Oceans and the Law of the Sea

Report of the Secretary-General

Contribution from the Intergovernmental Oceanographic Commission of UNESCO (IOC)

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Summary

The ocean is key to regulate climate and to mitigate climate change. The ocean absorbed more than 90% of excess heat, 100% of the additional water, and around 30% of the carbon released due to fossil fuel burning since the industrialization. However, its climate regulating role is endangered. A warmer atmosphere and increasing concentration of greenhouse gases resulting in ocean warming, ocean acidification, deoxygenation, pollution from land, overfishing, unsustainable coastal development and increasing population, are all degrading the health and functionality of Earth's most treasured and useful resource. For example, pollution is likely to aggravate ocean acidification, in particular in coastal areas. Climate change has already led to a 0.7oC increase in global mean sea surface temperature over the last century, with effects on many temperature-dependent biological processes. Among the most visible and destructive is coral bleaching, which is projected to become more frequent and more severe with climate change, threatening the many coral reef ecosystem services on which hundreds of millions coastal dwellers depend. The Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) is the recognized United Nations focal point and mechanism for global cooperation in the study and observations of the ocean. Through its leadership in coordination and management of the Global Ocean Observing System (GOOS), activities of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), and co-sponsorship of the Global Climate Observing System (GCOS), which supports and reports to the UNFCCC on the state of observations for climate, IOC provides essential information on the state of the ocean as a part of the climate system. IOC further supports the World Climate Research Programme (WCRP), which conducts a wide range of related scientific research activities, generates new science, reviews the state of knowledge on climate processes and impacts. In addition, ocean data and information facilitated by IOC through International Oceanographic Data and Information Exchange programme (IODE) are crucial in the studies on climate change, e.g. the Ocean Biogeographic Information System (OBIS), world's largest open-access ocean biodiversity and biogeographic database. IOC coordinates different programmes investigating the impacts of climate change and ocean acidification, e.g., via the Blue Carbon Initiative, Global Ocean Acidification Observing Network (GOA-ON), Global Ocean Oxygen Network (GO2NE), IOC Harmful Algal Blooms, etc. IOC's activities associated with marine technology transfer and capacity development, as well as with education and training, such as Ocean Teacher Global Academy, help Member States to fulfil their commitments to UNFCCC and the Paris Agreement. IOC proactively engages with the policy, research and civil society communities for more effective integration of ocean perspectives into climate change mitigation and adaptation mechanisms, while also promoting the importance of a robust scientific knowledge base to support policy development.

Key interactions between oceans and climate change

Covering 71% of the globe, the ocean provides essential services for maintaining life on Earth and is as important as forests in the supply of world oxygen. As a natural regulator of the Earth's climate and cornerstone of the global climate system, its importance can no longer be underestimated and ought to be recognized. Ocean and human health are linked globally as the ocean circulation – also known as the Ocean Conveyor Belt – connects all ocean basins (the Atlantic, Pacific, Indian, Arctic and Southern). The ocean absorbs both heat and carbon from the atmosphere, therefore alleviating the impacts of climate change in the environment. The ocean absorbed more than 90% of excess heat, 100% of the additional water, and around 30% of the carbon released due to fossil fuel burning since the industrialization.

However, its climate regulating role is endangered. A warmer atmosphere and increasing concentration of greenhouse gases resulting in ocean warming, ocean acidification, deoxygenation, pollution from land, overfishing, unsustainable coastal development and increasing population, are all degrading the health and functionality of Earth's most treasured and useful resource. From greater risk to coastal areas due to rising sea levels, strong winds, storms and cyclones, to food insecurity among island populations linked to declining marine resources, an unhealthy ocean in a changing climate can yield great environmental, economic and social imbalances.

Climate change mitigation and adaptation measures will in fact play a crucial role in slowing ocean acidification and minimizing its impacts. Therefore, the two issues of ocean acidification and climate change need to be considered in an integrated manner.

