Dependence of satellite ocean color data products on viewing angles: A comparison between SeaWiFS, MODIS, and VIIRS

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Abstract

Satellite measured radiance and derived geophysical parameters (e.g., remote sensing reflectance or *Rrs*, chlorophyll a concentration, absorption and scattering coefficients, diffuse attenuation coefficients) may show inconsistencies according to the sensor viewing geometry. Data fluctuations based on sensor zenith angle (SZA) can cause variable uncertainties in derived time series, as well as regional or global means. This study analyses single- and merged-sensor datasets from SeaWiFS, MODIS, and VIIRS for the Gulf of Mexico region, finding generally high cross-sensor fidelity for both *Rrs* and derived products. However, pronounced variation within and between satellites was identified as a function of SZA. Such effects are generally restricted to data with SZA above 40°, although large variation exists between satellites and products. The non-tilted MODIS and VIIRS also show residual errors during summer time for SZA < 30° due to imperfect sun glint, while SeaWiFS data indicate imperfect bidirectional reflectance distribution function (BRDF) corrections. Certain *Rrs* bands and products are more resilient to angular dependence in *Rrs* data. Overall, this study provides a framework for interpretation and account of SZA dependence in satellite ocean color data products towards creation of cross-sensor time series as required for analysis of changes on multi-decadal scales. Finally, these findings can inform design and calibration of future geostationary sensors, for which targets have fixed viewing geometry.