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Sensitivity analysis of a bio-optical model for Italian lakes focused on Landsat-8, Sentinel-2 and Sentinel-3

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In this work, a variance-based procedure was applied to study the sensitivity of a Case-2 bio-optical model which simulates the water reflectance of three Italian lakes - Garda, Mantua and Trasimeno - with different trophic conditions by analysing the main effect of single WQPs and their interactions. The water reflectance was simulated according to a four-components model [Brando and Dekker 2003] considering the SIOPs typical of each lake and the spectral characteristics of three optical sensors, on-board of Landsat-8, Sentinel-2 and Sentinel-3, which can be potentially applied for lakes.
Lakes Garda, Mantua and Trasimeno were selected as representative of different trophic levels; for these lakes long-term data of in situ measurements on water quality characteristics were also available. The bio-optical analytical model simulated the subsurface irradiance reflectance R(0-, λ) as a function of absorption and backscattering coefficients (a(λ), bb(λ)) given as a sum of the contribution of water and the water quality parameters. The sensitivity indices of water reflectance for three water types/trophic conditions were calculated
decomposing output variance (V) in partial variances which represent the share of V that is explained by the bio-optical model inputs [Saltelli et al., 2010].
The results provide important information relating the sensitivity of the new generation sensors to different trophic statuses, and in particular confirmed that Sentinel-3 water reflectance is sensitive to WQPs in all the trophic conditions investigated.