Effects of climate change on the oceans

Drawing on the work of the Intergovernmental Panel on Climate Change, the First Global Integrated Marine Assessment - the outcome of the first cycle of the United Nations Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects - highlighted that climate change and related changes in the atmosphere have serious implications for the ocean, including rising sea levels, higher levels of acidity in the ocean, reduced mixing of ocean water and increased deoxygenation. They also noted that whereas the basic mechanisms of change are understood, the ability to predict the detailed changes is limited. In many cases, the direction of change is known, but uncertainty remains about the timing and rate of change, as well as its magnitude and spatial pattern. The assessment also highlights relevant knowledge and capacity gaps. It is noteworthy in this regard that, in April 2016, the IPCC decided to prepare a special report on climate change and oceans and the cryosphere.

Previous studies showed, that while the ocean has absorbed CO2 and alleviated the impacts of climate change in the environment, this comes at a steep ecological cost for marine life. Dissolved CO2 in seawater lowers the oceans' pH level, causing acidification, and changing the biogeochemical carbonate balance. Concerns about ocean acidification, first expressed in the early 1980s, have now been confirmed, and the potential extent of the impacts on marine ecosystems is only now being investigated. A global issue with local effects, consequences of ocean acidification include reduced coral growth and biological diversity, decreased shellfish settlement, and variation in fish behavior. All these changes cause ecosystems and marine organisms to change, potentially affecting food security and limiting the capacity of the ocean to further absorb CO2 from human emissions.

Continued global warming is predicted to worsen deoxygenation during the 21st Century even under future climate scenarios dependent on greatly reduced greenhouse gas emissions. Global warming is predicted to reduce the mixing of atmospheric oxygen into mid-depth and deep parts of the ocean by increasing stratification, decreasing vertical mixing, and altering ocean circulation patterns. Warmer water holds less oxygen, so oxygen concentrations are declining even near the ocean's surface. Increasing temperatures also increase metabolic requirements of organisms. As a result, the need for oxygen is rising at the same time that a multitude of processes that contribute to ocean deoxygenation reduces the supply.

The impacts of climate change on the ocean – ocean warming, related sea level rise, ocean acidification, and deoxygenation – do not affect marine ecosystems in isolation, multiple other environmental stressors as extreme events, as well as other anthropogenic perturbations such as overfishing and pollution threatening the ocean at the same time. For example, pollution is likely to aggravate ocean acidification, in particular in coastal areas. Climate change has already led to a 0.7oC increase in global mean sea surface temperature over the last century, with effects on many temperature-dependent biological processes.

Global warming will affect more than just the open ocean. In some coastal upwelling regions, the intensity of upwelling is expected to increase, carrying low oxygen, low pH waters to the coastal zones. Upwelling winds have become stronger over the past 60 years in several major upwelling systems, and upwelling intensity and duration are predicted to continue to increase – at least at mid and high latitiudes in most systems

Among the most visible and destructive impact of ocean warming is coral bleaching, which is projected to become more frequent and more severe with climate change, threatening the many coral reef ecosystem services on which hundreds of millions coastal dwellers depend. Further increasing ocean temperature may cause species to move toward colder waters and impact species diversity, by creating an environment favourable for so-called 'alien species'.

The combined effects of climate change on the ocean and other ocean stressors are challenging Forecasting potential responses to abiotic changes is complicated by regional and seasonal variability and require increased global scientific collaboration and capacity development.

Actions and activities that have been undertaken by IOC to address the effects of climate change on the oceans and to foster climate-resilient sustainable development of oceans and seas

In a time of increasing pressures on the marine environment, supporting and facilitating continuing ocean observation and encouraging new ocean science are central to understanding past, current and future alterations in ocean biology and to monitoring future responses to climate change.

The UNESCO's Intergovernmental Oceanographic Commission (IOC) promotes international cooperation and coordinates programmes in marine research, services, observation systems, hazard mitigation, and capacity development in order to understand the impacts of climate change and other stressors and effectively manage the resources of the ocean and coastal areas. By applying this knowledge, IOC aims to improve the governance, management, institutional capacity, and decision-making processes of its Member States with respect to marine resources and climate variability and to foster sustainable development of the marine environment, in particular in developing countries. In this context, IOC proactively engages with the policy, research and civil society communities for more effective integration of ocean perspectives into climate change mitigation and adaptation mechanisms, while also promoting the importance of a robust scientific knowledge base to support policy development.

