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Toward a Satellite-Based Monitoring System for Water Quality

Water Quality Workshop for End Users
Greenbelt, Maryland, 27 September 2017

Declining water quality in inland and coastal systems has become, and will continue to be, a major environmental, social, and economic problem as human populations increase, agricultural activities expand, and climate change effects on hydrological cycles and extreme events become more pronounced. Providing governments and nongovernmental groups with timely observations on the time and location of anomalous water quality conditions can lead to more informed decisions about the use, management, and protection of water resources.

By observing the color of the water, satellite sensors provide information on the concentrations of the constituents that give rise to these colors. These constituents include chlorophyll *a* (the primary photosynthetic pigment in phytoplankton), total suspended solids (an indicator of sediments and other insoluble material), and dissolved organic matter. Other environmentally relevant optical characteristics include turbidity and water clarity.

A 1-day workshop at NASA's Goddard Space Flight Center introduced the concept and potential capabilities of a satellite-based, near-real-time water quality monitoring tool. This tool will complement existing field monitoring programs by automatically alerting water resource and ecosystem managers to potentially hazardous water quality conditions, resulting in more timely and informed decision-making.

The workshop brought together more than 340 environmental specialists, economists, scientists, industry representatives, and legal advisors from state and federal agencies and the private sector. The primary requirements that workshop attendees identified for developing this warning system include automated, near-real-time processing of Landsat-Sentinel imagery, the development of robust anomaly detection algorithms, and support for ongoing implementation and calibration and validation efforts. The workshop further aimed to identify the next steps toward making such a near-real-time system a reality with input and guidance from end users.

The workshop featured a series of short presentations on the perspectives of end users on the potential value of satellite data for water quality monitoring. These presentations covered a broad range of topics, including monitoring harmful algal blooms in California, Utah, Oklahoma, Oregon, and Florida; identifying sites for aquacultures in New England; and concerns about pipeline leaks contaminating waterways. Other talks highlighted the need for improved satellite technology (e.g., hyperspectral missions) with sunglint mitigation strategies in the future to enable more precise and accurate estimations of water quality conditions from space.

The NASA Goddard team is currently developing a prototype system for select regions (e.g., Florida's Indian River Lagoon, Lake Mead, and Oregon reservoirs) to evaluate the performance of such an expedited service. The team, in collaboration with water authorities, will initiate algorithm development, prototyping, testing, and implementation of the system.

All presentations are available on the meeting's website (https://go.nasa.gov/2FYBcW6).

The Water Quality Workshop was sponsored by the NASA Goddard Applied Sciences office. We thank Steve R. Greb, Richard Stumpf, Maria Tzortziou, and Jeremy P. Werdell for serving on the organizing committee.

A workshop last September introduced the concept and possible capabilities of using satellite imagery to monitor water quality in near-real time. This natural-color image from NASA's Landsat 8 satellite shows the Caspian Sea around the Tyuleniy Archipelago on 16 April 2016. Sea grasses or benthic algae cause the dark green colors, and most of the fine lines are caused by winter ice gouging the seafloor. Credit: Norman Kuring, NASA

By **Nima Pahlevan** (email: nima.pahlevan@nasa.gov; @nima_pahlevan), NASA Goddard Space Flight Center, Greenbelt, Md.; also at Science Systems and Applications, Inc., Greenbelt, Md.; **Steve G. Ackleson,** Naval Research Laboratory, Washington, D. C.; and **Blake A. Shaeffer,** U.S. Environmental Protection Agency, Research Triangle Park, N.C.