



Fertilisation of the Southern Atlantic: Ephemeral River Valleys as a replenishing source of nutrient-enriched mineral aerosols

Andrew Dansie, Giles Wiggs, and David Thomas

School of Geography and the Environment, University of Oxford, Oxford, United Kingdom (giles.wiggs@ouce.ox.ac.uk)

Oceanic dust deposition provides biologically important iron and macronutrients (Phosphorus (P) and Nitrogen-based (N) compounds) that contribute to phytoplankton growth, marine productivity and oceanic atmospheric CO₂ uptake. Research on dust emission sources to date has largely focused on the northern hemisphere and on ephemeral lakes and pans. Our work considers the ephemeral river valleys of the west coast of Namibia as an important yet overlooked source of ocean-fertilizing dust. Dust plumes are frequently emitted from the river valleys by strong easterly winds during the Southern Hemisphere winter, when the upwelling of the Benguela Current is at its weakest. We present field data from dust emission source areas along the main river channels near the coastal termini of the Huab, Kuiseb and Tsauchab river valleys. Collected data include erodible surface sediment, wind-blown flux, and associated meteorological data. Extensive surface sediment sampling was also undertaken throughout the combined 34,250 km² extent of each river valley catchment with samples collected from within the main river channels, the main branches of each river system, selected tributaries, and into the upper watersheds. Geochemical data show valley sediment and wind-blown flux material have high concentrations of bioavailable Fe, P and N, exceeding that measured at the major dry lake basin dust sources in southern Africa. The contribution of fertilising deposition material is enhanced by both the spatial proximity of the source areas to the ocean and enrichment of source material by ephemeral fluvial accumulation and desiccation. Results show that geographical factors within each watershed play a key role in the nutrient composition of the emitting fluvial deposits in the river valleys. Analysis explores potential relationships between land use, geology, climate and precipitation in the upper watersheds and their influence on bioavailability of Fe, P and N compounds in wind-erodible valley sediments. MODIS data for dust plume identification and chlorophyll concentration in the southern Atlantic is utilised to investigate associations between recorded dust emission events and phytoplankton growth in the ocean surface waters.