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Sensitivity of ocean reflectance inversion models for identifying and discriminating between phytoplankton functional groups

P. Jeremy Werdell and Collin S. Roesler

ABSTRACT

The daily, synoptic images provided by satellite ocean color instruments provide viable data streams for observing changes in the biogeochemistry of marine ecosystems. Ocean reflectance inversion models (ORMs) provide a common mechanism for inverting the "color" of the water observed a satellite into marine inherent optical properties (IOPs) through a combination of empiricism and radiative transfer theory. IOPs, namely the spectral absorption and scattering characteristics of ocean water and its dissolved and particulate constituents, describe the contents of the upper ocean, information critical for furthering scientific understanding of biogeochemical oceanic processes. Many recent studies inferred marine particle sizes and discriminated between phytoplankton functional groups using remotely-sensed IOPs. While all demonstrated the viability of their approaches, few described the vertical distributions of the water column constituents under consideration and, thus, failed to report the biophysical conditions under which their model performed (e.g., the depth and thickness of the phytoplankton bloom(s)). We developed an ORM to remotely identify *Noctiluca miliaris* and other phytoplankton functional types using satellite ocean color data records collected in the northern Arabian Sea. Here, we present results from analyses designed to evaluate the applicability and sensitivity of the ORM to varied biophysical conditions. Specifically, we: (1) synthesized a series of vertical profiles of spectral inherent optical properties that represent a wide variety of bio-optical conditions for the northern Arabian Sea under a *N. Miliaris* bloom; (2) generated spectral remote-sensing reflectances from these profiles using Hydrolight; and, (3) applied the ORM to the synthesized reflectances to estimate the relative concentrations of diatoms and *N. Miliaris* for each example. By comparing the estimates from the inversion model to those from synthesized vertical profiles, we were able to identify those bio-optical conditions under which the inversion model performs both well and poorly.