Impacts of marine Ocean Alkalinity Enhancement generated by Direct Air Capture on natural phytoplankton communities in New Zealand

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Ocean Alkalinity Enhancement (OAE) is a mCDR technique analogous to natural weathering that shows promise for mCDR. OAE has a potential co-benefit of mitigating ocean acidification, which could reduce marine ecosystem degradation and associated economic losses in coastal waters. However, OAE techniques that involve the addition of minerals could have negative environmental effects caused by the leaching of potentially toxic metals. Here, we will test a novel OAE approach using alkalinity generated by Direct Air Capture (DAC) in a case study in shelf waters off north-west New Zealand. We are developing coupled hydrodynamic and biogeochemical models to simulate release scenarios, and also establish experimental conditions for assessing ecosystem response to alkalinity addition. An experiment on natural phytoplankton communities will be conducted using two levels of alkalinity addition based upon the model outputs using the Ocean Alkalinity Enhancement Pelagic Impact Intercomparison Project framework. We will evaluate the potential impact of OAE on the growth, composition and size structure of the natural phytoplankton community, as well as other biogeochemical aspects. This project will be the first to assess the combination of two carbon removal techniques, OAE and DAC, for both mCDR and ocean acidification mitigation, and establish the benefits and risks for marine ecosystems and New Zealand climate strategy.