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Spatial downscaling of MODIS reflectances using MSI Sentinel 2 for high resolution coastal water monitoring

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Monitoring water quality changes in coastal waters is critical in response to the needs for sustainable development and also for mapping and monitoring ecosystems, species and threats to biodiversity. Consequently, there is a need for accurate, cost effective, frequent, and synoptic methods of characterizing and monitoring these zones of remarkable primary and secondary productivity, where complex ecosystems are found.
This work describes the application of a remote sensing downscaling method via multi-sensor satellite data merging, aimed at water quality monitoring of environmentally sensitive coastal areas. The availability of high quality and high resolution satellite data from satellite platforms such as Sentinel-3 and especially Sentinel-2, allows an effective optical remote sensing in coastal and inland waters, until now negatively affected by the low spatial resolution of the former satellites (MODIS, VIIRS). It is then possible to observe and study ocean surface dynamics in coastal areas as well as some impacts of human activities close to shore and inside ports and estuaries. Many new opportunities are outlined using Landsat-8, Sentinel-2 and Pléiades (K. Ruddick, et al., 2016).
Multi Spectral Instrument (MSI) Sentinel 2 sensor was developed for land observations, but it is turning out to be promising also for ocean observations (N. Pahlevan et al., 2017). Because of the high spatial resolution of the blue, green and red bands (10 m), this sensor is particularly suitable for complex coastal areas observations. The method (following Fu et al., 2018) consists of statistical bands downscaling. MSI Sentinel 2 data atmospheric correction was performed via ESA Sen2Cor processor. MODIS reflectance bands were downscaled from 1 km spatial resolution to 10 m on MSI Sentinel 2 reflectance bands. Curve fitting was used to derive the statistic relationships between MODIS and MSI bands. A coastal area north Elba Island (north Tyrrhenian Sea, Italy) was chosen as our test case, because of the steep rocky bottom slope, in order to minimize possible bottom effects. Preliminary results will be presented at the conference.