United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

The Ocean: Climate Change Impacts and Opportunities - with Special Reference to the Caribbean

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IOCARIBE XVI
Sixteenth Session of the IOC (of UNESCO) Sub-Commission for the Caribbean and Adjacent Regions

IPCC 2013 WG1 Fifth Assessment Report

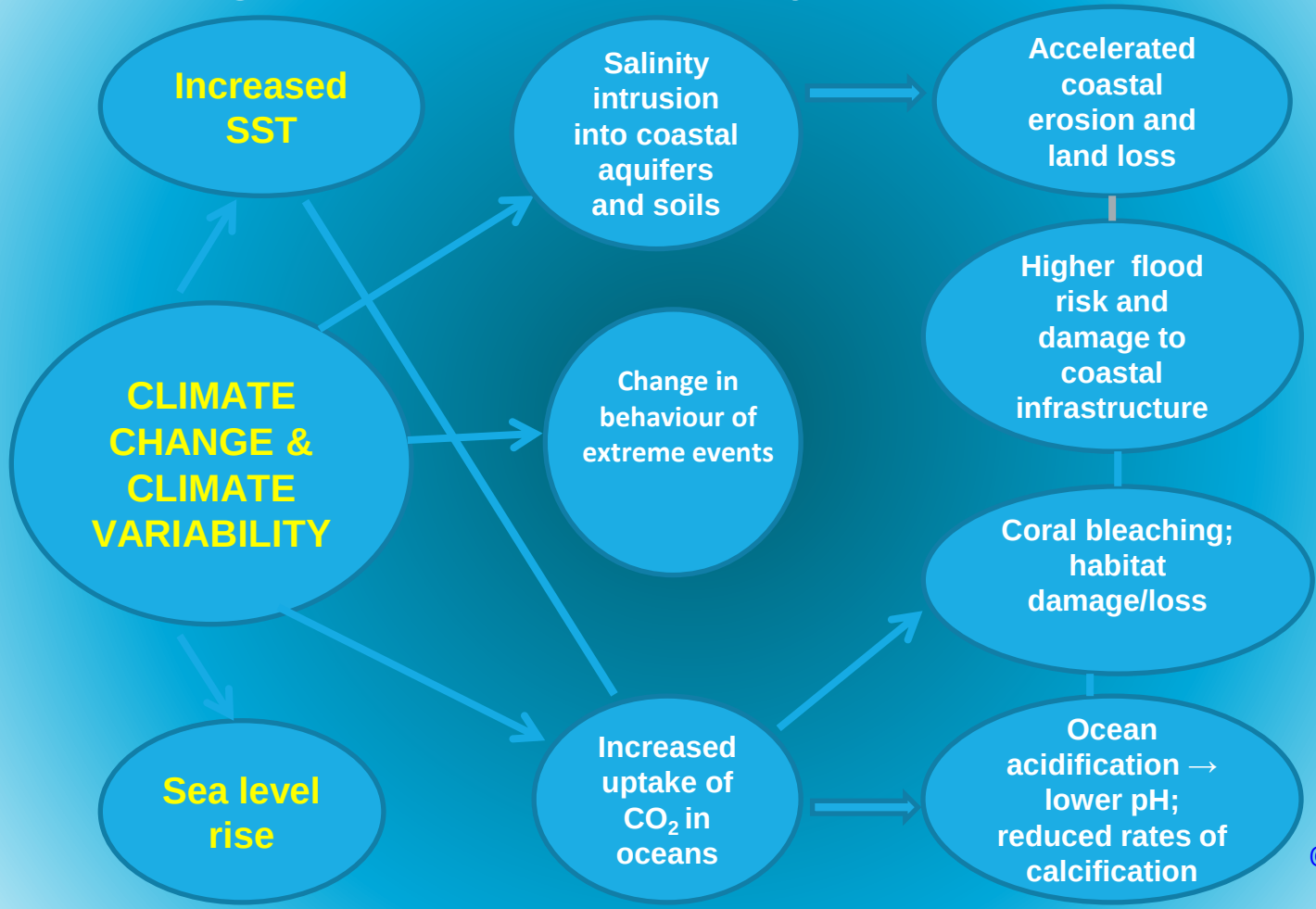
- "...Warming of the ocean accounts for about 93% of the increase in the Earth's energy inventory between 1971 and 2010 (*high confidence*), with warming of the upper (0 to 700 m) ocean accounting for about 64% of the total" (Chapter 3).

- ❑ High agreement....that oxygen concentrations have decreased in the open ocean thermocline since the 1960s.

- ❑ Warming causes a reduction in solubility of CO2 → decrease in supply of oxygen to thermocline from near surface waters

- ❑ *Likely* that the *tropical oxygen minimum zones* have expanded in recent decades.

