

## IOCCG Working Group

### Earth Observations in Support of Global Water Quality Monitoring

9-10 June 2014

NOAA/National Center for Weather and Climate Prediction  
College Park, MD, USA

#### Meeting Summary – Rev. 19 June 2014

Member Name		E-mail	Affiliation /Country (rep.)	PRESENT? Y/N
Greb*	Steve	Steven.greb@wisconsin.gov	Wisconsin Department Natural Resources/ United States	Y
DiGiacomo*	Paul	<a href="mailto:Paul.digiacomo@noaa.gov">Paul.digiacomo@noaa.gov</a>	NOAA/ United States	Y
Dekker*	Arnold	Arnold.dekker@csiro.au	CSIRO/ Australia	
Brockmann	Carsten	<a href="mailto:Carsten.brockmann@brockmann-consult.de">Carsten.brockmann@brockmann-consult.de</a>	CB Associates/Germany	Y
Kampel	Milton	<a href="mailto:Milton@ltid.inpe.br">Milton@ltid.inpe.br</a>	INPE - Brazilian Space Research Institute /Brazil	Y
Stumpf	Rick	<a href="mailto:Richard.stumpf@noaa.gov">Richard.stumpf@noaa.gov</a>	NOAA/ United States	Y
Schaeffer	Blake	Schaeffer.blake@epa.gov	USEPA/ United States	Y
Bernard**	Stewart	sbernard@csir.co.za	CSIR - NRE, Earth Systems Earth Observation/ South Africa	Y
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\*Working Group Co-Chairs

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#### **Summary of action items from this meeting:**

**ACTION: Arnold** will ask Claudio to arrange for coffee Thursday 4:30PM at the ILEC World Lake Conference, Perugia, 4 Sept. 2014.

**ACTION: Steve** to confirm calendar date for GEO Water Quality conference in Geneva, April 2015

**ACTION: Veronica** to distribute meeting summary and other communications by Monday, 16 June 2014 – drafts to Steve, Paul done. Full group distribution 19 June 2014

#### 1) Open Meeting, Welcome

- a. Paul – welcome to NCWCP, building conducive to meetings, collaborations.
- b. Introductions – all present
- c. Paul – safety, logistics
- d. Steve – Goal is to get report written.

- i. Timely
  - ii. Democratic process (although some discussion that the scientific process isn't really a democratic process and ultimately the chairs will have final say.).
  - iii. Others with experience with IOCCG Report writing process, please share experiences/expertise
- e. Steve – Reviewed the agenda. There were no suggested changes at this time.
- 2) Discussion about timelines for progress and future meetings as opportunities for this group to meet:
  - a. Sept. 2014, ILEC World Lake Conference, Perugia, – in general, the Europeans would prefer to go home Friday afternoon. Eventually it was decided that the coffee/meeting should be Thursday. **ACTION: Arnold will ask Claudio to arrange for coffee Thurs 4:30 afternoon,**
  - b. Feb. 2015, ASLO Aquatic Sciences, Spain,
  - c. April 2015, GEO Water Quality workshop, Geneva
    - i. potential target for chapter presentations
    - ii. not many of the group expect to attend in person
    - iii. April is ambitious timeframe – yes, but push for it, can be done.
  - d. May 2015, IOCS, West Coast US (TBD)
- 3) Discussion about instituting a Coastal Virtual Constellation within CEOS
  - a. Arnold - Other virtual constellations are more sensor focused
  - b. Paul - Water quality is mentioned in the CEOS Virtual Constellation documents
  - c. Rick - Lake monitoring requires a constellation of sensors for inland (e.g. Landsats, Sentinels, HyspIRI, Meris, etc.)
- 4) Discussion about Constellation concept in relation to Users
  - a. Many people will see this IOCCG report
  - b. Broader use, enables studies of global trends, seasonal phenology, environmental “winners and losers”
  - c. User focus is good, but sensors cannot be ignored, each needs to be optimized for inland purpose, calibrated
  - d. Map User key variables to sensors in the constellation
  - e. User interface will not be “the constellation”. “Earth Cube” examples mentioned
  - f. Borrow the traceability matrix format starting with Users
- 5) Discussion regarding monitoring and assessment
  - a. Monitoring is really monitoring (near real time) and assessment (trends over time)
  - b. Sensitivity of a perception (by managers, monitoring agencies) that remote sensing is “taking over” assessments
  - c. Useful products (to managers) are often different from observable (or derived) parameters (e.g. “Where are the algal blooms?” vs. a chlorophyll concentration image). List of remote sensing observations: CDOM TSS Chl Temp Carbon \*nutrients vs. list of management concerns: Trophic state, algal blooms, biomass, harmful algal bloom, water quality.
  - d. Large lakes tend to get sampled; small lakes need MORE remote sensing.
- 6) The above discussions lead to a more directed conversation about who is the audience for the report
  - a. Ocean Color remote sensing community in general needs to be educated about the unique needs and challenges of working with inland, coastal waters
  - b. Need awareness of processes related to inland waters (e.g. land use, meteorology, etc.)
  - c. CSIRO World Bank report discusses some of 6b (above)
  - d. Direct to managers, then to ocean color remote sensing, but not to space agencies.

