

# ***Great Lakes Workshop Series*** ***On Remote Sensing of Water Quality***

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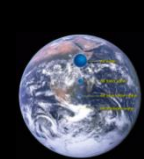
**Workshop 1**  
**Workshop 2**

**March 12-13**  
**May 7-8**

**Cleveland, OH**  
**Ann Arbor, MI**

***Larry C. Liou***

***Space Science Project Office***  
***NASA John H. Glenn Research Center***



# Steering Committee



**Larry Liou**  
(Co-Organizer)

**Lead for Freshwater Research**  
NASA Glenn Research Center

**Dr. Robert Shuchman**  
(Co-Organizer)

**Co-Director**  
Michigan Tech Research Institute  
Michigan Tech University

**Dr. Steve Greb**

**Hydrologist**  
Wisconsin Department of Natural Resources

**Dr. George Leshkevich**

**Physical Scientist**  
NOAA Great Lakes Environmental Research Laboratory

**Dr. John Bratton**

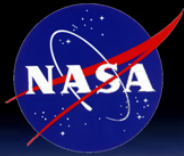
**Deputy Director**  
NOAA Great Lakes Environmental Research Laboratory

**Dr. Jennifer Read**

**Executive Director**  
Great Lakes Observing System

**Dr. John Lekki**

**Optical Systems Research Engineer**  
NASA Glenn Research Center



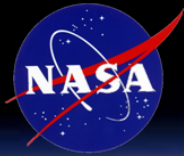
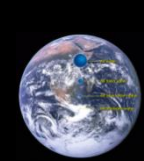
# ***Goal for the Workshop Series***

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**“Identification of gaps in science and technology for remote sensing of water quality**

***Featuring:***

- ***An emphasis on Great Lakes waters***
- ***Building upon results of past workshops***
- ***Formulation of potential, short, pilot projects***



# ***Objectives for the Workshops***

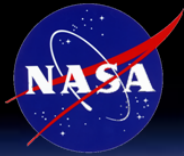
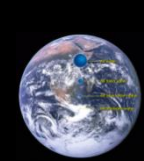
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**Workshop 1**

**March 12-13**

**Cleveland, Ohio**

- **Identify gaps between availability and needs of water quality data**
- **Identify science, technology, & missions required for satisfying the needs**



# ***Objectives for the Workshops***

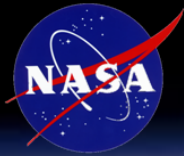
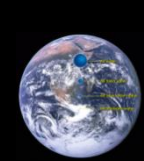
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**Workshop 2**

**May 7-8**

**Ann Arbor, MI**

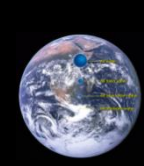
- **Conclude identification of gaps & define research/technology/mission needs**
- **Foster Great Lakes remote sensing and community development and data sharing**



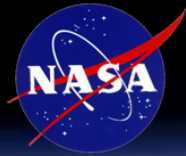
# *Post Workshop Activities*

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- **Co-authors will be invited for a white paper**
- **The workshop website continues into future for further exchanges and collaboration**
- **Collaborate on potential, short (10-week) projects**



# Workshop Format



## ➤ **Plenary talks in morning**

- Lay ground information for breakout discussions in afternoon

## ➤ **Afternoon breakout discussion topics**

- 1. Update sensor requirements
- 2. Identify gaps in remote sensing data and derived product
- 3. Identity technology gaps (sensors, instrument, & hardware)

