MICROPHYTOBENTHOS PRODUCTIVITY ESTIMATION USING HYPERSPECTRAL REMOTE-SENSING: FROM SPECIES TO THE ECOSYSTEM LEVEL.

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The estimation of primary production at the ecosystem level is a real challenge. It is crucial to understand ecosystem functioning in the context of monitoring, management and protection, as well as biogeochemical cycling. Primary productivity models are typically build using limited observations and sampling, covering at best several 100 km^2 for canopy and less then 10 km^2 for phytoplankton or microphytobenthos due to the difficulty to reach the ecosystems they inhabit. The results can be extrapolated to the entire ecosystem using a geostatistic approaches, but small areas are often not sufficient for a robust extrapolation (Forster and Kromkamp 2006). In this context, remote sensing, using airborne and space borne sensors, provides a simpler alternative for studying and mapping microorganism communities and their productivity. The main objective of this study is to develop the first primary productivity model for intertidal mudflat microphytobenthos using hyperspectral remote sensing data only.

Primary productivity models require, as input parameters 1) a biomass estimation (e.g. Chl *a* concentration), 2) the absorbed fraction of the photosynthetic available radiation (PAR), and 3) an efficiency parameter that describes the photophysiological response of organisms to PAR. The later is most often estimated by PAM-fluorimetry, a rapid and non-invasive technique. However, to reach our objective, the three parameters must be estimated by hyperspectral remote sensing data. Currently, remote sensing allows estimation of microphytobenthos biomass and PAR absorption (absorption cross section) using the quantitative transfer model (MPBOM), developed by Kazemipour et al. (2011). The estimation of an efficiency function that describes the photophysiological response of organisms to PAR is the challenge that remains to be taken up. The aim of this experimental study is calibrate hyperspectral data with fluorescence measurements using two diatom strains known for their different photophysiology: *Navicula phyllepta* (epipelic) and *Plagiogrammopsis vanheurckii* (thycopelagic). Following the first attempt carried out by Jesus et al. (2008), our objective is to retrieve absorption features at specific wavelengths from hyperspectral remote sensing data, and to develop radiometric indices based on reflectance changes in absorbance due to xanthophyll cycle pigments diadinoxanthin (DD) and diatoxanthin (DT). These indices were further linked to the differential photophysiological response of the two strains as illustrated by the non-photochemical quenching of fluorescence (NPQ) and the photosystemII quantum efficiency (ϕPSII).

References:

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