

Effect of intense short rainfall events on coastal water quality parameters from MODIS remote sensing data during the bathing season

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Introduction: Strong rainfall events, especially during summer, in small river basins cause urban drainage system spills in the sea, that often compromise the quality of coastal waters.

From the 1980s remote sensing techniques have been used extensively to estimate water quality parameters that can overcome these limitations providing information which are distributed in space and almost continuous in time (from hours to days especially combining different satellites information) [1, 2, 3].

The goal of this paper is then to study the temporal and spatial changes of coastal waters quality for safe swimming as a result of intense rainfall events with Earth Observation (EO) and ground data in small river basins not usually affected by sediment transport.

Methods: Several small watersheds in different Italian regions on the Mediterranean Sea are selected for this study (Liguria, Sicily and Tuscany). The remotely sensed parameters of turbidity, total suspended solids (TSS) and secchi disk depth, are retrieved from the Moderate Resolution Imaging Spectroradiometer (MODIS) data. The MODIS sensors onboard Aqua and Terra satellites providing 2 daytime and 2 nighttime time images.

The EO results are then compared with ground measurements performed in Golfo del Tigullio near Genova where TSS and turbidity are measured after different rainfall events.

Then the spatial and temporal changes of these parameters are analyzed after intense short storm events.

Results:

In Fig.1, as an example, for the Borghetto station (Liguria) the effect of the rain event is shown for the days between 22 and 25 July 2004. The rainfall data shows on 22 July a strong rain event covering all the Liguria region with values up to 50 mm day⁻¹. During 22 July, remotely sensed estimates of turbidity and suspended solid sediments are not available due to cloud cover. Instead on 23 July, Tb and TSS have high values near the shoreline which are then higher than the estimates made on 24 July that are in turn higher than the estimates of 25 July.

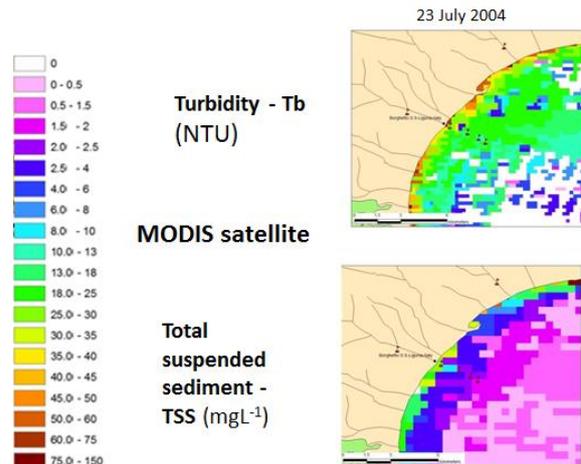


Fig. 1: TSS and Tb estimates from MODIS

In Fig.2 a longer period of analysis is observable for the Borghetto station where increases of turbidity and total suspended solids are found to be around 35 NTU and 20 mgL⁻¹ respectively depending on the intensity of the rainfall event and on the distance from the shoreline. Moreover the recovery of water quality after the rain event is reached after two or three days.

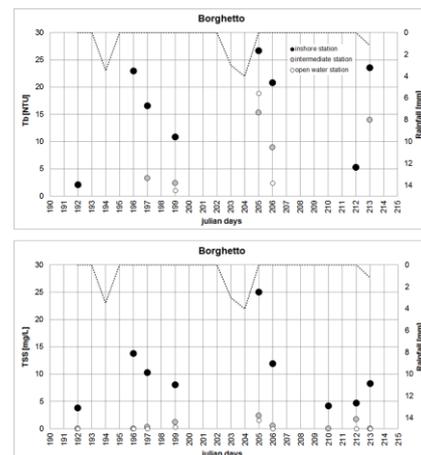


Fig. 2: Tb and TSS temporal variability at Borghetto stations from coastline to open water.

References: [1] Corbari et al. (2016) *Cont. Shelf Res.* **123** : 18–28; [2] Chen et al. (2006) *Remote Sens Environ* **109**: 207-220 [3] Doxaran et al. (2006) *Int J Remote Sens* **27**: 2303-2321