Peering through the global carbon cycle

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The oceans are one of the sink absorbing carbon dioxide derived from human activity. Yet fully quantifying the ocean's carbon uptake under a changing climate remains challenging.

Currently, the ocean takes up about 25% of the carbon dioxide emitted by human activities. But this uptake rate is governed by a number of factors, including global warming, which are not yet entirely understood. This is a topic that fascinates Christoph Heinze, who is professor in chemical oceanography at the Bjerknes Centre for Climate Research at the University of Bergen, Norway. As the coordinator of EU-funded project CARBOCHANGE, initiated in 2011, he tells youris.com about his experience of carbon cycle research, which aim are understanding the capabilities that oceans have in absorbing CO2.

What is the objective of the project?

Within the limits of our four year project our objective is to make the best possible quantification of the ocean carbon uptake under a changing climate. The problem is that the factors which determine CO2 uptake from the atmosphere are altered with the changes in the climate itself. If the temperature for example is increasing this has an effect on the solubility and dissociation of CO2 in the ocean. The increased CO2 in the atmosphere and hence in the surface ocean as well as changes in seawater composition and biological carbon cycling are also affecting air-sea carbon fluxes.

Why do we need to understand this better?

Previous studies have shown, that local uptake of CO2 by the ocean can fluctuate a lot. One special concern is in the high-latitude regions. Changes in deep water production rates and oceanic mixing as anticipated for a warmer world will slow down the vertical mixing of water saturated with CO2. This will decrease the rate of marine CO2 uptake and increase atmospheric CO2. Eventually, this will participate to increasing the rate of global warming.

What kind of information is still missing to help you understand the role of the oceans as carbon sinks?

One of the challenges is that we do not know the amount of CO2 absorbed by the oceans before the industrial revolution. This means that we do not have a sufficiently accurate knowledge on how much human activity has contributed to the dissolved carbon present in the oceans to date. We also lack data on carbon content in the Antarctic Ocean. And the Indian Ocean is not very well studied either. When it comes to modelling, the CO2 uptake we have very good models for the inorganic carbon uptake. But we still lack capabilities to realistically simulate the processes of deep water formation of dense saline rich water and the more biologically-dependent mechanisms of CO2 uptake in our models.

Have there been any surprises in your project up to now?

Yes, we have a new and surprising result concerning details of the oxygen cycle. I cannot reveal more at the current stage because it could influence the publication process of this result. When it comes to the understanding of the oceans role for the climate, we still know very little and there are still important discoveries to be done. This holds in particular for the interaction of biogeochemical processes and physical processes.

What do you think about the proposal of changing the CO2 uptake by adding iron oxide to the oceans?

This is an idea which came up some years ago. I do not think we can change very much by artificially adding iron or any other substance to the ocean water. In fact I do not think bioengineering the sea will have any practical use in the future. It may even be potential harmful to the environment.

More information: carbochange.b.uib.no/

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