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ATMOSPHERIC DEPOSITION OF BIO-ESSENTIAL TRACE ELEMENTS IN THE SOUTHWESTERN INDIAN OCEAN: RESULTS FROM THE 2021 SWINGS RESEARCH CRUISE

WILLIAM M. LANDING[1], PETER L MORTON[2], MARK STEPHENS[3] AND DAVID KADKO[3]

[1]Florida State University
[2]FSU
[3]FIU

Presenting Author: wlanding@fsu.edu

We will discuss the aerosol fractional solubility and atmospheric deposition of biologically-essential trace elements in the southwestern Indian Ocean using samples collected on the 2021 SWINGS cruise, a GEOTRACES section cruise led by French scientists studying trace element sources, transformations and sinks in the Indian Ocean sector of the Southern Ocean. The cruise track crossed the currents and oceanographic fronts that are major pathways of the general circulation in the region; this allows us to quantify the atmospheric deposition of bioactive trace elements in a region with multiple possible aerosol sources, and where aerosol Fe deposition and rainfall rates range over 1-2 orders of magnitude. Aerosol samples (bulk and size-fractionated) were collected on 24-72 hour intervals and analyzed for total and soluble major and trace elements including nitrate, phosphate, silicate, chloride, sulfate, Na, Mg, Al, V, Mn, Fe, Co, Ni, Cu, Zn, and Cd. We also measured water-soluble organic compounds (oxalate and MSA) that enhance aerosol trace element solubility. Total aerosol concentrations of crustal elements (Al, Ti, Mn, Co, and Fe) were highest near the coast of Durban SA and also near Marion Island; air-mass back trajectories suggest that the aerosols may have traveled from western Australia and South America. The aerosol Fe concentration pattern is compared with recent model estimates for aerosol Fe concentrations in the region showing order-of-magnitude disagreement. We used Be-7 activities in aerosols and the upper water column to calculate aerosol bulk deposition velocities. The trace element concentration data along with air-mass back trajectory analysis allows us to apportion the aerosols between anthropogenic and natural sources, and discuss how aerosol sources affected the fractional solubility.