Aerosol iron solubility: comparison between the Australian subtropics and Southern Ocean

H. Winton[1,2*], R. Edwards[1], A. Bowie[2], S. D. Chambers[3], M. D. Keywood[4], S. Wercynski[3] and A. G. Williams[3]

[1] *Curtin University, Perth, Western Australia, Australia*

[2] *University of Tasmania, Hobart, Tasmania, Australia*

[3] *ANSTO Institute for Environmental Research, Lucas Heights, NSW, Australia*

[4] *CSIRO Ocean and Atmosphere Flagship, Aspendale, Victoria, Australia*

* corresponding author: Holly Winton [holly.winton@postgrad.curtin.edu.au]

Abstract

Past changes in the atmospheric deposition of soluble, or bioavailable, trace metals to high nutrient low chlorophyll (HNLC) and nitrogen replete tropical waters have been shown to modulate primary production, atmospheric CO_2, and global climate. The deposition of soluble trace metals can also trigger toxic algal blooms, which impact Australia's fisheries and coral reefs. An understanding of the sources (e.g. mineral dust and biomass emissions) and geochemistry of soluble trace metals in atmospheric aerosols is critical for determining the impact of trace metal deposition on ocean fertility in the past and the future. However, to date no trace metal solubility data exists for biomass emissions from Australian fires and there are very few estimates of soluble trace metal aerosols entering the Southern Ocean.

Trace metal clean aerosols were collected during the early-late dry season experiment at Gunn Point, Northern Territory to investigate the trace metal aerosol solubility associated with biomass burning. Previous studies have suggested that mineral dust is the dominant source of trace metal aerosol. However, mineral dust is relatively insoluble and a significant fraction of soluble trace metals in the atmosphere could originate from biomass burning rather than mineral dust. Here we use the combination of soluble aerosol chemistry, back trajectories and diurnal and advective radon components to identify trace metal source regions throughout the campaign duration. We compare aerosol iron solubility at Gunn Point in the subtropics, where biomass burning can dominate the aerosol load in the dry season, to iron solubility in baseline air at Cape Grim which is representative of the Southern Hemisphere background. In doing this we highlight the importance of aerosol source at different latitudes for the solubility and bioavailability of trace metals.