

Proposal for New IOCCG Working Group

Proposed by:

Steven Greb

Senior Scientist, Fisheries and Aquatic Sciences Research, Wisconsin Department of Natural Resources; Steven.Greb@wisconsin.gov

Arnold Dekker

Director, Earth Observation & Informatics Transformational Capability Platform, CSIRO Land & Water; Arnold.Dekker@csiro.au

Paul DiGiacomo

Chief, Satellite Oceanography and Climatology Division (SOCD), NOAA/NESDIS Center for Satellite Applications and Research; Paul.DiGiacomo@noaa.gov

Working Group Title:

Earth Observations in Support of Global Water Quality Monitoring

Scientific and programmatic background and rationale

Water quality is a measure of the chemical, physical and biological condition of water relative to human and ecosystem requirements. Available freshwater resources are emerging as a limiting factor not only in quantity but also in quality for human development and ecological stability. Declining water quality has become a global issue of significant concern as anthropogenic activities expand and climate change threatens to cause major alterations to the hydrological cycle (UNEP, 2002; ICPP, 2008, GOOS, 2012).

Nutrient over enrichment of freshwater and coastal ecosystems—or eutrophication—is a rapidly growing environmental crisis. In coastal areas, occurrences of dead zones, which are caused by eutrophic conditions, have increased from 10 documented cases in 1960 to 405 documented cases in 2008. In addition, many of the world’s freshwater lakes, streams, and reservoirs suffer from eutrophication; in the United States, eutrophication is considered the primary cause of freshwater impairment. (Selman et al., 2008) In some regions, more than 50% of native freshwater fish species are at risk of extinction, and nearly one-third of the world’s amphibians are at risk of extinction. (Vié et al. 2009)

Every day, 2 million tons of sewage and industrial and agricultural waste are discharged into the world’s water (UN WWAP 2003). On an annual basis, this waste is equivalent to the weight of the entire human population of 6.8 billion people. These discharges introduce significant concentrations of pollutants as well as pathogens that can be deleterious to human health and negatively impact broader ecosystem health and

productivity and the ability for coastal and inland waters to deliver crucial goods and services. Worldwide, 780 million people do not have access to an improved water source (WHO and UNICEF, 2012). Each year 250 million cases of water-borne diseases are documented and these poor water quality conditions have resulted in the death of an estimated 800,000 children each year, mostly in developing countries (Liu et.al., 2012)

Globally, water quality monitoring is receiving inadequate attention particularly in developing countries and in countries in transition where existing water quality monitoring networks, expertise on water quality management and laboratories for water quality assessments are all deficient. The United Nations Environment Programme Global Environment Monitoring System (GEMS) Water Programme, with the largest archived global water quality data base (UNEP GEMS, 2006), has documented many gaps in global coverage. Only half the world's countries submit data, with many countries not participating simply because they do not have systematic water quality monitoring programs.

The measurement of water quality variables via radiometric measurements of the water's optical properties has rapidly grown over recent years. Improvements in algorithms and product development, sensor technology and maturity, and data accessibility and provision have led to demonstrated confidence in remotely sensed data with potential applications to water resources management. However, to date, management agencies have been slow to embrace satellite derived measurements even though important parameters such as chlorophyll, suspended solids, light attenuation, and colored dissolved organic matter have been quantified with required accuracies.

A recent internal US Environmental Protection Agency survey (Schaeffer et al, 2013) queried potential users' perceptions and found concerns centered on cost, product accuracy, data continuity and programmatic support. Their recommendation was initiating open and effective discussions between scientists, stakeholders, policy makers and environmental managers. This proposed working group seeks to build a stronger linkage between the water resources management end users and data providers to fully realize current and future Earth Observation (EO) products.

Goal and Vision

Provide a strategic plan for incorporation of current and future EO information into national and international near-coastal and inland water quality monitoring efforts. Promote best practices, coordination of efforts and partnerships, and propose specific new linkages between data providers and data end users. Ultimately the intent is to work toward implementation of a global water quality monitoring service under the auspices of GEO.

