Geophysical Research Abstracts
Vol. 21, EGU2019-3099, 2019
EGU General Assembly 2019

Pulse Amplitude Modulated (PAM) fluorometry to study Posidonia oceanica (L.) Delile (1813) photosynthetic dynamics

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Posidonia oceanica (L.) Delile (1813) seagrass represents an ecosystem of great importance in the Mediterranean sea. It is a priority habitat in the framework of Habitats Directive (92/43/EC) and its health evaluation is required within Marine Strategy monitoring programmes (2008/56/EC).
Posidonia oceanica meadows provide fundamental ecosystem services for human well-being and it has been estimated that the economic loss of just one hectare amounts to 15740 € in the northern Tyrrhenian sea.
One of the main emerging challenges in ecological research is the development of innovative methods to assess marine ecosystems health through non-invasive instrumental measures. Pulse amplitude modulated (PAM) fluorometry is widely used to monitor photosynthesis in terrestrial plants and it has recently been recognized as an efficient technique also for the study of photosynthetic dynamics of marine plants.
Here we investigated the response of Posidonia oceanica to different light environments through fluorometric (Fv/Fm, Y(II), ETR) and photosynthetic (Pmax, a, ß, Ek) parameters, as measured by pulse amplitude modulated (PAM) fluorometry. The study area includes a meadow of the Tyrrhenian coastline of Northern Latium (Santa Marinella, Italy), where three different patches were studied, along its bathymetric distribution (at -1 m, 5 m and 10 m). A Saturating Pulse Analysis and a Rapid Light Curve Analysis were performed on each sample after being acclimated to dark for 15 minutes. A morphometric analysis was realized to obtain the photosynthetic area index per shoot. Results indicate that patch at 5 m has the highest fluorometric and photosynthetic parameters in comparison to the other two patches, thus suggesting a higher capacity of photo-acclimation. Our hypothesis is supported by the higher photosynthetic area index per shoot value obtained for seagrass at 5 m. Despite the photo-acclimation differences, results for Fv/Fm show a homogeneous level of photo-adaptation between the three patches.
These observations indicate that in situ measurements with PAM fluorometry can describe the adaptive responses and state of health of Posidonia oceanica.