



## **Using empirical orthogonal functions from remote sensing reflectance spectra to predict various phytoplankton pigment concentrations in the Eastern Tropical Atlantic**

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Phytoplankton pigments play a major role in photosynthesis and photoprotection. Their composition and abundance give information on characteristics of a phytoplankton community in respect to its acclimation to light, overall biomass and composition of major phytoplankton groups. Most phytoplankton pigments can be measured by applying HPLC techniques to filtered water samples. This method like other methods analysing water samples in the laboratory is time consuming and therefore only a limited number of samples can be obtained. In order to obtain information on phytoplankton pigment composition with a better temporal and spatial composition, the rationale was to develop a method to get from continuous optical measurements pigment concentrations. We have used remote sensing reflectances (RRS) derived from ship-based hyper-spectral underwater radiometric and from satellite MERIS measurements (using the POLYMER algorithm developed by Steinmetz et al. 2011), sampled in the Eastern Tropical Atlantic, to predict the water surface concentration of various pigments or pigment groups in this area. A statistical model based on Empirical Orthogonal Function (EOF) analysis of these RRS spectra was developed. Then subsequently linear models with measured (collocated) pigment concentrations as the response variable and EOF loadings as predictor variables were constructed. The model results, which have been verified by cross validation, show that from the ship-based RRS measurements the surface concentrations of a suite of pigments and pigment groups can be well predicted, even when only a multi-spectral resolution of RRS data is chosen. Based on the MERIS reflectance data, only concentrations of total chlorophyll-a (chl-a), monovinyl-chl-a and the groups of photoprotective and photosynthetic carotenoids can be obtained with high quality. The model constructed on the satellite reflectances as input was also applied to one month of MERIS POLYMER data to predict for the whole Eastern Tropical Atlantic area the concentration of those pigments. Finally, the potential, limitations and future perspectives for the application of our generic method are discussed.