PACE MISSION APPLICATIONS - Harmful Algal Blooms

Upper Left: Harmful Algal Blooms kill fish, contaminate seafood and pollute our waters (Photo from NOAA/IOOS). Lower Left: Warning sign for cyanobacteria (Image Credit: J. Graham, USGS). Right: Satellite image of Lake Erie, showing the extent of the 2011 harmful algal bloom (the most severe in decades). Credit: MERIS/NASA; processed by NOAA/NOS/NCCOS.

Application Question/Issue: ***How can we better understand the causes and impacts (economic, cultural, environmental, human health) of Harmful Algal Blooms (HABs), and how can we improve monitoring and forecasting of the location and extent of HABs using ocean observations from space?***

Who Cares and Why?

Coastal HAB events have been estimated to result in economic impacts in the United States of at least $82 million each year. The impacts of HABs range from environmental (e.g., alteration of marine habitats and impacts on marine organisms including endangered species), to human health (e.g., illness or even death through shellfish consumption, asthma attacks through inhalation of airborne HAB toxins), to socio-economic and cultural (e.g., commercial fisheries, tourism, recreation).

NOAA, USGS, EPA (e.g., Gulf of Mexico Program), and other state environmental agencies and local health departments are interested in improved monitoring and understanding of HAB events. Among the main goals of these end-users is to provide coastal communities with advance warning, so they can adequately plan and deal with the adverse environmental and health effects associated with a harmful bloom.

Needed Measurements

Improved monitoring and forecasting of HABs requires satellite observations of sea-surface-temperature (SST), chlorophyll-a (Chla) and HAB pigments. To meet the needs of the user communities, satellite measurements (daily images) must be produced at spatial resolutions of approx. 300 m, with a spatial coverage that includes coastal waters (<100 nautical miles from the coast), signal-to-noise ratio (SNR) of 1000, uncertainty of 30% and range of 0.5-400 ug/L. Extended spectral coverage in the near infrared and shortwave infrared regions would be particularly helpful.

The NASA Response

The high (5-nm) spectral resolution measurements from PACE will allow regional algorithms to be developed for identifying and quantifying specific phytoplankton groups, thus allowing identification of HABs and tracking their evolution and variability over seasonal to interannual time scales. This information will lead to a highly sought-after understanding of environmental factors governing HAB appearance and demise. The recommended PACE ocean color data latency (0.5 hour data latency), extended spectral range from the ultraviolet (~350nm) to short-wave infrared (SWIR; 2130nm), spatial coverage (global), and spatial resolution of 250 m x 250 m to <1 km^2 in inland, estuarine, coastal and shelf waters, will meet the majority of users needs for improved space-based HAB retrievals. The combination of high quality PACE ocean color imagery with ancillary observations from various platforms, including other (current and planned, domestic and international) satellite sensors, aircraft measurements, ground-based and marine observation networks, will allow us to vastly improve monitoring and forecasting of the location and extent of HABs.

Comments? Thoughts?

For additional information about PACE mission applications or this particular application, please contact Maria Tzortziou at: *maria.a.tzortziou@nasa.gov*