



Atmospheric deposition fluxes and solubility over the Southern Indian Ocean: time series on Kerguelen and Crozet Islands.

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Atmospheric supplies bringing trace metals are suspected to have a significant impact on biogeochemical processes in High-Nutrient-Low-Chlorophyll waters of the open ocean, such as the Southern Ocean. We recorded time series of atmospheric deposition samples continuously collected over two years on Kerguelen and Crozet Islands in the Southern Indian Ocean. Dust deposition flux and scavenging ratio on Kerguelen Islands were reported in a previous publication [Heimburger et al., GBC, 2012]. Here, we present results of total atmospheric deposition fluxes for a large suite of elements (Al, As, Ba, Ca, Ce, Co, Cr, Cu, Fe, K, La, Li, Mg, Mn, Na, Nd, Ni, Pb including isotopes, Rb, S, Si, Sr, Ti, U, V, Zn), which are identified as coming either from sea-salt, crustal or anthropogenic sources. Enrichment factor variabilities for Pb, As, Cr, Cu and V and Pb isotopic ratios highlight the anthropogenic contribution during the austral winter only. For Al, Fe, Mn and Si, deposition fluxes are similar for both Kerguelen and Crozet Islands, which are situated 1300 km apart, and so can be extrapolated for the entire Southern Indian Ocean. Over the entire sampling period, those fluxes are on average equal to $53 \pm 2 \mu\text{g}/\text{m}^2/\text{d}$, $33 \pm 1 \mu\text{g}/\text{m}^2/\text{d}$, $0.83 \pm 0.04 \mu\text{g}/\text{m}^2/\text{d}$ and $88 \pm 14 \mu\text{g}/\text{m}^2/\text{d}$ respectively. For the other non-sea-salt elements, we observed differences between flux values from a factor of two to a factor of five with a decreasing gradient from Crozet to Kerguelen Islands. One-month field experiments were also performed during four different austral summers in order to collect rain water on an event basis. Soluble and insoluble fractions were directly separated by filtration and analysed using High Resolution – Inductively Coupled Plasma – Mass Spectrometry and Inductively Coupled Plasma-Atomic Emission Spectrometry as done for deposition samples. Concentrations in rain water samples are very low and difficult to measure accurately mainly because of possible contamination issues. Deduced solubility vary on a large extend but those variabilities are correlated between all the crustal elements.