Effects and evaluation on absorption of carbon dioxide by sea water

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Summary

Oceanic fertilization technique is one of the countermeasures against the global warming problem. The fertilization of ocean with nutrients, such as nitrate and phosphate, is expected to promote the propagation of the plant biota, leading to the decrease in the surface-ocean partial pressure of CO_2 at ocean surface, drawing down CO_2 from the atmosphere. In the present study, we evaluated the effective ratio of the nutrients sprinkling into the ocean by diffusion model considering the horizontal diffusion of nutrients and organic matter in ocean, and nutrients assimilation by plant biota. We also evaluated energy balance of transportation of the fertilizers of N and P by ship to optimize the fertilization in ocean.

The nutrients sprinkled by ship are diffused in the surface of sea with assimilation by the plant biota. When the nutirients equivalent to the 1/500 of the accumulated amount of CO_2 in the atmosphere were sprinkled within the circle of 7.1 - 100 km radius, less than 0.01 % of the nutrients were found to be transferred to the deap ocean without assimilation. The energy evaluation also indicated that the amount of CO_2 produced from the transportation process was about 0.23 % of the amount that is expected to be taken up into the ocean from the atmosphere.

The weathering of alkaline rocks, such as alkaline or alkaline earth silicate is thought to have played a great role in the historical reduction in the atmospheric CO_2 of this planet. To enhance the process artificially, some additional pulverization energy is necessary, which leads to the additional CO_2 emission. In the present study, we also evaluated the weathering kinetics for various kinds of silicates. Wollastonite showed the most fast absorption rate of CO_2. When the wollastonite is pulverized to 10μm, the pulverizatio energy is 6.76 % of the fixed amount of CO_2 by rock weathering. It was concluded that the CO_2 absorption by rock weathering is one of the most promissing measures.