Three-component light scattering model of coastal sea water

Vladimir I. Haltrin,† Oleg V. Kopelevich,° Richard W. Gould, Jr.,† Robert A. Arnone,†
Donald R. Johnson † and Alan D. Weidemann †

† Naval Research Laboratory, Ocean Sciences Branch, Code 7330,
Stennis Space Center, MS 39529, USA, phone: 228-688-4528, fax: 228-688-4149,
e-mail: <haltrin@nrlssc.navy.mil>

° Shirshov Institute of Oceanology, Russian Academy of Sciences,
36 Nakhimovsky Prospect, Moscow 117851, Russia.

ABSTRACT

Hyperspectral analysis of light spectral signatures reflected from the ocean needs detailed knowledge of seawater optical properties as a function of dissolved and suspended matter. Previous attempts to develop a description of seawater optical properties result in a chlorophyll-based optical model applicable to open ocean waters and biologically stable coastal waters. The scattering part of this model includes two different scattering components with different size distributions – small terrigenic, and large biogenic fractions of suspended matter. In many important coastal water situations when biological stability is not achieved or disturbed by recent storm or other physical effects the chlorophyll-based model did not work and should be corrected.

This presentation attempts to extend an existing chlorophyll-based model to coastal waters. Analysis of extensive measurements of particle size distributions and inherent optical properties of seawater during Cope 1 experiment in Chesapeake Bay area shows that in addition to open ocean components of suspended matter we found another, larger component. The particle size distribution for this extra-large coastal component with radius between 13 and 80 micrometers can be described by a hyperbolic law. The preliminary analysis of additional information shows that this component is a mixture of larger species of phytoplankton, sand and detritus particles.

Analysis of measured and calculated optical properties shows that the use of proposed three-component model of light scattering in coastal seawater in processing of hyperspectral information may enhance precision of restoration of seawater optical properties using aircraft and satellite information.