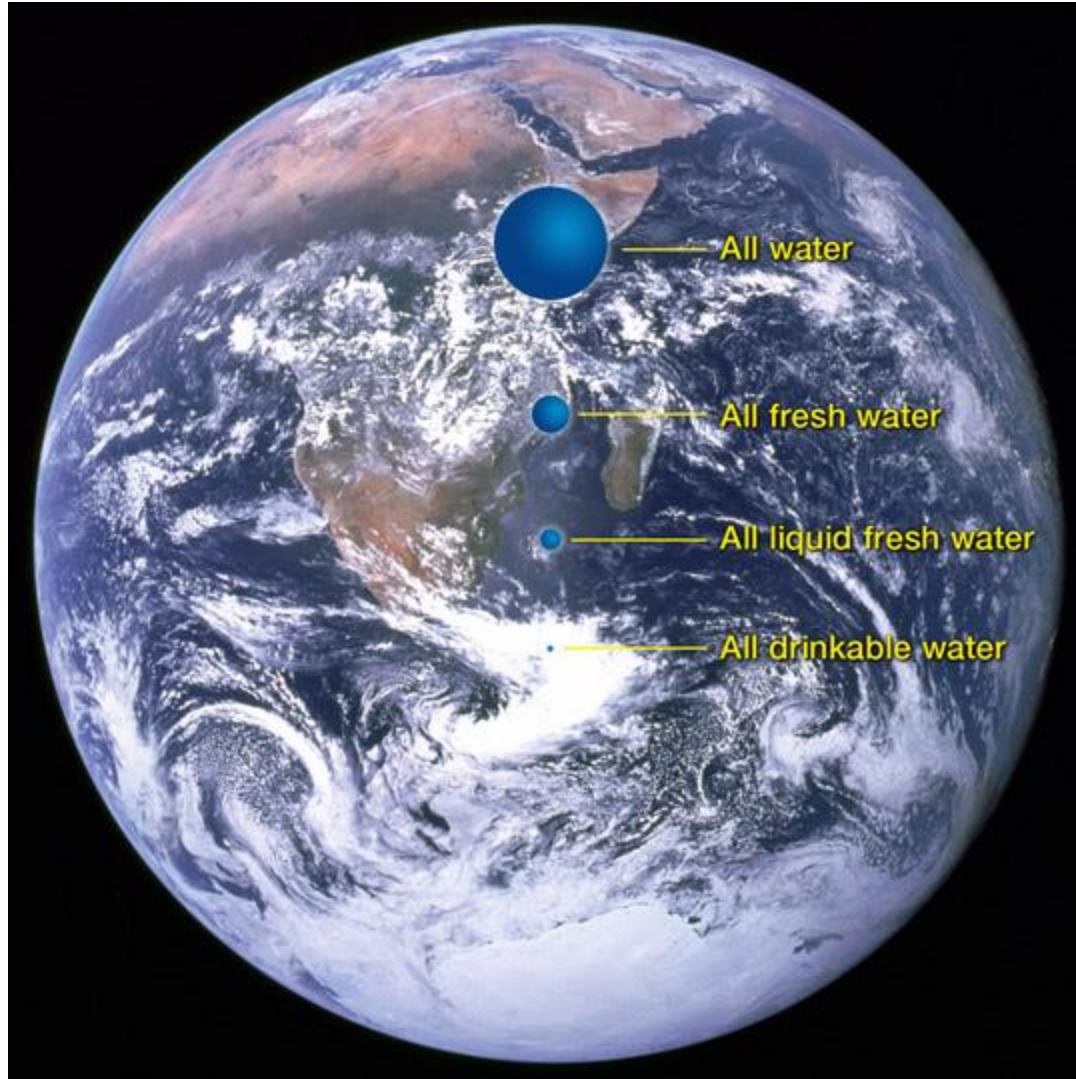
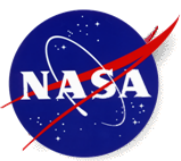
*Day 1*

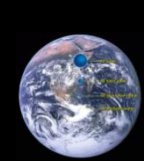
- 4. New potential applications for remote sensing of inland waters
- 5. Algorithms/modeling current approaches: Status, strengths, and deficiencies
- 6. Platform/mission gaps and recommendations

*Day 2*

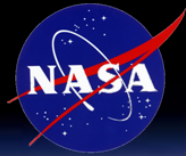


# Reasons for Freshwater Research...

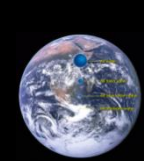




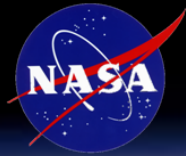
# *Water Research*



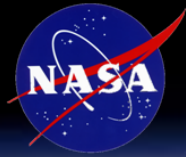
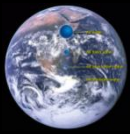
- **Water & Energy Cycle**
- **Water Resource**
  - **Quantity**
  - **Quality**
  - **Decisions/Management**
  - **Capacity Building**



