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Remote sensing of coccolithophore blooms in selected oceanic regions using PhytoDOAS method applied to hyper-spectral satellite data

Alireza Sadeghi (1), Tilman Dinter (2), Marco Vountas (3), and Astrid Bracher (4)

(1) Institute of Environmental Physics(IUP), University of Bremen, Bremen, Germany (sadeghi@iup.physik.uni-bremen.de), (2) Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany (tilman.dinter@awi.de), (3) Institute of Environmental Physics, University of Bremen, Bremen, Germany (vountas@iup.physik.uni-bremen.de), (4) Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany (astrid.bracher@awi.de)

Phytoplankton, as the main oceanic primary producers, play a crucial role in the marine food-chain, as well as playing an important role in the global carbon cycle, due to photosynthesis and carbon pumping. On the other hand, because of their sensitive responses to ecological impact, they are reliable indicators for monitoring the variations of climate factors and anthropogenic contributions. Ocean color remote sensing often utilizes satellite data to provide us with continuous observations of phytoplankton biomass on a global scale. As different phytoplankton species cause different bio-geochemical impact, the identification of phytoplankton groups using satellite data has been recently of great interest (e. g. Bracher et al., 2009). Studying the bloom cycles of specific phytoplankton functional types (PFTs, Nair et al., 2008), in terms of spatial and temporal variations of their abundance, is now regarded as a method to follow annual and inter-annual variations in climate impacts (Winder et al., 2010). Among different phytoplankton blooms, coccolithophore blooms, dominated by Emiliania huxleyi species, are very important due to their wide coverage and frequent occurrences, as well as their unique bio-optical and bio-geochemical properties (Brown et al., 1997).
In this study the PhytoDOAS method (according to Bracher et al. 2009 and improved by Sadeghi et al., 2010) has been applied to the satellite data of the sensor SCIAMACHY (a hyper-spectral sensor on-board ENVISAT) to detect coccolithophore E. huxleyi blooms in three selected oceanic regions. To monitor the bloom cycles, eight years of SCIAMACHY data have been processed, classifying the blooms based on a threshold value for monthly averaged Chl a concentration. The retrieval results, shown as time series, were also compared to corresponding satellite images and some model-based PFT data. In addition, PhytoDOAS results were compared to results extracted from specific algorithms developed to detect E. huxleyi blooms from water-leaving radiances.