

Climate engineering by Carbon Dioxide Removal Techniques:

1. Ocean Alkalinity Enhancement and 2. Ocean Iron Fertilization

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In the ocean, two techniques for climate engineering have been tested, by in situ experiments and modeling studies. The potential of artificially enhanced silicate weathering of olivine operates against rising temperatures and would oppose ocean acidification via altering the global carbon cycle. The effects of this approach, e.g. alkalization in soils and for ecosystems in the draining rivers and open water dissolution of fine-grained silicate, will have to be considered in the future before the full potential of removal of 1-5 Pg C per year may be fully exploited. Fertilizing the open ocean with iron has been tested in various high nutrient low chlorophyll (HNLC) regions world wide. We will report on contrasting evidence from three of such experiments in the Southern Ocean, that in theory would have a high potential for significant CO₂ removal capacity. Depending on the physical and chemical boundary conditions and the biological settings within the ecosystems (e.g. biodiversity) in a given ocean area the pathway of newly fixed carbon via the plankton food web will either end up sinking to the deep ocean interior or, alternatively being recycled in the upper ocean food web. Risks and potentials for both techniques will be discussed during the presentation.