CO_2 in the Atmosphere-Ocean System: Impacts and feedbacks

Open seminar at the 44th session of GESAMP

Wednesday, 6 September 2017
14:00– 17:00, Geneva, Switzerland

Globally averaged atmospheric concentrations of the major long-lived greenhouse gases (carbon dioxide, methane and nitrous oxide) have risen considerably since pre-industrial times due to emissions related to human activity. These gases collectively account for ~88% of the radiative forcing by long-lived GHGs. Their concentrations, also regulated by natural sources and sinks, form part of natural biogeochemical cycles. CO_2 is the single most important GHG, as it is responsible for 65% of the radiative forcing by LLGHGs and for 81% of the increase in radiative forcing over the past decade. Globally averaged atmospheric CO_2 has increased by ~40% since pre-industrial times (before 1750). The largest CO_2 sinks are the land biosphere and the oceans, with the latter absorbing ~30% of the emitted anthropogenic CO_2.

A direct consequence of the excess CO_2 absorbed by the oceans is ocean acidification. Since the beginning of the industrial revolution, oceans have become ~27% more acidic and ocean acidity could increase by 150% by 2050. Ocean acidification affects calcifying organisms, such as corals, and is a serious global threat to the ocean food web, ecosystems and resources. Other impacts on the oceans related to increases in atmospheric GHGs include warming and deoxygenation, as 90% of the energy accumulated in the climate system is stored in the oceans. Although the surface ocean is changing the fastest, the uptake of CO_2 and heat from the atmosphere is also rapidly changing the pH, temperature and oxygenation of the deep oceans. In addition to acting as a sink, the ocean contributes to many aspects of the Earth's climate system, including its atmospheric composition, surface temperature and the hydrological cycle. There is a potential that the ocean sink might become saturated and respond by increasing the fraction of naturally emitted CO_2 and other GHGs thus accelerating their atmospheric growth rate. Understanding and quantifying the magnitude and impacts of this feedback are of urgent interest.

This session is intended to provide an overview of existing scientific knowledge on GHGs with emphasis on CO_2, impacts on the ocean ecosystem, and ocean feedbacks that control GHG fluxes; and to discuss how this ties in with GESAMP's existing and/or future work.

Moderator: Professor Robert Duce (Member of GESAMP)

Speakers:

Dr Tatiana Ilyina Max Planck Institute for Meteorology; World Climate Research Programme's Grand Challenge on Carbon Feedbacks in the Climate System	**Ocean carbon cycle feedbacks and global change**
Dr Carol Turley Plymouth Marine Laboratory	**Ocean acidification and other CO_2 related stressors**
Dr Frances Hopkins Plymouth Marine Laboratory; GESAMP WG 38	**Changing ocean acidity as a modulator of atmospheric biogeochemistry and climate**
Discussion	

Sources:

WMO Greenhouse Gas Bulletin No. 12, October 2016.

IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

The Ocean Conference, June 2017. Concept Paper on Partnership dialogue 3: Minimizing and addressing ocean acidification

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Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

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