Terms of reference

Assess current knowledge regarding coastal and inland water quality and associated use of remote sensing data

- ⇒ Provide overview and assessment of global inland and coastal water quality, societal and ecosystem benefits, and trends (current knowledge).
- ⇒ Describe existing water quality monitoring frameworks (local, regional, and global) and current gaps.
- ⇒ Provide case studies of EO supported water quality activities including baseline monitoring, historic trends and current operational efforts.

Identify user needs and requirements; future mission requirements

- ⇒ Identify current and future end-user needs with respect to spatial, temporal and accuracy requirements for monitoring and forecasting both long-term and episodic water quality conditions.
- ⇒ Recommend specific mission requirements needed to fulfill water quality needs.

Assess existing and identify new space-based and in situ observing capabilities

- ⇒ Describe current capabilities of earth observations in support of inland and coastal water quality monitoring
- ⇒ Describe of current in situ monitoring technologies employed and minimum institutional requirements.
- ⇒ Describe planned capabilities of earth observations in support of inland and coastal water quality monitoring, and how these might address existing gaps.

Identify supporting research and development activities

- ⇒ Describe current research and development activities in support of these missions (e.g., algorithm development, validation) relative to water quality needs
- ⇒ Identify emerging areas of investigation and development related to water quality issues.

Identify best practices and new & improved data streams and products

- ⇒ Provide best practices, specific guidance and road map on how management agencies can utilize and implement currently generated products and software in support of their needs, including derived, integrated water quality information products.
- ⇒ Recommend development of specific new and improved remote sensing-derived products, indicators and services.

User engagement and outreach

- ⇒ Develop strategy to strengthen linkages between data providers and end users. Propose future collaborative efforts.
- ⇒ Work in coordination with GEO and its Blue Planet Task to advance development of a global coastal and inland water monitoring service.

Working group structure and functions

- The working group membership will have diverse backgrounds and perspectives, i.e., including both data providers and (potential) users, and include individuals from space agencies, science community and national and local management agencies.
- This working group will reference, complement and leverage existing IOCCG reports particularly Report 3 (2000): Remote Sensing of Ocean Colour in Coastal, and Other Optically-Complex, Waters, Report 5 (2006): Remote Sensing of Inherent Optical Properties: Fundamentals, Tests of Algorithms, and Applications, Report 7 (2008): Why Ocean Colour? The Societal Benefits of Ocean- Colour Technology, Report 8 (2009): Remote Sensing in Fisheries and Aquaculture, Report 10 (2010): Atmospheric Correction for Remotely-Sensed Ocean-Colour Products, Report 13 (2012) Mission Requirements for Future Ocean-Colour Sensors.
- This working group will interact and work in conjunction with existing and planned IOCCG working groups including Phytoplankton Functional Types, Harmful Algal Blooms, Intercomparison of Retrieval Algorithms for Coastal Waters, and Atmospheric Correction in Turbid Waters.
- This working group will extend the efforts of previous IOCCG reports (i.e., Reports #7 and #8) to support broader “downstream”, end-user utilization of ocean color data.
- This working group will support the objectives of GEO with the goal of contributing to the broader implementation of GEOSS.
 - This includes liaising and contributing to the GEO *Blue Planet Task*, specifically its proposed new “Services for the Coastal Zone” component, to be led by the Coastal Zone Community of Practice, which has identified the need for global coastal water quality monitoring service, potentially support by a dedicated Water Quality Community of Practice.
 - The GEOSS Water Strategy Report, which provides the framework for this working group. The report’s recommendations are reflected in the terms of reference stated above.
 - Linkages to other GEO tasks including IN-01, Earth Observing Systems; HE-01, Tools and Information for Health Decision-Making; SB-01, Oceans and Society: Blue Planet; and other task components included in WA-01 Integrated Water Information.
- WG recommendations will provide input to future CEOS planning and coordination activities, including supporting related activities and plans articulated in the current version of the Ocean Colour Radiometry Virtual Constellation (OCR-VC) Terms of Reference.