- e. Don't exclude space agencies, 2-fold report - Part 1 Space, Science; Part 2 Users; develop both in parallel; 2 birds with one stone; intro and summary chapters in language for managers while technical sections use language familiar to science/technical/space agencies
  - f. User-focused sections must concentrate on existing or very near future sensor capabilities, while sections aimed at agencies can point out what's needed for longer term. *This time scale concept was embraced and adopted as a foundation upon which develop the Report.*
    - i. Short time scale – Users, products
    - ii. Medium time scale – Look for better ways to fill gaps, opportunities to tweak designs already on the books
    - iii. Long time scale – Influence space agency programs beyond 2022
  - g. Remember IOCCG is funded by space agencies; both opportunity to influence and obligation to inform/include them
    - i. Influence Sentinel 2, 3 C&D models (~2025)
    - ii. Influence A&B ground segment
    - iii. Influence Landsat9
    - iv. Influence Enhancement of GeoStationary Constellation for inland
  - h. New paradigm of commercial satellites
    - i. means considering “many, quick, cheap”
    - ii. But no good if they are “cheap and dirty”; if not calibrated (or properly calibrated) will NEVER be useful
- 7) Question was raised if this group had the requisite expertise to write to these audiences, should the writing group be expanded? General consensus was that this group is well suited and can invite in “experts” or outside help on an as needed basis with approval from Working Group chairs.
- Examples of groups missing:
- a. Actual managers
  - b. Regions
    - i. China
    - ii. India
    - iii. Indonesia
  - c. Land remote sensing people
- 8) Discussion surrounding similar work already done or in progress – documents from which material, tables, etc. can be borrowed:
- a. Arnold involved/shared /recommended:
    - i. Dekker and Hestir, May 2012, “Evaluating the Feasibility of Systematic Inland Quality Monitoring with Satellite Remote Sensing” Produced for the National Plan for Environmental Information Environmental Information Services-Bureau of Meteorology, CSIRO 117441
    - ii. World Bank Report
    - iii. Matthews review paper
  - b. Menghua – “Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Mission Science Definition Team Report”, October 16, 2012
  - c. Blake – Schaeffer et al. 2013 Int. J Rem. Sens.
  - d. Much discussion surrounding Arnold's flow chart – too detailed – many variations on the theme suggested (at least inverted, simplified). Need to be able to map actual manager/user experience onto the flow chart.
- 9) Formulating chapters – the time scale theme was merged with the multiple audience concept to get to a stage of 3 broad categories, plus an introductory chapter. The three sections are:

