



Terms of Reference

Virtual Constellation on Coastal Observations, Applications, Services & Tools (COAST)

The 2019 CEOS Plenary established a CEOS Ad Hoc Team on Coastal Observations, Applications, Services & Tools (CEOS-COAST). The 2020 CEOS Plenary subsequently approved COAST as an Ad Hoc Team (AHT) based on the sustained agency support and outcomes demonstrated. The 2023 CEOS Plenary considered the Initial Proposal for COAST to transition to a CEOS Virtual Constellation, pending approval of a Full Proposal, Terms of Reference, and an implementation plan at SIT-39 in April 2024.

Measurement and Data Collection Scope

The Committee on Earth Observation Satellites (CEOS) formed the COAST (Coastal Observations, Applications, Services and Tools) study team in 2019 to address challenges and risks in the coastal zone and bring new and improved scientific/technical capabilities and building capacity for a more robust end-to-end value chain (observations to data to products to information to actionable knowledge) in support of coastal stakeholders and global sustainable development.

CEOS-COAST identified the specific scope and priorities of the COAST effort moving forward, focusing on the transboundary and transdisciplinary nature of the coastal zone. Specifically, this includes sea impacts on land – including coastal hazards such as flooding and inundation, at continental as well as for small island countries and territories – as well as land impacts on the sea, including water quality issues such as coastal eutrophication and sediment loading, affecting the ability of the coastal ecosystem to deliver valuable goods and services. Coastal blue carbon, surface and subsurface habitat and biodiversity are included in the COAST scope of activities, likewise high latitude areas that are experiencing accelerated environmental changes.

This virtual constellation with a coastal focus helps bridge land and aquatic observations within CEOS, and given its cross-cutting nature, will continue to integrate across multiple CEOS entities and domains, both thematic and technical. COAST will leverage the CEOS Analysis Ready Data (ARD) framework already demonstrated for terrestrial applications, best practices arising from WGCapD, and to the extent practicable utilise the CEOS Systems Engineering Office Analytics Lab for product development.

The strategic approach and priorities of the COAST-VC will be to:

- Maintain a CEOS perspective and ensure a clear focus on the “upstream” end of the value-chain, i.e., observations to data to products, addressing issues such as fit-for-purpose/analysis ready data; new/improved, higher resolution, integrated products et al.
- Co-design and co-develop specific, tractable high priority pilot projects and related activities in geographical areas that resonate with stakeholders/users in GEO, UN et al., particularly technology transitions toward broader global implementation
- Identify, leverage and integrate appropriate CEOS capabilities and capacities across CEOS Agencies, VCs, and Working Groups (WGs)

- Identify and articulate exactly what the novel contribution is from CEOS relative to other existing and planned community activities, ensuring complementarity and avoiding redundancy
- Collaboratively work with stakeholders to ensure pilot products meet existing and emerging user needs, that their evolution is co-designed, and that a path forward for longer term implementation is identified
- Develop a viable strategy to identify and acquire the necessary resources (human, Internet Technology et al.) from CEOS members to successfully execute the Phase 2 implementation plan.

	3-year horizon	5-year horizon and beyond
Space Segment	e.g., PACE, SWOT, NISAR, S-1C/D, S-3C/D, S6B	e.g., GEO-XO, GLIMR, CIMR, Australian AquaWatch, S2-NG, S3-NG, S3-NGTopo, CRISTAL, CHIME, LSTSR, ROSE-L
Group Segment and Information Systems	NOAA, ISRO, Geoscience Australia, ESA and COAST members using the CEOS Analytics Laboratory for product development	COAST members leveraging CEOS ARD in the cloud and CEOS Analytics Laboratory
Products and Services	Deliver and improve Application Knowledge Hub. Product Development - Global: Shorelines, physical oceanography products. Product Development Pilot areas: Coastal Flooding, satellite derived bathymetry, Coastal Habitat.	Product Development: Coastal Eutrophication AI Anomaly, Blue Carbon products, Refined products for polar regions.

Reports to SIT from the COAST-VC will emphasise progress towards achievement of these outcomes and deliverables and the issues and obstacles for SIT Chair attention.

Space Segment Concerned

Agencies involved: CSIRO (AquaWatch Australia, a program combining in-situ and satellite data, with the objective to build a customized sensor for water quality) , ESA (CIMR, Sentinel 2 c/d), ISRO (NISAR, CNES (SWOT), NASA (PACE, GLIMR, SWOT and NISAR), NOAA (GEO-XO), USGS (Landsat 9). We will collaborate within the CEOS Analytics Lab for product development where possible, and we have historically worked successfully within other data cube environments (e.g., Digital Earth Africa).

Coastal zones are extraordinarily important from a societal and economic perspective. They are home to much of the global population, amongst the most productive ecosystems on Earth and crucial to the emerging Blue Economy as essential sites of commerce, transportation, food security, and recreation. Within both developed and developing nations, coastal zones continue

to grow and diversify. In this regard, there is a compelling need to better observe, understand, manage, and predict changes in these regions in support of sustainable development.

