Ocean acidification -- another undesired side effect of fossil fuel-burning

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Up to now, the oceans have buffered climate change considerably by absorbing almost one third of the worldwide emitted carbon dioxide. The oceans represent a significant carbon sink, but the uptake of excess CO2 stemming from man's burning of fossil fuels comes at a high cost: ocean acidification.

Research on ocean acidification is a newly emerging field and was one of the major topics at this year's European Geosciences Union (EGU) General Assembly held in Vienna in April. The European Science Foundation EUROCORES (European Collaborative Research) programme EuroCLIMATE, which addresses in particular global carbon cycle dynamics, organized and co-sponsored several sessions on ocean acidification.

The chemistry is very straight-forward: ocean acidification is linearly related to the amount of CO2 we produce. CO2 dissolves in the ocean, reacts with seawater and decreases the pH. Since the industrial revolution, the oceans have become 30 percent more acidic (from 8.2 pH to 8.1 pH). "Under a "business as usual scenario, predictions for the end of the century are that we will lower the surface ocean pH by 0.4 pH units, which means that the surface oceans will become 150 percent more acidic – and this is a 'hell of a lot' ", said Jelle Bijma, chair of the EuroCLIMATE programme Scientific Committee and a biogeochemist at the Alfred-Wegener-Institute Bremerhaven.

"Ocean acidification is more rapid than ever in the history of the earth

and if you look at the pCO2 (partial pressure of carbon dioxide) levels we have reached now, you have to go back 35 million years in time to find the equivalents" continued Bijma. A maximum allowed change in pH, where the system is still controllable, needs to be found. This is a major challenge considering the multifaceted unknowns that still are to be clarified. This so-called "tipping point" is currently estimated to allow a drop of about 0.2 pH units, a value that could be reached in as near as 30 years. More research and further modeling needs to be undertaken to verify the predictions.

The expected biological impact of ocean acidification remains still uncertain. Most calcifying organisms such as corals, mussels, algae and plankton investigated so far, respond negatively to the more acidic ocean waters. Because of the increased acidity, less carbonate ions are available, which means the calcification rates of the organisms are decreasing and thus their shells and skeletons thinning. However, a recent study suggested that a specific form of single-celled algae called coccolithophores actually gets stimulated by elevated pCO2 levels in the oceans, creating even bigger uncertainties when it comes to the biological response.

"There are thousands of calcifying organisms on earth and we have investigated only six to ten of them, we need to have a much better understanding of the physiological mechanisms" demanded Jean-Pierre Gattuso, a speaker from Laboratoire d'Océanographie Villefranche invited by EuroCLIMATE. In addition, higher marine life forms are likely to be affected by the rapidly acidifying oceans and entire food webs might be changing.

So far, hardly any economic impact assessments of ocean acidification exist, but with the fragile marine ecosystems under threat, it can be assumed that fisheries and many coastal economies will be severely affected. Many of these societies depend on the sea as their main source

of food and the loss of species is highly detrimental to them; coral reefs serve as highly valuable tourist destinations and as natural protections against natural hazards such as tsunamis. Together with climate change, ocean acidification poses a major challenge to the oceans as a human habitat.

“Ocean acidification is happening today and it’s happening on top of global warming, so we are in double trouble” stated Bijma. Only a serious cut of CO2 emission can reduce ocean acidification. Therefore, knowledge on ocean acidification is being disseminated and awareness among policymakers and the general public raised. “We need to make sure that the message gets delivered to the right people at the right time” urged Carol Turley, lead author of the Nobel prize-winning IPCC report and scientist at the Plymouth Marine Laboratory.

According to her, a concise integrated opinion of leading scientists is necessary, and it would be useful for policy makers to devote one integrated chapter on the impacts of climate change including ocean acidification on the marine environment in a future IPCC report.

Source: European Science Foundation

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