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The task of algorithm-development activities at USF continues. Our major activities involve collecting field data and modeling coastal Case II Waters to derive algorithms for the SeaWiFS and MODIS-N sensors. AVIRIS and cruise data are used in this process.

The algorithm for determining chlorophyll a concentration, [chl a] and gelbstoff absorption coefficient for SeaWiFS radiance data is currently under way. We have been developing several algorithms for different locations, and for high and low chlorophyll concentrations. Currently we are concentrating on the Mississippi River plume and West Florida Shelf waters, where we have collected comprehensive bio-optical data on two separate cruises in the past year (GOMEX II and COLOR I).

The major aspects of the bio-optical ocean color model has been developed in Carder et. al., 1991. Refinement of the model consists of developing new expressions for certain parameters within the model that either depend on the region studied, or for which we have new and improved data. Specifically, we have developed new expressions for the following: the phytoplankton specific absorption coefficient, a, as a function of chlorophyll concentration; the shape of the gelbstoff absorption spectrum (ag(~)); and the spectral dependency of the Q factor (Q(~)).

The new algorithms for high chlorophyll waters will consist of multiple spectral ratios of radiance bands that vary when Rrs(~i) gets low enough that accuracy suffers. High absorption by phytoplankton and gelbstoff will force a transition in the algorithm from bluer to greener wavelengths, and may be different from those used in Carder et al., 1991. The general algorithm equations are based upon where i and j represent bands 1 to 5 on SeaWiFS or the visible ocean color bands on MODIS, and Rrs = fn(C,G), where C=[chl a], and G=ag(400). This algorithm thus consists of two equations in two unknowns. Because matrix inversions are unstable with noisy data and/or imperfect model functionalities, and because exponential, non-invertable functions are involved, look-up tables (LUTS) are developed to extract C and G using ri,j and rj,k pairs as input data. We are presently looking at using algorithms involving (r1,2;r2,5), (r1,3;r3,5), (r2,3;r3,5) where ~1= 412 nm, ~2= 443 nm, ~3= 490 nm, ~4= 510 nm, and ~5= 555 nm.

13 stations for which Rrs(~), [chl a], and ag(~) were measured were selected from the two cruises as a test data set. Other stations were excluded if

1.) Bottom reflection was significant(e.g. > .005 Rrs(~)),

2.) ad r am, where subscripts "d" and "m" represent detritus and phytoplankton, respectively (e.g. high suspended sediment loading).

3.) time of measurement was more than 2 hours different from local noon, or if

4.) it is suspected that high back scatter from suspended sediments is contaminating the Rrs(~) data.

Preliminary results show:

1.) ag(400) is more accurately modeled than [chl a] in the Mississippi plume, because absorption there is dominated by ag(~) (e.g. ag(400) > 0.5 m-1 for salinity > 15 ppt),

2.) [chl a] and ag(400) retrievals were about q50% and q40%, respectively, for these Case II waters.

AVIRIS data, calibrated vicariously in the Florida current remained stable and accurate throughout a flight in November 1992. Spectra from 400 nm to 900 nm are being used near Tampa Bay to evaluate the effects of bottom reflected radiance on the performance of various candidate algorithms for C and G.

Future Work planned

AVIRIS data for the Mississippi plume region in July 1993 has arrived and that acquired for the same region and the west Florida shelf in June 1993, when cruise data (COLOR 1) were acquired, are expected within one month. After calibration these data will provide a means to test SeaWiFS and MODIS-N algorithms for Case II waters for sensitivity to atmospheric-correction residuals since about 95% of the path radiance expected for satellite data will be exhibited in the AVIRIS data acquired from 20 km altitude. Solar transmissometry and water-leaving radiance data acquired concurrently with the overflight will assist in atmospherically correcting the data(Carder et al., 1993a &b). The algorithm development work described above will be continued.

References

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