

Water quality and remote sensing in NASA Applied Sciences

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Great Lakes Workshop Series on Remote Sensing of Water Quality March 12-13, 2014



NASA Earth Science Division (ESD) leads a program of breakthrough research that advances knowledge on the most important scientific questions about Earth as a system.



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Applied Sciences Program (within ESD) works to maximize the benefit of these breakthroughs, by supporting the development of decision support tools and information products for end users (resource managers) and strengthening capacity to use them.



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Great Lakes and NASA Earth science





Great Lakes and NASA Earth science









Potential connections with Great Lakes activities (applied research, training, capacity building?)

NASA

Applied Remote SEnsing Training (ARSET)

- Provides webinar or hands-on trainings
 - Over 25 Air Quality trainings w/ > 500 users
 - 8 Water trainings w/ > 400 users
 - Trainings impacting **nearly every state**; many trainings already translated into Spanish
 - Possible water quality training module in the future?





DEVELOP Program

- Develops workforce to utilize Earth observations by providing opportunities to participate in 10-week applied research projects
 - 14 nodes around US, 2 international
 - End users from local to international
 - Additional info in next presentation







Gulf of Mexico Initiative (GOMI)

- Regionally focused
- Established to strengthen regional capacity for
 Earth observations-based applications development and use for resource management and policy, disaster assessment
 - 48 projects, including several on water quality, habitat conservation and restoration, environmental education











A NASA-USAID <u>partnership</u> to <u>improve environmental management and</u> resilience to climate change by strengthening the capacity of governments and other key stakeholders to integrate Earth observation information and geospatial technologies into development decision-making



Administrator Rajiv Shah of USAID and Administrator Charlie Bolden come together to sign an MOU for the partnership.



NASA

Water Quality in Applied Sciences (WR)

Application of ocean color remote sensing to water quality standards development and marine spatial planning



Highlight: Established an approach and reference condition for developing numeric nutrient (nitrogen or phosphorus) criteria using SeaWIFS, Landsat, MODIS.

OBJECTIVE

Develop retrospective time-series (mid-1980s to the present) of light attenuation and determine contributions of phytoplankton, suspended sediment, and dissolved organic matter to light attenuation Florida Panhandle Estuaries, FL coastal waters, and Mobile Bay, Alabama.

OPERATIONAL PARTNERS

EPA and FKNMS

APP SCI INVESTIGATORS

J Lehrter, B Schaeffer, R Conmy, J Hagy, W Fisher, B Spiering, L Underwood, C Ellis, B Barnes, C Hu, L McCeachron, K O'Kiefe









Water Quality in Applied Sciences (GOMI)

A Tool to Evaluate Potential Impacts of Climate and Land Change on Pathogen and Nutrient Concentrations in Weeks Bay



Highlight: Used data from satellites (SeaWiFS, MODIS, Landsat) and in situ measurements (NERR), weather stations to develop predictions for stream flow, nutrients, pathogens







Battelle

OBJECTIVE

Create a software Decision Support System tool to evaluate and visualize impacts of potential future and land use changes on runoff (nutrients, pathogens) in Weeks Bay, AL using various datasets and detailed watershed and hydrologic modeling for historical and future scenarios

OPERATIONAL PARTNERS

Weeks Bay Fdn, Weeks Bay National Estuarine Research Reserve, AL Coastal Fdn, Baldwin County Soil and Water Conservation District, Mobile Bay Nat Estuary Program

APP SCI INVESTIGATORS

G. Lough, D. Mooney, C. Cooper, J. Wightman, J. Schuetter, N. Richardson, M. Al-Hamdan, M. Estes

Monitoring Algal Bloom in Lake Atitlan, Guatemala

Sensors used: Landsat ETM+, EO-1 ALI/Hyperion, and Terra-ASTER

Results of Analysis:

The algal bloom reached its peak in November 2009, covering about 40% of the lake's surface area.

End users:

The images provided by SERVIR were used by the Ministry of Environment and Natural Resources of Guatemala, the Lake Authority (AMSCLAE), media and universities to identify the extent of the algal bloom.

Impact:

This analysis was crucial to make aware not only government institutions but also civil society about the magnitude of this event. Government authorities were forced to initiate a rapid response program to alleviate the damage.













