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Mapping benthic habitats and coastal seagrass ecosystem using new generation of HR multispectral sensors

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Mediterranean sea beds and benthic ecosystems, as the vulnerable *Posidonia oceanica* (PO) meadows, are increasingly being threatened, by various anthropogenic pressures and climate change effects; along the 8000 km of Italy coasts they are poorly mapped and the existing maps are not up to date and have often unsatisfying spatial resolution for properly evaluating their health status. Remote sensing (RS) has proved one of the most cost effective methods for coastal operative monitoring, to support the sustainable management of these shallow water areas. However in this context, the effective exploitation of the RS satellite techniques requires finer ground geometrical resolution, radiometry sensibility and capacity to properly account for the atmospheric noise (especially in term of the AOD main contribution) increase of water turbidity and possible spectral contamination (adjacency effects) from near lands reflectance. Since the new families of polar satellite HR (High Resolution) multispectral sensors, like Landsat 8 OLI and Sentinel 2 MSI, provide a useful opportunity in this sector previously unavailable, this work focused on preliminary test of Landsat 8 OLI data for seagrass (PO) mapping in the middle Tyrrhenian coasts. In addition to near synchronous sea truth information, including the PO LAI (Leaf Area Index), used for calibration/validation purposes, two different image based approaches for atmospheric preprocessing of these multispectral HR data were exploited. The first method provides a more effective per pixel AOD (Aerosol Optical depth) noise removing, also in case of optically complex shallow waters, but without a removal of adjacency effects, typical of land-sea interface areas. The second one, has less effective treatment of the AOD, but is able to correct for the adjacency effects. The successful model of LAI distribution of PO meadows was implemented through on purpose developed spectral indices, based on the coastal and blue-green responses atmospherically corrected using the first method. The preliminaries results, in term of significant correlation between on purpose developed spectral indices and the PO LAI distribution (as different cover percentage on different sea bed substrates) demonstrated the capabilities of the new Landsat 8 orbiting sensors to usefully capture the spectral responses in visible wavelengths from the PO submerged plants. The alternative atmospheric correction approach, based on coarse AOD retrieval and adjacency effect removal, provided a superior thematic discrimination capability at station level, evidencing the importance of this noise effect removal also for coastal marine monitoring and mapping applications based on satellite remote sensing. The final indication arising from the present work is that the critical atmospheric preprocessing, in addition to efficient AOD retrieval, must include a removal capacity of the adjacency noise effects for effective monitoring of marine coastal ecosystems.