- a) **User/Manager, short time frame, short time frame. Societal Infrastructure** (but don't focus on regulatory aspect). *Mission Statement A: Report Rationale; Inform manager /stakeholder of possibilities currently, and near future; Identify needs that can be filled by remote sensing.*
- i) Include recommendations, applications (for example : S3 as replacement for Meris; GCOM-C with uV; Himawari, stop at PACE,... up to year ~2020?)
  - ii) "OC-101" for water quality inland/coastal – for manager audience; demystify radiometric transfer theory to enable better comprehension, appreciation, of how products are developed, produced.
  - iii) Red vs. blue
  - iv) "6" major user requirement (some manageable number – keep revisiting in each section)
  - v) Case studies that have worked –(refer back to "6" issues above)
  - vi) representative water bodies
  - vii) Current knowledge and user needs.
  - viii) Current monitoring frameworks.
  - ix) Legal framework
  - x) Health
  - xi) Socioeconomics
  - xii) In-situ water quality measurements. (current obs)
  - xiii) Information and Decision Support Tools – existing, bridging gaps (GIS, use remote sensing to locate problem, but not to analyze, track, solve, problem)
- b) **Remote Sensing science – 1-5 yr – research questions, needs, development. Science Infrastructure.** *Mission Statement B: science required to meet user needs – current and near future; how to fully exploit sensor capabilities current and near future; inform existing programs of minor changes that make significant impacts for inland/coastal use.*
- i) Use some of the examples from above to as basis to show details – more technical
  - ii) "OC-102" remote sensing of water quality for ocean color scientists (i.e. approaches/concerns/challenges for coastal/inland waters are different from those for oceans)
  - iii) Technical challenges, atmospheric corrections, Rayleigh corrections
  - iv) optical in-situ needs for remote sensing use: Vicarious calibrations, validation, document uncertainties
  - v) Error, robustness, uncertainties, need for algorithm tuning (confidence in extending algorithms into regions with no field observations)
  - vi) Natural ranges of various observations needed here? Or documented elsewhere (Colleen's workshop publication – in revision or in press, some thought not in there)?
- c) Agencies – long time – recommendations to agencies for future programs; Technical infrastructure; *Mission Statement C: Technical infrastructure to address user needs*
- i) New platforms, atmos corr. New sensors
  - ii) Design matrix, science traceability
  - iii) Constellation approach – i.e. mission document
  - iv) In-situ (optical) measurements. (institutional/agency support – vicarious calibrations; also reaffirmation to users)
  - v) Satellites – link back to OICCG #13 L1 requirements
  - vi) Processing & distribution
  - vii) Rick showed a "table of fitness for purpose" covering sensors (sensor, time, space resolution) which the working group liked.
  - viii) Gaps between what we have and what we would like (modifications, i.e. add 680 band to next version of VIIRS)

- ix) Common bands for cross calibrations
- 10) Case Studies – The theme of using a carefully chose, limited number, set of case studies (“6”) to be introduced early and referred to throughout the document was discussed and developed over the course of the meeting.
  - a) How to choose the case studies? Categorization schemes included:
    - i) Lake size
    - ii) Lake type (e.g. Finnish, alpine, etc.)
    - iii) Regional representation
    - iv) Parameters, observations associated with management problems
    - v) By management problems, not observations (i.e. Rick’s list: water clarity, trophic state (eutrophication), harmful algal blooms, biomass, sediment load, temperature, nutrients, dissolved oxygen (hypoxia). Others added CDOM and macrophytes.)
    - vi) Only include those that actually have management applications (as opposed to being merely heavily studied, scientific publications, e.g. Chesapeake Bay). Might actually be very few in practice.
    - vii) Include a time series example
    - viii) Include a biodiversity example
    - ix) Sampling planning
    - x) Consider “states of development” (i.e. “1<sup>st</sup> World”; “3<sup>rd</sup> World”); different problems, different solutions.
    - xi) Aquaculture in China
    - xii) Be careful of random “google search” examples
    - xiii) Case studies are not to be considered “comprehensive” but “representative”
    - xiv) Societal and legal
    - xv) By remote sensing issues/algorithms
    - xvi) Illustrate end-to-end? or highlight particular aspects depending on the section the case study is used for?
    - xvii) Summarized in a “check the box” matrix, for example:

Water Body	Phenomena	Product	Region/Type	Function	User/Framework
Lakes	Habs	Chl	Geographic examples	Monitoring/NRT	
Estuaries	Eutrophication	Tsm	Distrophic/eutrophic	Assessment/time series	
Coastal	Pathogen/contamination	Cdom	Types of lakes	Forecasting	
	Water clarity	Kd	Land Use: Urban, Agricultural, natural, mixed use		