Several IOC projects and programmes are actively trying to close knowledge gaps and to improve the preparedness of society to adapt to and to mitigate climate change, including observation and science, data management, coastal disasters Warning Systems, and capacity development. IOC's portfolio comprises the following activities: e.g. the Global Ocean Observing System (GOOS); the World Climate Research Programme (WCRP); the Global Sea Level Observing System (GLOSS), the Ocean Biogeographic Information System (OBIS); the international Blue Carbon Initative, the Global Ocean Acidification Observing Network (GOA-ON); the Global Ocean Oxygen Network (GO_2NE); International Group for Marine Ecological Time Series (IGMETS); IOC Working Group to Investigate Climate Change and Global Trends of Phytoplankton in the Oceans (TrendsPO); IOC's Harmful Algae Bloom Progamme.

As said observation and monitoring the changing ocean environment are fundamental to understand and project the ocean ecosystems functions and processes in the past and in the future. It has to be highlighted that in particular GOOS, coordinated and managed by IOC, provides essential information on the state of the ocean as a part of the climate system and further contributes to the Global Climate Observing System (GCOS), which supports and reports to the UN Framework Convention on Climate Change (UNFCCC) on the state of observations for climate. IOC also supports the World Climate Research Programme (WCRP), which conducts a wide range of related scientific research activities, generates new science, reviews the state of knowledge on climate processes and impacts. These observation and projections are strengthened via strong collaborations with the scientific expert groups and networks established with the help of IOC.

In addition, ocean data and information facilitated by IOC through International Oceanographic Data and Information Exchange programme (IODE) are crucial in the studies on climate change. The Ocean Biogeographic Information System (OBIS) of IODE for example provides the world's largest global online open-access database (integration of >1,900 databases) and has become a reference point for tracking the impact of climate change on marine biodiversity.

IOC further informs the Member States of the possibilities to enhance the adaptive capacities towards climate and ocean change. Entry points for IOC are the Intergrated Coastal Area Management, via Coastal Adaptation handbooks, ocean governance (LME) and marine assessments such as the Transboundary Water Assessment Programme (TWAP).

Via the previously mentioned activities IOC, will continue to play a central role in providing authoritative scientific and technical information to support evidence-based policy and decision-making, enable climate services and to inform the work of the IPCC and, in particular, the future IPCC Special Report on climate change, oceans and cryosphere.

In this regard, IOC possesses recognized expertise and strong coordination role for monitoring and assessing the progress in implementing relevant SDG targets of the 2030 Agenda. As such, the Commission has been identified as “custodian agency” for a number of SDG 14 targets focused on marine pollution, ocean acidification and marine science capacity.

Another climate change, ocean change related legacy, the Sendai Framework for Disaster Risk Reduction 2015-2030 highlights international, regional, sub-regional and transboundary cooperation and calls for a broad and more people-centred preventive approach to disaster risk. It specifies seven global targets, among which is the need to substantially increase assistance to developing countries to complement their national action and ensure access to multi-hazard warning systems and disaster risk information and assessment by 2030. At present, the IOC coordinates a global tsunami warning system supported by four regional tsunami warning systems in all tsunami-prone areas of the ocean. The IOC’s hazard warning system develops in complete accordance with the Sendai Framework and is highly relevant in the context of SIDS and low-lying coastal countries.

IOC’s engagement in support of SIDS will be guided by the IOC SIDS Action Plan and Strategy adopted by IOC Member States in June 2016 in response to the SAMOA pathway, with particular emphasis on the building of SIDS actions related to tsunami early warning systems, the development of marine scientific and technological capacity of SIDS, and enhanced cooperation to assess climate change and ocean acidification impacts.

IOC has been and will continue to be instrumental in highlighting the role of the ocean for climate regulation.. It will keep working with Member States, UN agencies, NGOs, to mobilize the civil society, scientists and governments in order to ensure the visibility of the ocean at the local, regional and global levels, including the United Nation Framework Convention for Climate Change.

IOC's activities associated with marine technology transfer and capacity development, as well as with education and training, such as Ocean Teacher Global Academy, help Member States to fulfil their commitments to UNFCCC and the Paris Agreement. The IOC is committed to assist and develop the capacities of its Member States by brokering innovation and learning, facilitating the transfer of marine technology and providing science-informed policy advice for the implementation of integrated ocean governance and management.