

The Deep Ocean as Climate Mitigator

- The deep sea is an integral part of the earth system and plays a significant role in minimizing the impact of human-released CO₂ on the earth's climate.
- The ocean has absorbed 93% of the heat generated by excess CO₂ in the atmosphere, much of this occurs below 200m.
- The ocean is one of the largest sinks of excess carbon dioxide and has already absorbed more than a quarter of anthropogenic atmospheric CO₂. Thermohaline circulation carries this into deep waters.

A Deadly Trio of Impact

Excess CO₂ leads to ocean warming. – altering species metabolic rates, and distributions.

A warmer ocean holds less oxygen and is more stratified, reducing oxygenation of waters from 200-1000 m. These and other factors lead to global ocean deoxygenation. Oxygen shortages cause migration, reduce biodiversity, and alter ecosystem services.

Excess CO₂ reduces pH and carbonate saturation leading to ocean acidification.

Ocean acidification, warming and deoxygenation resulting from human CO₂ release has already been observed in deep waters and these impacts are projected to intensify in coming decades.



Why Should We Care?

The deep sea, accounts for 99% of the habitable volume of the planet. It is comprised of many different ecosystems that provide key provisioning, supporting, regulating, and cultural services to the global population, beyond its role in the global carbon cycle and heat regulation. The regeneration of nutrients in the deep sea provides shallow-water ecosystems the ability to extract CO₂ from the atmosphere and sustain productive, harvestable fish stocks. It also provide habitats and energy hotspots for a unique diversity of deep-sea biota, sequestering carbon over long time periods.

The cumulative effect of climate stressors (expanding deoxygenation, shoaling of aragonite saturation horizons, acidification and warming) will lower resilience and increase vulnerability to growing human impacts from deep-sea fishing, energy extraction, mining, pollution and waste disposal.

What Should We Do?

*Incorporate climate change into holistic environmental planning and ecosystem assessments for the deep ocean.

*Develop a global 'deep' observing network to improve climate prediction and track changes in ecosystems and regions at the nexus of climate change and deep-sea exploitation.



[www.dosi-project.org](http://dosi-project.org)

<http://dosi-project.org/working-groups/climate-change>



It is crucial to share knowledge about the deep-ocean roles in climate mitigation and its impacts on ecosystems in order to inform international and national policy and guide the sustainable use of ecosystem services from the deep sea.

DOSI working group

Climate change cumulative impacts on deep-sea ecosystem

Objectives

Share research & promote observations to establish vulnerability patterns of deep-sea ecosystems to climate change in order to:

- Assess deep-sea ecosystem services under threats
- Fill the gaps between local observations and global-ocean models
- Discriminate long-term trends from short-term effects on ecosystems
- Address multi-stressor impacts, promoting interdisciplinary exchange and dedicated ecological studies
- Inform policy makers and other stakeholders of deep climate change-highlighting deoxygenation and acidification issues



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Images courtesy of : - NOAA –OER 2016 Deepwater Exploration of the Marianas, NOAA-OER-BOEM-USGS , Deepwater Canyons 2013 - Pathways to the Abyss, – N. Le Bris Chair Biodiversity, extreme environment and global change UPMC-Fondation Total, - NSF C. Smith & K. Heirman.



Recent outcomes

A STATEMENT BY THE DEEP-SEA RESEARCH COMMUNITY FOR CONSIDERATION BY UNFCCC signed by 270 scientists. Sept. 2015

Ocean and Climate Platform membership (Sept. 2015)

Contributions to COP21 events (Global Ocean Forum and Tara Ocean), Paris, Nov. 2015

A bibliographic database compiling scientific publications on deep-sea climate change (Dec. 2015)

« The Deep Ocean Under Climate Change » by Levin & Le Bris; Science 350: 766-768. (2015)

A CASE FOR THE DEEP OCEAN. Note submitted to the IPCC scoping group for the Oceans and Cryosphere; June 2016

CLIMATE CHANGE in OCEANS BEYOND NATIONAL JURISDICTIONS Policy brief submitted to the second meeting of the UN BBNJ PrepCom, August-September 2016

Ocean and Climate Platform Factsheet 'A case for the deep ocean' Oct. 2016