- b) Where do they go?
  - i) Introductory chapter?
  - ii) Side boxes?
  - iii) Website to collect case studies contributed by users
- c) Do the “6” well, lots of references for more details elsewhere – or branching off into the representative subject.
- 11) Breakout Groups to determine chapters from each of the 3 broader themes (1a, 1b, 1c above). For final report outline including chapter working titles, bullet points, leads and author groups, see separate document.
  - a) Group “A”: Steve, Rick, Blake
  - b) Group “B”: Menghua, Arnold, Stewart
  - c) Group “C”: Paul, Milton, Carsten

- 12) Assigning chapters – the method of choosing leads for chapters was discussed
  - a) Assign only to people here?
  - b) Draft working group absentees?
  - c) Draft others from outside working group (suggested: Mark Matthews, Nima Pahlevan, Colleen Mouw)?
  - d) Leave it to the lead to decide whether to invite extra authors then only with co-chair approval.
  - e) Each chapter should have one lead and one co-chair for responsibility.
- 13) Authorship of chapters
  - a) Two ways to go
    - i) List authors separately for each chapter
      - (1) Benefits
        - (a) Faster
        - (b) Easier
        - (c) Incentive for junior authors
      - (2) Limitations
        - (a) Final report not cohesive
        - (b) Harder to get working group members to review other chapters
        - (c) The citation generally lists only the report in full with chairs/editors named, not the chapter authors anyway
    - ii) Include all working group as authors of report, chapters are not authored
      - (1) Benefits
        - (a) Cohesive document
        - (b)
      - (2) Limitations
        - (a) Slower
        - (b) More reviews, revisions required
  - b) The working group attendees consented to the co-chairs' later decision
- 14) Review of expertise of working group members who were not in attendance:
  - a) Caren Binding – applied Canada, lakes managements (A)
  - b) Mark Dowell – Not likely to respond (B, C)
  - c) Steve Groom – (A, B, C)
  - d) Chris Mannaerts – model integration, tech transfer (A, B)
  - e) Yuji Sakuno – (B)
  - f) Andrew Tyler – Global Lakes (B)
- 15) Final Chapter Outline – see separate document**
- 16) Timeline for progress - with REGULAR REMINDERS, telecons interspersed
  - a) 16 June 2014 (Monday) Send out draft from this workshop, solicit responses, approval (~10 days)
  - b) 26 Jun 2014 - Responses received
  - c) End of July – Telecon – doodle survey for date.
  - d) 25 August 2014 – Leads submit chapter outlines to working group
  - e) 1-5, September 2014 - Perugia– 2 page outline for each chapter minimum, farther along OK – group meets 4:30 pm Thursday meeting then dinner.
  - f) Oct 2014 - Executive IOCCG meeting (- at Ocean Optics, Portland, ME USA) Outlines from Perugia will be used for midterm report.
  - g) End of Feb 2015 - IOCCG –Paris – Full Draft v. 1.0 (with or without case studies?)
  - h) March-April 2015 - “Crossthreading” — reviewing discussing among chapter groups

- i) April 2015 - Water Quality — Geneva, Full Draft v2.0 – full group meeting – **ACTION: Steve to confirm calendar date soon.**
  - j) April 2015 onwards - Rest of Schedule TBD
  - k) May 2015 - IOCS meeting – US West Coast - input from this group
  - l) May 2015 Report revisions: Iterations .v3 to .vx
  - m) Feb 2016 - Final Report
- 17) Associated Activities
- a) Brochure – short document – example “why ocean color brochure” (8 pages, many figures, aimed to sell OC to funders)
    - i) Aim toward end users, local managers
      - (1) Include point of contacts list
      - (2) Can be translated into many languages
      - (3) Could be co-sponsored by GEO and IOCCG
    - ii) Aim toward space and operational agencies (i.e. ESA/Eumetsat; NASA/NOAA) to influence, educate
  - b) Attend management conferences – ask questions, report back to funders, agencies
  - c) Training and manuals – mentioned but not discussed much
  - d) GEO Water Quality collaboration – community practice, global water quality monitoring
    - i) IOCCG WQ working group as a “kernel” to the GEO, not only satellite, includes in situ
    - ii) Website should be running next week (Swiss)
    - iii) Showcase case studies – send in your work (to Steve)
    - iv) Document repository (potential)
- 18) Group photo – see above
- 19) Rick Lawford gave a presentation of proposal to World Health Organization , UNEP, UN Water Sustainable Development Goals – asked for assistance in identifying “indicators”
- 20) Adjourn