SPATIO-TEMPORAL DYNAMICS OF MICROPHYTOBENTOS IN THE TAGUS ESTUARY (PORTUGAL) DETECTED BY SPATIAL REMOTE SENSING

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Benthic microalgae can make a substantial contribution to the food web in coastal ecosystems, in particular diatoms, which dominate photo-autotrophic assemblages in intertidal mudflats. They form dense biofilms in the most superficial sediment layers and contribute to their stabilization. Many studies investigated the spatio-temporal dynamics of these biofilms at microscale (below 1 m^2) using coring techniques to sample surfaces often smaller than 20 cm^2. However, the validity of microscale sampling protocols used to infer spatial structures at macroscale or to analyse temporal patterns of microphytobenthos biomass is questionable (Spilmont *et al.* 2011).

In this study, we analyzed spatio-temporal variations of benthic diatom biofilms at the macroscale of the Tagus estuary (Portugal), one of the largest estuarine systems in western Europe (38°44'N, 9°08'W), using SPOT multispectral satellite images. The intertidal flats (mean tidal amplitude of 2.6 m) are dominated by muddy sediment and represent 128 km^2.

SPOT HRV sensor is characterized by a low spectral resolution (3 broad spectral bands of *ca*. 100 nm) but a high spatial resolution with pixel size ranging from 10x10 m to 20x20 m. The Normalized Difference Vegetation Index (NDVI) involving red and near infrared (NIR) bands: NDVI = (NIR-red)/(NIR+red), was used to discriminate benthic microalgae from the other benthic photoautotrophs: angiosperms of the saltmarshes in the upper intertidal or macroalgae attached to dead oyster shells in the lower intertidal. The spatial distribution of microphytobenthos showed that the main assemblages were detected in the upper intertidal flats (+3 to +5 m above the lowest atronomical tide) with a decrease toward the lowest bathymetric levels. The temporal dynamic was analysed with 5 images covering a seasonal cycle. NDVI time-series revealed a striking seasonal variation, with high NDVI values in winter and low NDVI values in summer. This result is the opposite of the pattern detected in north European estuaries with MODIS satellite images (van der Wal *et al.* 2010).

A significant empirical relationship was obtained between an extensive microphytobenthos biomass dataset collected in the top millimetres (2-5 mm) of the sediment during winter *in situ* campaigns and NDVI values retrieved from a synchronous satellite image. This relationship was used to obtain a biomass distribution map (mg chlorophyll *a* .m^2) that was compared with other microphytobenthos biomass data measured in the Tagus estuary.