Other - Coast to Cosmos/Coastal Studies Institute Seminar

YBiogeo-optics: Suspended Particulate Matter in the Northern Gulf of Mexico and Other Coastal Oceans. Applications and Remote-Sensing Comments

Robert H. Stavn, University of North Carolina at Greensboro

Professor

Digital Media Center 1034
October 14, 2014 - 10:30 am

Abstract:

Recent work is beginning to reveal the importance of suspended mineral matter for the biogeochemistry and remote sensing of inland waters and the coastal ocean. It is now possible to accurately define optical properties of major categories of suspended matter (i.e. mineral and organic) and relate them to the overall dynamics and fate of particles in inland waters and the coastal ocean. Application of our new techniques of Model II multiple regression generate these newly defined optical parameters. Furthermore, recent work with sophisticated angular scattering meters allows the definition of several suspended particle types by their refractive indices and modal diameters. The angular scattering function allows inversion of the concentration and size distribution of the several particle types in suspension. This optical inversion of particle types was verified by direct measurement of suspended mineral and suspended organic matter in Mobile Bay, Alabama, USA and Monterey Bay, California, USA. The optical parameter of importance determined by these two methods is the mass-specific scattering cross section, a function of both the mean or, most likely, modal diameter of the suspended mineral particles and their fractal dimensions. Knowledge of the mean diameter of the suspended mineral matter and the fractal dimension of this matter is critical in studying the biogeochemical processes of the coastal ocean. that affect nutrient/pollutant transport, phytoplankton productivity, harmful algal blooms, and the generation of dead zones at major river mouths.

When we consider remote-sensing, the optical scattering of the suspended mineral matter in coastal waters is the major driver of the coastal remote sensing signal detected by satellites and aircraft. Maximizing the information obtainable by remote sensing requires well-defined particle size distributions for predicting the optical properties that impact the remote sensing signal. At this point suspended mineral matter can be accurately defined optically and its semi-conservative behavior in aquatic systems leads us to optimistically propose the ease of prediction of its fate, dynamics, and interactions with dissolved and colloidal materials.

Speaker's Bio:

Robert Stavn is a Professor of Biology at the University of North Carolina at Greensboro. He is adjunct with the Marine Sciences Department at the University of North Carolina, Chapel Hill. He is also a Visiting Research Scientist with the Oceanography Division of the Naval Research Laboratory (NRL), Stennis Space Center, MS.

He received his B.A. degree from San Jose State College (now University) in California with a major in Biological Sciences and a minor in Physical Chemistry. He received his Ph.D. in Ecology with minors in both Evolution and Physiology/Biochemistry from Yale University. His mentor at Yale was the late G.E. Hutchinson, one of the last genuine polymaths in Biogeochemistry (which Hutchinson helped establish in the USA), Ecology, and Aquatic Sciences.

His initial research was in hydrodynamic and optical relations of freshwater zooplankton and he eventually zeroed in on photon penetration in aquatic systems and optical properties of all suspended matter in these systems. It is the suspended matter that most strongly alters the penetrating photon field. He has modeled the effect of Raman scattering on submarine light fields with Monte Carlo techniques as photon penetration equations have no analytical solution. More recently he has modeled the penetration of UV radiation in sediment dominated coastal systems. It became increasingly evident that modeling efforts are fruitless without reliable data to put into the models. Thus, in recent years he has concentrated on improving the methods of extracting suspended matter from surface ocean waters, primarily coastal, and solving the problems of partitioning the suspended matter into mineral and organic components. These efforts have been promoted primarily at the NRL. Combining the information on suspended matter with the ocean optical properties obtained with the advanced optical equipment utilized by the Bio-optical Physical Processes & Remote Sensing Section, Ocean Sciences Branch, NRL, it has been possible to define valid and accurate optical properties of the suspended matter. New statistical techniques have been derived for this. The new optical properties reflect the status of the suspended matter in terms of aggregation, fractal dimensions, etc. It is felt that these efforts will lead to newer and more accurate models of the dynamics of suspended matter in the coastal ocean and their role in coastal biogeochemical processes.

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957