass density and median grain size; two important factors for benthos, and potentially the distribution of two crab species. If successful, this project will be an important step to enable monitoring the tidal flats of remote Wadden areas.

This Bright Minds project will be supervised by a subgroup from the NWO project, including researchers from UU and NIOZ. We will have online meetings as well as face-to-face meetings in the VMA building if Covid regulations allow. The project will be a desktop study, no fieldwork is needed to collect the data. There is a possibility though to join a field campaign at Texel for a few days to walk on the flats and experience the field sampling yourself.

Job requirements

You have experience with remote sensing, GIS and scripting in R or Python. An interest in tidal systems and their ecology is a pre.