Multisensor Merged Water Leaving Radiances: Development and Assessment of an Optically-Based Merging Techniques

Abstract: Merging normalized water leaving radiance spectra Lwn from concurrent missions is an avenue to create a long-term consistent record of the primary ocean color product with optimal spatial and temporal coverage. An optically-based technique is presented that produces merged spectra of Lwn by combining all data from different sensors in a spectrally consistent way. This is done by using available Lwn spectra to invert a bio-optical model that is then used in forward mode. The assumption that the merged Lwn output does not depend significantly on the parameters of the bio-optical model is checked. The assessment of the merging technique is based on a 4-year field data series collected by the autonomous above-water radiometer SeaPRISM located on the Acqua Alta Oceanographic Tower in the Adriatic Sea. The uncertainties associated with the sensor specific Lwn are first quantified on the basis of 248, 244 and 110 match-ups for SeaWiFS, MODIS and MERIS, respectively. This ensemble allows the assessment of the merging technique with a unique data set of 172 match-ups for which SeaWiFS and MODIS Lwn are available concurrently with field measurements. Mean absolute percent differences between merged and field Lwn are 24%, 17% and 28% at 412, 440 and 674 nm, respectively, and 11% at 500 and 555 nm. These results are consistent with those given by the sensor specific match-ups. The impact of including MERIS in the merging set has been tested on the basis of 33 match-ups for which all 3 sensor products are available. The uncertainties inherent to the proposed method are also quantified and the benefits of merging in terms of temporal and spatial information are illustrated.

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