Climate Change – Observed and Projected Risks to Caribbean



Coastal & Marine Ecosystems : Enhancing Resilience

- < 0.5 % coastal & ocean space covered by vegetated habitat → *mangroves, seagrasses, salt-marshes, macroalgae*
- Provide vital global services → habitat for fish & variety of organisms, wave energy attenuation, sediment entrapment, turbidity reduction, etc.
- These habitats account for *50% of all carbon sequestered in marine sediments*



So Where are the Opportunities? What Can We Do?

- There are numerous *opportunities for enhancing resilience* and *improving human well-being* through:

  - *Science-based* ocean and coastal management practices, including *nature-based* solutions

  - *Sustainable exploitation* of the coastal and ocean space and associated resources.

Coral Restoration Initiatives in Caribbean


Coral restoration at Marino Ballena, Costa Rica


Replanted coral fragments, Utila, Honduras

https://diveintolife.blog/coral-reef-restoration-utila/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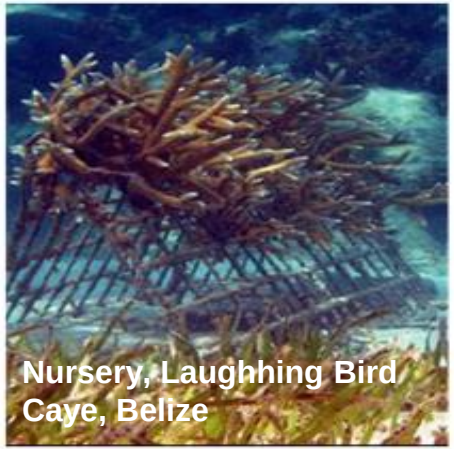
Nursery tree with coral fragments, Saba, NA


Nursery, Laughhing Bird Caye, Belize


Coral restoration, Barbados

Gisbarbados.gov.bb


Replanting staghorn corals, White River Fish Sanctuary, Ocho Riios Jamaica

scx2.b-cdn.net/gfx/news/hires/2019/24-coralgardene.jpg

Seagrass Rehabilitation – A Strategy for Habitat Restoration

- Vital element of marine ecosystem of IOCARIBE Member States
- High productivity → habitat, nursery, food for other organisms
- Trap resuspended sediment from the water column → reduce turbidity and help to stabilize sandy bottom.

Mangrove Restoration in Latin America and the Caribbean

Capacity of World's Oceans for Energy Generation

- Increasing concern about the risks posed by global climate change has led to renewed interest in research and development of clean energy sources.

- Ocean energy is available from many sources → wind, waves, currents, geothermal, solar, methane hydrates, marine biomass etc.

➢ Presently, the greatest commercial potential appears to be associated with two broad sources:

i. *Mechanical energy* from tides and waves → *intermittent* sources ;
ii. *Thermal energy* → from the sun's heat → *constant* sources

New and Emerging Energy Technologies: *Ocean Thermal Energy Conversion* (OTEC)

OTEC Facility, Hawaii – operational August 2015

Natural Energy Laboratory of Hawaii Authority (NELHA) & Makai Ocean Engineering, Hawaii

Proposed Site of OC-OTEC Plant, Cozumel island, Mexico (Source: Google Earth)

http://dx.doi.org/10.5772/intechopen.86591

Ocean Thermal Energy Conversion (OTEC)

- OTEC exploits temperature gradient between warm surface and cold water at depth → tropical oceans → location of IOCARIBE Member States.

❖ OTEC requires consistent temperature differential of approx. 20^0 C between top layers of the ocean and colder ocean depths → produces stable electricity throughout year; zero GHG emissions (CO_2, So_x, No_x).

❖ OTEC systems can produce fresh water → reverse osmosis → significant advantage in many SIDS where fresh water is limited.

❖ Cold sea water from the process has many other potential uses → e.g. air-conditioning; irrigation; fish, shellfish, kelp and other sea plants thrive in the nutrient-rich, cold H_2O from depth.

Offshore Wind and Solar PV Potential

Summary

- The severe threats to the ocean posed by global climate change present *challenges* as well as *opportunities*:
- Sustainable management of ocean resources → *judicious use*, *conservation* and *restoration* are compatible principles that are both urgent and necessary.
- Management built on these 3 principles will support achievement of (i) UN SDGs, in particular SDG 14, Life Below Water (ii) Decade of Ocean Science 2021-2030 (iii) Paris Agreement (iv) Recommendations of UNESCO-IOC's '*Global Ocean Science Report 2020 - Charting Capacity for Ocean Sustainability*'.
- By implementing these calls to action, we have a reasonable chance of (i) reducing some of the adverse impacts of climate change (ii) sustaining ocean health and productivity (iii) Providing livelihood support for all mankind.....for generations in the future.

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MUCHAS GRACIAS

THANK YOU

MERCI BEAUCOUP

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