**Title**

Global distribution of muddy coasts using a hybrid classification model: An automated method that employs multispectral satellite imagery and globally available coastal datasets

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**Abstract**

The coastal area provides important services such as valuable habitats for wildlife, resources for regional development, and buffer zones for the land against natural disasters such as storm surges. But these narrow coastal areas experience pressure from both land and ocean side. In order to regulate sustainable coastal development, protect coastal areas from natural forces, implement ecosystem protection strategies and mitigate the impacts of climate change on coastlines, it is crucial to observe and quantify the changes along coastlines that are vulnerable to these pressures. Among the various coastal environments, the focus of this master thesis is on muddy coasts. A muddy coast is defined as a coastal depositional environment that is usually formed along an unsheltered coastline exposed to low energy conditions and that consists mainly of fine sediments, which are smaller than 63 micrometres in diameter. So far, few methods have been developed to detect sandy coasts and the rate of change of sandy coastlines at global scale, but little is known about the detection and behaviour of muddy coasts. The main objective of this thesis is to develop an automated classification method to identify muddy coasts along all the coastlines of the world. The main objective can be translated into the following research question: How can a reliable global mud classification be obtained by analysing the characteristics of muddy coasts using publicly available satellite remote sensing techniques and globally available coastal datasets? To obtain a reliable global mud classification, a method based on the spectral properties of individual mud patches and on the physical geographical characteristics of muddy coasts is proposed.
The spectral properties of individual mud patches are studied at pixel level using multispectral satellite images and the physical geographical characteristics of a muddy coastal system are studied using seven globally available coastal datasets. The information from the multispectral images and the information from the coastal datasets are used as the input of the development of a hybrid coastal transect classification model, in order to obtain a more reliable and robust classification model that can detect muddy coasts at global scale. With supervised machine learning the hybrid coastal transect classification model is developed, which can classify global coastlines into five coastal types: plain beaches, muddy coasts, coastal cliffs, vegetated coasts and other. 85 percent of the muddy coasts are correctly recognised by the hybrid classification model. The accuracy of the hybrid model is still increasing significantly, meaning that the model could perform even better if more training data is added to train the model. The large amount of training and validation data at both pixel and transect level resulted in a reliable, robust global mud classification model. With the addition of the coastal datasets, the model performs better than when only the multispectral satellite images are used for classifying muddy coasts. The hybrid classification model is used to classify 100000 global coastal transects from which 12 percent are classified as muddy coasts; 60 percent of the classified muddy coasts are in the tropics.