Our ability and more so capacity to address changes in these regions is still relatively limited, particularly in the developing world. Coastal zones are characterised by complex processes, with rapidly changing and evolving conditions that can be challenging to effectively observe in both time and space, particularly given their inherent transboundary and transdisciplinary nature. Within coastal zones there is dynamic coupling of terrestrial, aquatic and atmospheric domains; complex, episodic and often ephemeral physical and biological/biogeochemical processes; and finally, the overarching challenge of integrating environmental sciences with social sciences.

There are also significant risks and threats to human health and safety, as well as the abundant ecosystem resources from these regions. Coastal hazards such as flooding and inundation, as well as water quality and associated impacts (e.g., eutrophication, hypoxia, harmful algal blooms, sediment loadings and coral reef et al. habitat degradation) to ecosystem health and productivity, represent particularly great challenges for society to address.

Mission Statement and Objectives

***Mission Statement:** There is a broad spectrum of coastal needs, issues and challenges, with a diverse ecosystem of stakeholders to engage. The CEOS COAST Virtual Constellation focuses on the user-driven value chain, to facilitate targeted work and engagement on priority coastal observations and applications within CEOS, addressing the identification, extension/expansion, integration and transformation of multi-sensor observations into fit-for-purpose information supporting existing and emerging stakeholder requirements.*

The COAST-VC will encourage broader utilisation of Earth observations and other CEOS capabilities for societal benefits within coastal zones (e.g., High-latitude observations, Blue Carbon; SDGs), and demonstrate specific opportunities and mechanisms for CEOS to engage, particularly through the linkage of the Group on Earth Observations. There is significant opportunity for the COAST-VC to facilitate technology transfer from developed to developing nations and building capabilities and capacity, with an eye toward scaling up from individual demonstration activities at national and regional levels to full global implementation.

ACTIVITIES, OUTCOMES AND DELIVERABLES

The COAST-VC will report to the SIT Chair. Within the VC framework, specific activities, outcomes and deliverables of the COAST VC are to:

- Strategically utilise CEOS assets and bodies to engage with users and advance capabilities for COAST pilot project implementation, and also generally for future COAST planning and activities.
 - Identify and analyse opportunities for new and emerging satellite-based observations and derived capabilities to support coastal needs, challenges and opportunities at all latitudes (e.g., new methods, new data, new products)
 - Provide feedback to various VCs on the gaps in the satellite-based observations in addressing critical coastal applications.
- Enhance COAST pilots and supporting infrastructure
 - Engage in co-design of products, tools and services with GEO, UN entities and other relevant authoritative stakeholders that meet coastal needs and issues.

- working together on pilot project implementation
- building partnerships to transfer operational control and sustain COAST deliverables
 - Make the CEOS Analytics Lab more robust as a development forum accessible to COAST members for methodological development. Within CEOS, promote its tools and platforms for discovery and accessibility to high priority global/regional data sets
- Deliver and continue to augment an Application Knowledge Hub enabling easy open source user access to COAST products and other open source coastal data sets
- Serve as a Communication Forum sharing best practices and approaches across CEOS and the broader international community in support of COAST activities and priorities

IMPLEMENTATION AND COORDINATION ISSUES TO BE ADDRESSED BY SIT

COAST has been successfully coordinating over the last 4 years as a Study Team and then an Ad Hoc Team. It is anticipated this coordination will continue smoothly as a VC.

Schedule

COAST has been successfully coordinating over the last 4 years as a WG, and it is anticipated this coordination will continue smoothly as a VC. Product development within COAST should endure through the end of key international programs such as the UN Ocean Decade (2030) and the International Decade for Action, “Water for Sustainable Development” (2028) and Nippon Foundation-GEBCO Seabed 2030 Project. {Further detail on the overall schedule in addition to the requested 3- and 5-year horizon outcomes and deliverables.}

Leadership and Membership

The COAST-VC will have two or more Co-leads from CEOS Agencies representing different geographical regions and with complementary interests and areas of expertise. Each Co-lead will serve for an initial term of one year. The COAST VC reports to the CEOS SIT Chair, as do all other CEOS VCs.

Participation is open to all CEOS Agencies who are willing to support and contribute to activities that are in scope with the COAST VC mission and objectives. Agencies that are not already part of COAST and are interested in participating are encouraged to directly contact the Co-leads for integration into its activities.

Resources

The COAST-VC leverages people, missions, data, expertise and infrastructure from CEOS agencies, mostly through the COAST member agencies, VCs and WGs. CEOS Agency resources (such as: tools, knowledge bases, available algorithms, in situ and satellite data applicable to coastal data product development) will be sought or augmented. COAST uses, requesting on a best effort basis, the CEOS Analytics Laboratory (formerly known as the EAIL), and its available data sets (within pilot region boxes) for a development space. Funding of these activities comes currently from diverse avenues in the USA, India, Australia, and Europe, including limited deliverable-based resources within NOAA, ISRO, Geoscience Australia, ESA, and others. This will continue, particularly for product development expertise and co-design with stakeholders, as well as for training and outreach. The COAST-VC will make best efforts to engage new and existing members of the VC in its activities.