THE UNIVERSITY OF SOUTHERN MISSISSIPPI

SCHOOL OF OCEAN SCIENCE AND ENGINEERING

Faculty Spotlight on Dr. Xiaodong Zhang

Dr. Xiaodong Zhang joined the Division of Marine Science in the School of Ocean Science and Engineering in 2019 holding the inaugural position of Endowed Chair in Marine Science. A central theme of his research is to study natural aquatic environment through optical observation. Propagating through a water body, light interacts with water and its constituents, causing physical, chemical and biological changes. The ocean contains a diverse mixture of dissolved and particulate matter that constantly change in time and space. Each of these constituents exerts an influence on the light. Therefore, the optical measurements implicitly contain embedded information regarding the concentration, sizes, composition, shape and structure of these materials and their dynamics. Dr. Zhang's research is to decipher these linkages to retrieve useful information about various water constituents from optical measurements. When extended to optical data obtained remotely from in situ or air-and space-borne platforms, such measurements offer observational capabilities over a much broader range of temporal and spatial scales over which regional and global investigation of the ocean can be conducted.

Dr. Zhang received a PhD in Oceanography from Dalhousie University, Canada in 2002 and was a faculty member with the University of North Dakota for 17 years before moving to USM. He was often asked by people "How can you study the ocean in North Dakota?" Dr. Zhang often joked that "The advantage is that he was in a location equally distanced to all the major oceans around the North American continent but the real answer is that it doesn't matter because it is people who make things happen." Dr. Zhang has and will continue to apply the same mentality and approach to push the frontier of optical oceanography here at USM.

CURRENT PROJECTS

High-Resolution Coastal Test Area Sensor and Model Development:

Map the inherent optical properties and particle dynamics using an autonomous surface platform surveying the Mississippi Sound. The results will be used to corroborate the model prediction and to validate the U.S. Army Corps of Engineers coastal mapping effort.

Using Multi-Angle Polarimetry to Derive χ Factor and Improve BRDF Correction for PACE's OCI

Plankton, Aerosol, Clould, Ocean Ecosystem (PACE) is the next generation satellite mission to be launched by NASA to provide unprecedented capability to study the coupled ocean and the atmosphere system. One of the three sensors looking at the Earth, Ocean Color Instrument (OCI) observes the subtle change of the color of the ocean to deduce the change of phytoplankton. The color of the ocean also varies with the location of the Sun in the sky or when viewing at different angles. This project is estimate and correct for the change of color due to this viewing geometry such that the real color effect due to phytoplankton can be better quantified.

Optical Observation for Oyster Larvae

Dr. Zhang works with Dr. Eric Powell in this project to apply optical observation to estimate water quality and food quality that are critical for the survival and growth of oyster

The School of Ocean Science and Engineering is proud to salute you, Dr. Zhang, for all of your work and dedication to your science.

larvae in the Mississippi Sound. These optically derived parameters will drive a oyster larvae model to predice the metamorphasis stages of the larvae.

Optically resolving size and composition distribution of particles in the dissolved-particulate continuum from 20 nm to 20 mm to improve the estimate of carbon flux.

The net transfer of CO_2 absorbed by phytoplankton through photosynthesis from the surface to the deeper ocean is a major pathway for sequesting atmospheric CO_2. This carbon export depends strongly on the size and density of organic matter sinking through the water column. This project is to apply latest technology and theoretical advances to estimate the size and density of sinking particles to better understand the efficiency of this carbon export.

Understanding natural varaibility of VSFs and its impact on biogeochemical retrieval from ocean color

Light typically goes through two processes when encounting a particle, part of its energy is absorbed by thte particle and part is scattered into various directions. The volume scattering function (VSF) describe the angular distribution of the scattered light and this angular parttern is determined by the characteristics of the particle, such as its size, compositioin, shape or internal structure. This project is to measure the VSF to characterize the particles in the ocean.

Inferring marine particle properties from polarized volume scattering functions

While human eyes can discern the color, intensity, and direction of light, we cannot see the polarization, although polarized light is abundant in nature and is used by many animals. For example, skylight on a cloudless day shows maximum polarization at 90° to the sun's rays, a phenomenon used by bees for navigation. Squid, sensitive to linearly polarized light, can detect zooplankton prey that are otherwise transparent to visual predators. Polarization, resulting ultimately from the interaction of electromagnetic radiation with asymmetry (e.g., asymmetric molecules, non-spherical shape, or oblique incidence), contains a great deal of information about particles. This project is to explore the way to use polarization to better characterize particles in the ocean.