Post Event Summary Report: CEOS Water Quality Workshop

Overview

On 13 April 2026, 26 in-person and 13 virtual participants from 15 different organisations convened in Irvine, California, for the first CEOS Water Quality Workshop, titled *Remote Sensing of Water Quality: Requirements for Comprehensive Catchment-to-Coast Observation*. Participants including CEOS Agencies, hydrology experts, and partners came together to initiate dialogue and collaborate with the aim of identifying how EO capabilities can better support integrated water quality monitoring and management. The workshop theme was derived to respond to a growing global need for a more integrated and holistic approach to water quality monitoring, one that bridges inland, riverine, estuarine, and coastal systems, and enables Earth Observation (EO) data to be translated into practical, actionable information for decision-makers.

Traditional scientific and operational silos between terrestrial hydrology, inland waters, and coastal oceanography often limit the ability to put into place management strategies that consider the influence of drivers across the catchment on water quality. These barriers are increasingly problematic given rising pressures from climate-driven extreme events, urbanisation, population growth, and land-use change. Effectively addressing water quality challenges requires a catchment-to-coast perspective that integrates observations, modelling, and user needs across the full water continuum.

Purpose and Objectives

The workshop was convened to initiate dialogue and collaboration across CEOS agencies with the aim of identifying how EO capabilities can better support integrated water quality monitoring and management.

The primary objectives were to:

- Identify key challenges in translating EO data into actionable water quality insights
- Highlight critical observational, continuity, and interoperability gaps
- Strengthen linkages between inland and coastal water quality communities
- Establish a foundation for improved integration of satellite data, in-situ observations, and models

The overarching aim was to address observational gaps and strengthen the integration of diverse data sources, including EO data, to enable actionable insights for water quality management, hazard mitigation, sustainable land and water use, ecosystem protection, and aquaculture –fostering holistic, catchment to coast perspective.

Workshop Approach

The Workshop adopted a user-centred and interactive approach, progressing from end-user perspectives to discussions on critical variables, satellite capabilities, and remaining gaps in the current observation landscape. The intention was to ensure that discussions remained grounded in operational decision-making needs and emphasised the importance of making EO-derived products accessible to downstream users.

Interactive breakout sessions focused on identifying water quality variables that bridge inland and coastal systems, and gave participants the opportunity to look at how current and planned sensor capabilities could address these requirements. Overlaying user needs with sensor characteristics highlighted trade-offs between spatial resolution, temporal resolution, spectral performance, and data continuity.

Workshop participants in action






Key Findings and Messages

Catchment-to-Coast Integration

Participants strongly recognised the complexity of linking catchment processes to coastal water quality outcomes. Rivers, streams, and estuaries were highlighted as critical transport pathways for sediments, nutrients, and pollutants. Achieving an effective catchment-to-coast approach requires improved understanding of hydrological drivers, better integration of modelling frameworks, and greater consistency in terminology and concepts across disciplines and regions.

Similar to the demonstrators developed by other CEOS groups, suggestions for the establishment of a thematic catchment to coast water quality demonstration project could help to bring the ideas and discussion points together in a practical and user driven way.

End-User Needs

End-User needs were consistently recognised as a central part of the success of a useful catchment to coast observation system. Key end-user needs were identified throughout the workshop, and included:

- Higher spatial resolution, particularly for small rivers, lakes, and nearshore zones
- Higher temporal resolution and long-term data continuity
- Improved salinity products in coastal and nearshore areas
- Multi-sensor and multi-platform data fusion
- Higher level family product suites (L3-L4) Analysis Ready Data (ARD) to reduce technical and adoption barriers
- Integrated data products and services rather than fragmented datasets

It was also noted that there was a strong preference for publicly funded EO data, citing trust, transparency, and reliability as key factors for operational decision-making.

It was expressed during the workshop that having more participation from hydrologists and modellers, as well as specific water management experts, community scientists and boundary organisations would provide additional insights to support the workshop's objectives.

