Abstracts

Tuesday, April 29

Session D1: Remote Sensing: Tools and Applications

1:30 – 3:00 pm | Room 263

Initial Results from the Workshop on Developing a Great Lakes Remote Sensing Community

Larry Liou[1], Robert Shuchman[2], Colin Brooks[2] and Amanda Grimm[2]
[1]National Aeronautics and Space Administration, Cleveland, Oh., [2]Michigan Tech Research Institute, Ann Arbor, Mich.

Abstract
This presentation unveils results from the workshop on remote sensing of inland water quality. The workshop is titled "Workshop on Developing a Great Lakes Remote Sensing Community."

Water quality is of vital importance to the nation and the Great Lakes region. The Great Lakes provide shipping, drinking water, and recreational opportunities for 40 million people and are home to some of the most productive freshwater fisheries in the world. The Great Lakes also make a valuable inland water laboratory in which to study forcing factors such as climate change and human influences that affect inland waters globally. The findings from this Great Lakes focused workshop can be applied worldwide.

State of the science of remote sensing of Inland waters, particularly the Great Lakes, has progressed significantly over the past decade in step with the next-generation satellite infrastructure; the improvement of freshwater optical algorithms; the aquatic radar and lidar data; and the increasingly capable unmanned aerial vehicles (UAVs) and autonomous underwater vehicles (AUVs). However, despite the above and the current efforts in coordinated research and facilitate data sharing, the evolution of a remote sensing community in the Great Lakes is still in its early stages. The current workshop aims to accelerate the forming of this community and thereby furthering the advancement of remote sensing of water quality.

This workshop has the objective to establishing a community consensus on the scientific and technical gaps in remote sensing of water quality. The community consists of data generators and data users from the federal and state agencies, academia, water monitoring programs, tribal and other stakeholder organizations, regulatory bodies, and the international organizations. The workshop will generate a summary white paper with recommendations for consideration by the 2017 NASA Earth Science Decadal Survey.

The workshop also sets up an accompanying interactive website to share summarized findings of three previously held, similar workshops on the same topic. Collaborated by academic, regulatory, and other community partners, this website also provides access to the current workshop documents and serves as a platform for collaboration on a continuing basis.

Use of MODIS Earth Observation Data in Regional-Scale Models of Reactive Nitrogen in Watersheds

R.A. Smith[1], J.S. Shih[2], J.W. Brakebill[1], A.W. Nolin[3], M.K. Macauley[2], G.E. Schwarz[1] and R.B. Alexander1
[1]US Geological Survey, Reston, Va., [2]Resources for the Future, Washington, D.C., 3Oregon State University, Corvallis, Oreg.

Abstract
Reactive nitrogen (Nr) from agriculture and other human sources is transported hundreds to thousands of kilometers through river basins before reaching estuaries and the coastal margin. Continental and regional-scale

models of (Nr) have become critical tools in the management of both coastal and inland water quality. Spatial and temporal sparseness and discontinuities in the data available for quantifying Nr sources, however, limit the usefulness of these large-scale models. Agriculture and natural resources data programs commonly report at annual or less frequent temporal cycles, and at a county (1000 km2) spatial scale. By contrast, forecasting nutrient conditions and hypoxia risk in coastal and inland receiving waters often requires Nr source information at seasonal (or finer) time scales.

We tested the usefulness of seasonally-averaged 1-km observations of the Enhanced Vegetation Index and snow/ice cover data derived from the orbiting Moderate Resolution Imaging Spectroradiometer (MODIS) in augmenting ground-based Nr source inputs to SPARROW (spatially-referenced regression on watershed attributes) models of Nr for the Chesapeake Bay and the conterminous United States, both of which are currently used for water resources management purposes. SPARROW models are developed through statistical calibration of a mass balance equation relating Nr supply rates to Nr flux rates in streams and rivers measured via long-term network monitoring. The models accommodate spatially-detailed information for multiple Nr sources including leguminous crop acreage, fertilizer application rates, livestock manure production, forest and other natural vegetation coverage, atmospheric Nr deposition, and human population-related sources. The availability of spatially-detailed seasonal time series of EVI and snow/ice cover provide many options for modifying the Nr source terms to reflect seasonal vegetation condition. Statistical calibration of the models provides an objective means for assessing the value of these modifications in terms of improved accuracy of predicted aquatic Nr flux.

Using Remote Sensing Tools to Target Stream Protection and Wastewater Treatment Management Practices in Rural Kentucky

Barry Tonning, Catherine Carter, Peter Cada and Gregory D. Sousa
Tetra Tech, Research Triangle Park, N.C.

Abstract
For the Hinkston Creek Watershed CWA 319 (Nonpoint Source Pollution) Project in east central Kentucky, Tetra Tech used remote sensing tools to produce an onsite wastewater system risk analysis, a riparian buffer assessment, and a focused study of two selected tributaries affected by livestock access to the stream corridor. Onsite wastewater treatment system potential risk to water quality was assessed via mapping analyses that considered system densities (*i.e.*, number per square mile), system age, and proximity to surface waters. Prioritization was based on level of household density, closeness to streams, and closeness to karst topography (to account for impacts to groundwater). Publicly serviced areas with centralized wastewater treatment were eliminated first; household density was calculated for areas outside of public sewer line boundaries in the areas surrounding the municipalities.

The riparian buffer assessment and deficiency analysis used aerial photography to determine canopy cover presence/absence and buffer zone widths. A 100- foot buffer was created along each side of the mainstem of Hinkston Creek, with a 50-foot buffer for the upper watershed and tributaries. A Multi-Resolution Land Characteristics Consortium (MRLC) geospatial dataset (LANDFIRE) was used to determine riparian buffer health status (impacted vs. intact). Using methodology from Roy *et al.*, 2005, any vegetated layers with less than 30 percent coverage were lumped together with other impacted riparian habitat LULCs (*e.g.*, developed, open space, pasture/hay, etc.). The percent buffer deficiency within each assessment subwatershed was estimated using GIS.

A broader, desktop analysis of high-risk stream channel areas was also conducted by analyzing riparian vegetation (*i.e.*, canopy cover), cattle access points, and property ownership records. The riparian deficiency data described above was overlaid with imagery from the National Agriculture Imagery Program to assess the intensity of impact on riparian areas within two impaired subwatersheds. Impacted riparian areas were divided into four levels of impact based on stress conditions observable from the aerial imagery, such as proximity of intense tilling and/or grazing to the stream edge, cattle access points, and lack of tree or shrub cover in the riparian buffer.