Other topics to be potentially addressed:

- Data integration, modeling and assimilation
- Decision support tools
- Standardization of methods
- Special considerations for developing countries
- Education and capacity building
- Potential supportive role of citizen-based monitoring and crowdsourcing

- Role and responsibilities of CEOS agencies, World Bank, and other international organizations (e.g., UNEP, IOC/GOOS)
- Science and/or application traceability matrices
- Water body size considerations

Proposed membership

	First name	Last name	Affiliation	Country
1	Stewart	Bernard	CSIR	South Africa
2	Caren	Binding	Environment Canada	Canada
3	Carsten	Brockman	CB Assoc.	Germany
4	Arnold	Dekker	CSIRO	Australia
5	Paul	DiGiacomo	NOAA	USA
6	Mark	Dowell	JRC	Italy
7	Steven	Greb	WDNR	USA
8	Steve	Groom	PML	UK
9	Milton	Kampel	INPE	Brazil
10	Chris	Mannaerts	ITC	Netherlands
11	Yuji	Sakuno	Hiroshima Univ.	Japan
12	Blake	Schaeffer	USEPA	USA
13	Richard	Stumpf	NOAA	USA
14	Andrew	Tyler	Univ. Stirling	UK
15	Menghua	Wang	NOAA	USA

Proposed Timeline

- January 2014: Working Group Proposal briefed at IOCCG-19 Meeting
- March 2014: Team composition and terms of reference finalized for the WG
- June 2014: First meeting of the WG to finalize scope and structure of the report and initiate writing assignments
- February 2015: Progress report provided at IOCCG-20 Meeting
- April 2015: Second meeting to review and refine report development. Potentially held in conjunction with GEO Water Quality workshop in Geneva.
- November 2015: Submit complete draft of report for review at IOCCG-21 Meeting
- February 2016: Committee briefing and review of report at IOCCG-21 Meeting
- May 2016: Final version of the report completed and submitted for publication

Resources

Resources are requested from the IOCCG to cover travel expenses for up to 10-12 working group members for the two working group meetings proposed. Agency members

are asked to support their own travel and expenses if at all possible. NOAA (P. DiGiacomo) has expressed a willingness to cover the expenses of the printing and distribution of the report from this working group.

References

GOOS. 2012. Requirements for Global Implementation of the Strategic Plan for Coastal GOOS. UNESCO/IOC: Paris, France. 200 pp.

IPCC. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, Bates, B.C., Kundzewicz, Z. W., Wu, S. & Palutikof, J. P. (eds.). Secretariat, Geneva, 210.

Liu L., H. L. Johnson, S. Cousens, J. Perin, S. Scott, J. E. Lawn, I. Rudan, H. Campbell, R. Cibulskis, M. Li, C. Mathers, R.E. Black. 2012. Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet*. Jun 9;379(9832):2151-61.

Schaeffer, B.A., K.G. Schaeffer, D.K. Ross, S. Lunetta, R. Conmy, and R.W. Gould. 2013. Barriers to adopting satellite remote sensing for water quality management. *International Journal of Remote Sensing* Volume 34, Issue 21.

Selman, M., S. Greenhalgh, R. Diaz, and Z. Sugg. 2008. Eutrophication and Hypoxia in Coastal Areas: A Global Assessment of the State of Knowledge. *Water Quality: Eutrophication and Hypoxia Policy Note Series No.1*. Washington, DC: World Resources Institute.

UNEP. 2002. Fresh Water for the Future: A synopsis of UNEP activities in Water. United Nations Environment Programme 2002.

UNEP GEMS/Water Programme. 2006. Water Quality For Ecosystem and Human Health. UNEP GEMS/Water, Burlington, Ontario.

UN WWAP. 2003. United Nations World Water Assessment Programme. *The World Water Development Report 1: Water for People, Water for Life*. UNESCO: Paris, France.

Vié, J.-C., Hilton-Taylor, C. and Stuart, S.N. (eds.) 2009. *Wildlife in a Changing World – An Analysis of the 2008 IUCN Red List of Threatened Species*. Gland, Switzerland: IUCN. 180 pp. Available at <http://data.iucn.org/dbtw-wpd/edocs/RL-2009-001.pdf>

World Health Organization and UNICEF. 2012. Progress on Drinking Water and Sanitation: 2012 Update. United States: WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation.

