



Concept Brief: Ocean Carbon Observatory

The world ocean holds fifty times more carbon than the atmosphere and absorbs more carbon than all the rainforests on Earth. To date, 40% of fossil fuel emissions have been absorbed by the ocean through processes collectively known as the “ocean carbon pump”. This vital carbon sink is being impacted significantly by unprecedented human-induced climate change.

And yet, the ocean’s vital carbon-absorbing function remains critically under-observed. While nations are labouring to address the many issues arising from climate change, the climate assessments informing their policies are based on fundamentally incomplete and insufficient data.

The ocean is missing - and this gap represents the most significant miscalculation of climate policy by nations, undermining the credibility of national and international climate targets, including global net-zero aspirations.

To be credible, climate target calculations require carbon information, more rapidly and at higher resolution than has hitherto been attempted. In the current global context, we rely almost entirely on computer models to reach conclusions regarding the ocean. Uncertainties in the estimate of the current ocean carbon sink remain at 25%, with these estimates arriving sometimes years after observations. As climate risks to humans and infrastructure become clearer, and climate investments accelerate into the trillions of dollars, *we cannot afford to accept this high level of uncertainty around the ocean carbon sink.*

Such significant uncertainties will cripple policy efforts to reach defensible climate targets. Massive investment in adaptation schemes to protect communities from climate change and support human resilience may miss the mark if climate information is not available quickly and accurately.

This critical gap urgently needs to be addressed at the international level. **Global action at the scale of an “international ocean space station”** – an **Ocean Carbon Observatory** - would link, process, and deliver ocean information worldwide, through a globally integrated system, supported by an international consortium of acting nations. This, integrated directly with land and atmosphere information, would deliver a complete ongoing picture of the climate equation at time scales relevant to decision-making.

This would ensure that international leaders, policy makers, institutional financial investors and citizens can act with the correct numbers, having confidence that the climate equation driving policy is accurate.

Technologies and expertise currently exist to resolve the ocean carbon sink at high resolution in near-real-time. At the scale and ambition of an “ocean space station”, an **Ocean Carbon Observatory** would collect, integrate and deliver transformative climate information in a timely fashion. Such strong action would attract support from nations committed to increase their climate security and lower climate risk - by fully resolving the actual source of that risk, the CO₂ budget, in near-real-time, and simultaneously revising global estimates of the regional impacts of climate change.

To launch an Ocean Carbon Observatory at a global scale, initiation through a **global exemplar** is a timely and effective opportunity for Canadian leadership. Advancing ocean carbon observation efforts in the **North Atlantic Ocean** would bring strong observing nations together to resolve changes in the planet’s most intense carbon sink.

The North Atlantic is an unusually strong “sink”, accounting for approximately 30% of global ocean CO₂ uptake. This vital carbon sink is particularly sensitive due to its location downstream of the Arctic Ocean and the Greenland ice cap, both of which are experiencing extreme warming resulting from climate change.

The **North Atlantic Carbon Observatory** would link Canadian environmental ambition to tangible outcomes, demonstrating global bona fides, building a climate implementation track record and highlighting economic growth potential. Leading the first module in an international “ocean space station” would bring a first-mover advantage in digital transformation of ocean carbon / climate data, development and application of Artificial Intelligence and machine learning solutions in the ocean space.

A North Atlantic Carbon Observatory would allow Canada to achieve a global step-change in confidence around carbon targets, through an international consortium that champions:

1. **Near-real-time information delivery:** Delivery, globally and quickly, of novel and accessible dashboards, indicating clusters of key variables monitoring ocean carbon changes, linking and correlating with important changes in atmospheric conditions and with key land-based changes. This global integration will lead to **reduced uncertainty in all three major global carbon sinks** (land, ocean, atmosphere).
2. **Data gaps:** Assessments of the data gaps and data quality that need to be filled for higher resolution observation, and scripting of new sensors and technologies into these gaps for maximum benefit and reduction in uncertainty in global climate model parameters.
3. **Integration:** Monitoring regimes must measure carbon sinks frequently and automatically. Technological integration of sensors, observation platforms and data management and delivery systems will bring higher level understanding of carbon sinks than was previously possible, and the global reach of the “ocean space station” will also produce an observation and data system which allows information access across nations and programs, providing integration currently critically lacking in the global observation community.
4. **In situ enhancements:** A digitised ocean data management platform will provide scientific and economic opportunities supporting innovation and learning. Technological innovation globally is currently pushing at the boundaries of conventional ocean observation, increasing the efficiency and accuracy of observations, and reducing costs. The Observatory would massively accelerate existing opportunities for innovation, particularly in the climate integration / acceleration of data delivery. Canadian technology companies are at the forefront of such work and are poised for leadership in this area.

As industries seek to de-risk their businesses and climate-proof their investments, an Ocean Carbon Observatory would help measure the value of their climate investments through data verification. As the first exemplar, a Canadian-led North Atlantic Carbon Observatory would enhance the value proposition for innovative mitigation technologies by helping them calibrate the efficacy of test models.

Globally, discussions on the maintenance of blue carbon sinks, on carbon dioxide reduction and mitigation efforts in the ocean, and on carbon credit schemes, all require a credible ocean science baseline. Indeed, the creation of an international benchmark can be an outcome of a global Ocean Carbon Observatory, to standardise practice and support businesses and nations in their critical carbon accounting.

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