Water Quality in Applied Sciences (HAQ)

NASA Partnership with NOAA on Harmful Algal Bloom Monitoring and Forecasts in Lake Erie



Experimental Lake Erie Harnful Algal Bloom Bulletin 2011-014 08 September 2011 National Ocean Service Great Lakes Environmental Research Laboratory Last bulletin: 01 September 2011



Figure 1. MERIS image from the European Space Agency. Imagery shows the spectral shape at 681 nm from September 03, where colored pixels indicate the lakelihood of the last known position of the Microsystis spy holm (with red being the highest concentration). Microsystis spy abundance data from shown as white squares (very high), circles (high), diamonds (medium), triangles (low), + (very low) and V (our treasmit).



Figure 2. Nowcast position of Microcystis spp. bloom for September 08 using GLCFS modeled currents to

News ands: MERSS images was distributed by the NAAA CoastWaith Program and provided by the European Spoor Agency -Intry News glard nona party-no Commerch UNIN-late, are, Jubihilar, etc., Jubihilar, -Edit ownets was considered by the Stored Later European Laternated - The ward data is available through the National Data Booy Certer and the National Weather Service Conditions: A massive Microcystis bloom persists throughout most of La Western Basin.

Analysis: As indicated in satellite imagery from Saturday (9/3/2011), an enormous Microsystis bloom was present in western Lake Erie. The southern extent of the bloom was remotely observed along the coast of Ohio from Maumee Bay to Catawba Island. The northern extent of the bloom was observed to be consistent along the Michigan



Highlight: Produced a bulletin for HABs that was hosted by NOAA; this tool helped reduce the impact/costs to the public from HABs. According to Ohio EPA, these products help focus and minimize resources necessary for large scale surveillance

OBJECTIVE

Produce Harmful Algal Bloom (HAB) products and forecasts based on observations from MODIS and (formerly) ESA MERIS for Lake Erie.

OPERATIONAL PARTNERS

Ohio EPA, Ohio DNR, Toledo Water Supply, Sandusky Water Supply, Cuyahoga Dept of Health, NOAA

APP SCI INVESTIGATORS

R. Stumpf (PI)





Water Quality in Applied Sciences (WR)

Mapping and Monitoring the Extent of Cladophora Algae in the Great Lakes using Multi-Resolution, Multi-temporal Satellite Imagery



Highlight: Mapped algae extent using Landsat; EPA funded the operational use of this algorithm under the Great Lakes Restoration Initiative

OBJECTIVE

Map Cladophora algae extent in near-shore regions from tracking and responding to nuisance algae issues

OPERATIONAL PARTNERS

EPA

APP SCI INVESTIGATORS

R. Shuchman, C. Brooks, M. Sayers, M Auer, G Meadows, N Jesse, A Dayton





Water Quality in Applied Sciences

ESD/Applied Sciences' DEVELOP and Great Lakes (next presentation!)



2 Current Opportunities for Supporting Great Lakes Activities in Applied Sciences

Health and AQ solicitation

Released as Element A.44 of NASA's 2013 Research Opportunities in Space and Earth Science

Proposals due: April 24, 2014

http://nspires.nasaprs.com/external

Water Resources Solicitation

Released as Element A.45 of NASA's 2013 Research Opportunities in Space and Earth Science

Proposals due: April 30, 2014

http://nspires.nasaprs.com/external/ www.c3.nasa.gov/water

Other Potential Upcoming Opportunities and Activities

PEER-Water – Joint NASA-USAID activity to support international collaborators to work with NASA AppSci and (selected) R&A investigators. RFA release: mid April 2014

Sign up for our NASA Water Resources email listserv too: contact me or visit: https://lists.nasa.gov/mailman/listinfo/nasa-water-resources

CHALLENGE:

What are other ways for AppSci to support the GL community in bridging research to operations?

Key partners?

Key water quality challenges (for the operational community, not just the science/research community)?

Models or analyses that can (within 2-3 years) become decision support tools or operationalized?

Can training help? Other ideas? Thanks to the GL community and GRC for organizing this workshop and for the opportunity to learn more about on-going work, activities, and potential synergies.

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