Analysis Ready Data and Accessibility

The importance of ARD was also highlighted as an enabler for broader uptake by end users. CEOS-ARD was seen as critical to lowering technical barriers and supporting non-expert users. Participants also highlighted the need for a "one-stop shop" where trusted water quality products,such as HAB indicators, frontal boundaries, gradients, habitats, and site suitability,can be accessed with clear documentation and quality assurance.

Recognising that ARD and decision ready data are two separate parts of the puzzle, and align with accessibility requirements. This topic will need to be discussed at a deeper level at workshop 2.

It was noted that creating higher-level ARD products (L3-L4) built on the draft suite of Essential Water Variables (EAVs) could be a beneficial next step.

Sensors, Continuity, and Modelling

Emerging sensor capabilities, particularly imaging spectroscopy (e.g. VSWIR), were recognised as transformative for water quality applications. Sensor fusion approaches, including the combination of missions such as Landsat, ECOSTRESS, SWOT, and PACE, were seen as particularly valuable.

Continuity of both missions and algorithms was identified as a critical issue; users are reluctant to depend on data products that may not persist. Participants also emphasised that many end users are seeking integrated model outputs, not just observational data, especially for forecasting and early warning applications.

Cross-Cutting Challenges

Participants identified several persistent challenges that exist across the spectrum of EO data users:

- Limited trust and uncertainty around the quality and continuity of commercial EO data
- Gaps in technical capacity and EO expertise among user organisations
- The “last-mile” challenge of converting EO data into decision-ready information and then management action
- The need for sustained engagement and relationships between space agencies and users
- Importance of international coordination for transboundary water quality issues

Pilot projects, co-development, and stronger science communication were identified as effective mechanisms to address these challenges and build confidence in EO-based solutions especially to support improved catchment to coast observations for water quality.

Interoperability of all data continues to be a challenge. Understanding how necessary variables can work together could be very impactful. A possible solution would be to utilise AI to set up/manage an ensemble style system, which could assist in identifying which data is the most critical for applications including water quality monitoring. It would be similar to an ensemble weather forecasting system.

Outcomes and Next Steps

The Workshop successfully balanced technical content with open discussion, fostering productive exchange across disciplines.

Participants consistently recognised the importance of interoperability, cooperation, and inclusive partnerships in addressing catchment-to-coast water quality challenges. The discussions also highlighted complementarities with existing CEOS initiatives, including the Aquatic Carbon Roadmap, Biodiversity-VC, COAST-VC, LSIVC, WGISS, the CEOS Analytics Lab, and relevant SIT priorities. There was strong enthusiasm to progress to a second workshop and deepen this work.

The Workshop confirmed strong support across CEOS agencies for advancing accessible, actionable water quality information that meets real operational needs. Addressing catchment-to-coast challenges will require sustained commitment from CEOS, strengthened partnerships, improved interoperability, and closer integration of observation, modelling, and user communities.

The participants provided a number of relevant ‘commitments’ and collectively, committed to advancing a coordinated, user-driven, and interoperable approach to water quality monitoring, with a strong emphasis on:

- CEOS-ARD development for water quality products and the distinction around ‘decision-ready’ data
- Integrated catchment-to-coast science
- Operational relevance and user uptake
- Collaboration across agencies, disciplines, and communities

Building on this foundation, a second CEOS Water Quality Workshop is planned to:

- Broaden participation to include additional user communities and stakeholders
- Bring together inland and coastal scientists with hydrologists, modellers, and data specialists
- Advance integrated modelling and early warning capabilities
- Further identify EO data and interoperability needs across the catchment-to-coast continuum

- Maintain the interactive approach to deliver progress and opportunities for proposals/projects to help advance Catchment to Coast observational approach

This next phase will support CEOS' evolving approach to catchment-to-coast science and contribute to closing critical gaps in understanding and managing the water cycle.