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Is photosynthetic efficiency in microbial mats affected by tidal state?

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Microbenthic photosynthetic biofilms and microbial mats are amongst the main primary producers in shallow intertidal water habitats. Their productivity depends on tidal state and its interaction with the photoperiod. However, it is unknown how these changes affect the photosynthetic efficiency of microphytobenthos. Here, we estimated the spatial distribution of the photosynthetic efficiency within the euphotic zone of a microbial mat under increasing irradiances (100, 400 and 800 μmol photon m-2 s-1) and different tidal conditions (immersion and emersion) from combined microsensor measurements of O_2 and scalar irradiance. Photosynthetic quantum efficiency decreased with increasing irradiance. Significant differences between immersion and emersion were only found at the lowest irradiance studied where the highest photosynthetic quantum efficiency under emersion doubled that under immersion (0.093 O_2 photon-1 vs 0.056 O_2 photon-1) and located more shallow (0.2 mm vs 0.3 mm) These maximum photosynthetic efficiencies seem to be related to a higher phototropic biomass at these depths, thus migratory movements due to tidal changes (immersion/emersion) might explain the differences observed in the light utilization efficiency in photosynthetic microbial mats.