

Phytoplankton Phenology in the Marsdiep region of the Dutch Wadden Sea

Behnaz Arabi ^{1,*}, Mhd. Suhyb Salama ¹, Marcel R. Wernand ² and Wouter Verhoef ¹

¹ Faculty of Geo-Information Science and Earth Observation (ITC), Department of Water Resources, University of Twente, P.O. Box 217, 7500AE Enschede, The Netherlands; s.salama@utwente.nl (M.S.S.); w.verhoef@utwente.nl (W.V.)

² Department of Coastal Systems, Marine Optics and Remote Sensing, Royal Netherlands Institute for Sea Research (NIOZ), P.O. Box 59, 1790AB Den Burg, Texel, The Netherlands; marcel.wernand@nioz.nl

* Correspondence: b.arabi@utwente.nl or arabi.behnaz@gmail.com; Tel.: +31-534-874-288

Abstract

Monitoring of phytoplankton phenology is essential to understand the changes in the pelagic ecosystem in response to changing environmental conditions. We analyzed 15 years of hyperspectral measurements to investigate the phenological cycle of Chlorophyll-a (Chla) concentration in the Marsdiep region of the Dutch Wadden Sea, the Netherlands. The two-stream radiative transfer model 2SeaColor was applied to retrieve Chla concentration values from daily hyperspectral measurements recorded from 2002 to 2016 at the NIOZ jetty station. The validation of the 2SeaColor model against ground truth measurements has shown an acceptable accuracy for Chla retrieval ($R^2=0.85$ and $RMSE=2.80 \text{ mg.m}^{-3}$). In addition, good agreement was observed between the retrieved Chla concentration changes and those of the ground truth measurements. Next, phenological analysis was performed, using TIMESAT, to detect the temporal dynamics for the Marsdiep region of the Dutch Wadden Sea as expressed by peak and end timing, duration, maximum, rates of increase and decrease, and the bloom Chla concentration integral. Finally, the high degree of temporal variability is highlighted and discussed. Our long-term Chla phenology has significant implications for identifying positive anomaly events and may act as an alert for management actions in this region.

Keywords:

Phenology, Marsdiep, NIOZ jetty, The Wadden Sea, Hyperspectral measurements, 2SeaColor, TIMESAT,.

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