EGU Position Statement on Ocean Acidification

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Impacts of ocean acidification may be just as dramatic as those of global warming (resulting from anthropogenic activities on top of natural variability) and the combination of both are likely to exacerbate consequences, resulting in potentially profound changes throughout marine ecosystems and in the services that they provide to humankind.

Background on Ocean Acidification (OA)

Ocean acidification is a rapidly emerging scientific issue and its possible ecological and economic impacts (which are largely unknown) have raised serious concerns across the scientific and resource management communities.

Since the beginning of the industrial revolution the release of carbon dioxide (CO_2) from our industrial and agricultural activities has resulted in atmospheric CO_2 concentrations that have increased from approximately 280 to 385 parts per million (ppm). The atmospheric concentration of CO_2 is now higher than experienced on Earth for at least the last 800,000 years (direct ice core evidence) and probably the last 25 million years, and is expected to continue to rise at an increasing rate, leading to significant temperature increases in the atmosphere and ocean in the coming decades. The ocean has absorbed about 430 billion tons of carbon dioxide from the atmosphere, or about one-third of anthropogenic carbon emissions. This absorption has benefited humankind by significantly lowering greenhouse gas levels in the atmosphere, thereby reducing anthropogenic global warming. However, the pH of ocean surface waters has already decreased by about 0.1 units, from an average of about 8.21 to 8.10 since the beginning of the industrial revolution. By the middle of this century atmospheric carbon dioxide levels could reach more than 500 ppm, and near the end of the century they could be over 800 ppm. This will result in an additional surface water pH decrease of approximately 0.4 pH units by 2100, implying that the ocean will be about 150% more acidic than at the beginning of the industrial revolution.

The relationship between atmospheric CO_2 increase and global change is highly non-linear. On the contrary, the relationship between atmospheric CO_2 increase and OA via absorption by the ocean is straightforward and future projections can be carried out with very high confidence, provided that future atmospheric CO_2 increase is known. When CO_2 is absorbed by seawater, chemical changes occur that reduce seawater pH and the concentration of carbonate ion in a process commonly referred to as ocean acidification. Carbonate ion is a basic building block of skeletons and shells for a large number of marine organisms, including corals, shellfish, and marine plankton. Some of these smaller calcifying plankton are important food sources for higher marine organisms. Hence, if the planktonic preys of larger fish are affected, this will have serious consequences for marine food webs. Also, the abundance of commercially important shellfish species could decline. A decline in coral reefs due to increases in temperature and decreases in carbonate ions would have negative impacts on fisheries and tourism. On the other hand, not all biological impacts from rising atmospheric CO_2 are necessarily deleterious for a species. There will likely be ecological "winners" as well as "losers". The question remains, however, how the "winners" will impact the ecosystem or the biogeochemical cycles as a whole. Thus ocean acidification could have profound impacts on some of the most fundamental biological and geochemical processes of the sea in coming decades.

Ocean acidification is already occurring today and will continue to intensify, closely tracking atmospheric CO_2 increase. Given the potential threat to marine ecosystems and its ensuing impact on human society and economy, especially as it acts in conjunction with anthropogenic global warming, there is an urgent need for immediate action. This "double trouble" is arguably the most critical environmental issue that humans will have to face in the immediate future. The impacts of ocean acidification will be global in scope yet are some of the least understood of all climate change phenomena. Given that chemical effects are already measurable and that biological impacts may be dramatic within only decades, Europe must now accept the challenge to better coordinate and stimulate its research on ocean acidification. This is fundamental if we are to fully understand the risks and consequences of OA and to eventually help mitigate ocean acidification.

This rather new recognition that, in addition to the impact of CO_2 as a greenhouse gas on global climate change, OA is a **direct** consequence of the absorption of anthropogenic CO_2 emissions, will hopefully help to set in motion an even more stringent CO_2 mitigation policy worldwide. The only solutions to avoid excessive OA are a long-term mitigation strategy to limit future release of CO_2 to the atmosphere and/or enhance removal of excess CO_2 from the atmosphere.