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Study of water chlorophyl content in the Venice Lagoon through hyperspectral data

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In the framework of the HICO Project (http://hico.coas.oregonstate.edu/), a number of radiance and reflectance images of the Venice Lagoon were used to evaluate the possibility of performing quick and reliable mapping of water quality parameters.
Sponsored by the Office of Naval Research, the Hyperspectral Imager for the Coastal Ocean (HICO^{TM}) is the first spaceborne imaging spectrometer specifically designed to sample the coastal areas, with 128 spectral bands, a 90 m spatial resolution, full spectral coverage (380 to 960 nm sampled at 5.7 nm) and a very high signal-to-noise ratio to resolve the complexity of the coastal ocean.
Eutrophication is one of the major causes of water quality deterioration. The concentration of chlorophyll-a found in water can be used to trace the abundance of planktonic algae in rivers, lakes or lagoons. The Venice Lagoon, famous worldwide, represents one of the most fragile and vulnerable ecosystems, which is being constantly threatened by factors of stress, both human and natural, such as erosion, presence of urban and agricultural sources of pollution, stress from fishing, pollution produced by the industrial area of Porto Marghera and by the city of Venice itself, downwash of sediments from the hinterland and eutrophication.
Traditional methods of water quality estimation are often time consuming and involve periodical sampling and plenty of laboratory analyses. In this study the possibility of using imaging spectroscopy to rapidly obtain raster-based maps of chlorophyll concentration by comparing the results obtained through five different literature bio-optical models, which permit the retrieval of mathematical relations between the water's spectral properties and physicochemical parameters; pH, dissolved oxygen, turbidity and chlorophyll concentration. Evaluation of performances is achieved by comparing the hyperspectral based maps with maps of kriged concentration values, provided by the Magistrato delle Acque di Venezia (http://www.magisacque.it/sama/sama_monitoraggi1.htm) and collected by the network of SAMANET sensors.