Aerosol trace metal concentration and dissolution from known dust sources in Southern Africa

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Understanding different physical characteristics and trace elemental of dust compositions is crucial in determining the possible bioavailability of trace elements to phytoplankton communities. Surface sediment samples were collected from four known dust plume sources in southern Africa namely: Etosha Pan, Kuiseb and Omaruru River in Namibia and the Makgadikgadi Pan in Botswana. HYSPLIT modeling software was used to determine when most of the dust travels towards the southern oceans. Modeling trajectories showed high variability, although the months between April and September showed dust pathways which travelled to the southern oceans with a few circulating around Antarctica. Based on the HYSPLIT modeling, the southern African dust travels most towards the Indian Ocean and Australian continent. A small fraction of dust from southern Africa gets dispersed towards Antarctica. However, modeling the dust pathways showed high variability with changes in modeled parameters which illustrates the level of heterogeneity in dust trajectories. The general geochemistry and sedimentological characteristics of the different dust samples from the four known dust plume sources in southern Africa was analysed to determine the speciation of the different trace metals. Complete digestion of different sediment types was performed to determine the overall trace metal composition. Experiments were conducted to leach trace metals, including iron, from the dust samples. Several dust types, size fractions, and leaching solutions were tested. Iron solubility was determined from these experiments to determine which dust is most suitable as a fertilizer for the Southern Ocean