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Suspended sediment estimation via Remote Sensing in shallow coastal waters

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The dynamics of coastal waters are characterized by a delicate balance between biological and physical processes and the comprehension and monitoring of such processes require observations over a wide range of temporal and spatial scales. Remote sensing techniques can be applied in this context with added advantages: on one hand remote sensing monitoring overcomes the limitations of traditional techniques, which produce isolated and often infrequent observations; on the other hand they provide new opportunities for the calibration and validation of spatially-distributed hydrodynamic and transport models, whose performance is traditionally evaluated on the basis of point observations.

This work presents a new estimation method for the suspended sediment concentration in lagoon/estuarine waters using a simplified radiative transfer model in shallow waters. The method is developed with specific application to the Venice lagoon, were observations from a network of turbidity sensors which has been operational since 2000. We explore the possible use of several multispectral satellite sensors (SPOT5, SPOT2, LANDSAT, ASTER and ALOS AVNIR) and address uncertainties related to radiometric calibration, atmospheric correction and a variable bottom reflectance.

The comparison of remote sensing evaluations with in situ observations shows that consistent estimates can indeed be retrieved, provided that additional information on water depth is accounted for. The suspended sediment maps produced show a general coherence with known features in the Venice lagoon and point to the role played by benthic vegetation in reducing bottom erosion. The analyses show that knowledge of the spatially-variable bottom reflectance would be desirable in order to increase the estimation accuracy. Interestingly, all sensors but SPOT yield remarkably consistent estimates of suspended sediment concentrations.