Solubility and bioavailability of Patagonian dust in the future Southern Ocean

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Abstract:

Trace metals play a significant role in the ocean biogeochemical cycles. They are present at extremely low concentrations in the ocean (~fmol.kg^{-1} to nmol.kg^{-1}), but are essential for the phytoplankton growth and physiology since they are micronutrients. For instance, they are used for photosynthesis that consumes carbon dioxide and, therefore, they have a large impact upon climate. This process known as the biological carbon pump accounts for about a third of the oceanic carbon pump.

The Southern Ocean is the largest HNLC area (High macroNutrients Low Chlorophyll), where low iron inputs are limiting the phytoplankton growth. External sources of trace metals in the surface Southern Ocean are by the atmospheric inputs, which can episodically alleviate the limitation by trace metals. Here, Patagonian dust represents half of the trace metals dust input, and those inputs are expected to increase by two or three times with the global warming, potentially constituting a negative feedback on the atmospheric carbon increase.

However, the solubility of the trace metals contained in the Patagonian dust is still unknown, and thus, the bioavailability of the trace metals needs to be explored. In addition, other changes are expected in the future Southern Ocean that should be considered together with the increase of dust inputs.

In this context, this study aims to determine the solubility and bioavailability of the trace metals contained in the Patagonian dust under various other changes in the Southern Ocean. Abiotic and biotic experiments will be conducted under different scenario of present and future conditions (dust input, CO_2 level, macronutrient concentrations, temperature and light). The laboratory work will be combined with field experiments in the Southern Ocean. This work could be changing the current view of the climate prediction.

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