# *Water Research*

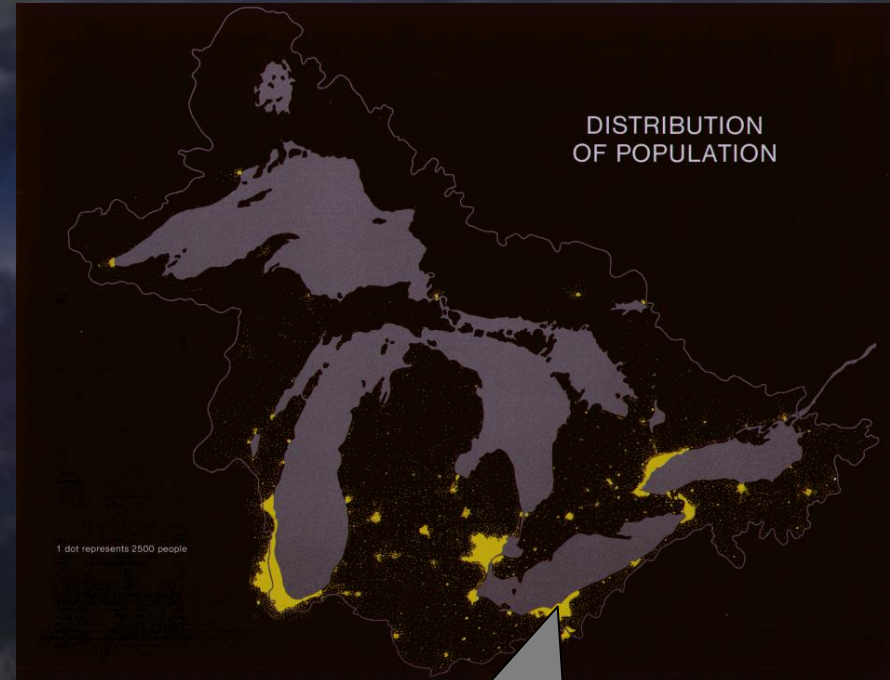


- **Coordinate water quality research regionally, nationally, & internationally**
- **Help organize the Great Lakes and other remote sensing communities and activities**
- **Coordinate in-situ (air, water surface & under, and ground stations) and remote sensing measurements**
- **Develop instrument for remote sensing, airborne, in-situ, and in-water**
  - ✓ **Test and validation**



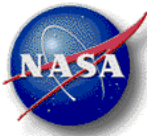
# The Great Lakes...

- **Contain 18% of the world's fresh surface water and 95% of the U.S. supply**
- **Provide drinking water to over 40 million people**
- **Have over 500 recreational beaches**
- **Generate \$4 billion in commercial and fishing business**



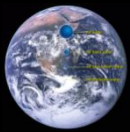
**NASA GRC**

<http://www.glerl.noaa.gov/res/Centers/HumanHealth/>

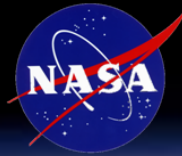


# GRC Air Fleet for Arial Remote Sensing



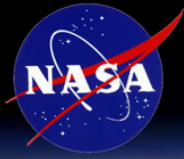
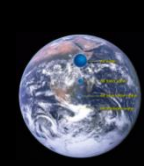


# Aerial Monitoring Enables & Enhances measurement capabilities



- **In Situ – many physical measurements at a point but poor spatial coverage**
- **Satellite – Measurements over a large area but poor / marginal temporal coverage**
- **Aerial Monitoring is Complementary**
- **More frequent measurement opportunities to understand rapidly changing blooms**
- **Lower concentrations potentially detectable because of higher spatial and spectral resolution**
- **Can quickly locate areas of interest and guide in situ measurements**
- **Easily tailor instrumentation to suit the problem**

Observation Method	Observation Frequency	Resolution
Satellite Landsat TM	Once every 8 days	30 meter
Satellite MODIS	2/day	1km
Satellite MERIS	Every 2-3 days	300m
Satellite SeaWiFS	1/day	1km
Research Vessel In situ	Flexible	Point
Aerial Monitoring	As Needed	1- 5 m (Variable)



# *Questions? Inputs?*

*Larry Liou*

NASA GRC

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