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Improving the Algae Bloom Prediction through the Assimilation of the Remotely Sensed Chlorophyll-A Data in a Generic Ecological Model in the North Sea

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Harmful algae can cause damage to co-existing organisms, tourism and farmers. Accurate predictions of algal future composition and abundance as well as when and where algal blooms may occur could help early warning and mitigating. The Generic Ecological Model, GEM, [Blauw et al 2008] is an instrument that can be applied to any water system (fresh, transitional or coastal) to calculate the primary production, chlorophyll-a concentration and phytoplankton species composition. It consists of physical, chemical and ecological model components which are coupled together to build one generic and flexible modeling tool. For the North Sea, the model has been analyzed to assess sensitivity of the simulated chlorophyll-a concentration to a subset of ecologically significant set of factors. The research led to the definition of the most significant set of parameters to the algae blooming process in the North Sea [Salacinska et al 2009]. In order to improve the prediction of the model, the set of parameters and the chlorophyll-a concentration can be further estimated through the use of data assimilation.

In this research, the Ensemble Kalman Filter (EnKF) data assimilation technique is used to assimilate the chlorophyll-a data of the North Sea, retrieved from MEdium Resolution Imaging Sensor (MERIS) spectrometer data [Peters et al 2005], in the GEM model. The chlorophyll-a data includes concentrations and error information that enable their use in data assimilation. For the same purpose, the uncertainty of the ecological generic model, GEM has been quantified by means of Monte Carlo approach. Through a study covering the year of 2003, the research demonstrates that both data and model are sufficiently robust for a successful assimilation. The results show that through the assimilation of the satellite data, a better description of the algae bloom has been achieved and an improvement of the capability of the model to predict the algae bloom for the North Sea has been confirmed.

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