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Radium-224: A Potential New Tracer for Aerosol Deposition to the Surface Ocean

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Estimating aerosol flux to the ocean has been the subject of much research within the atmospheric and marine-based science community, and radioisotopic tracers, such as the suite of radium isotopes, are often employed for this purpose. The effectiveness of radium as a tracer in the marine environment lies, in part, to its wide range of half-lives (^{223}Ra = 11.4 days, ^{224}Ra = 3.7 days, ^{226}Ra = 1600 years, and ^{228}Ra = 5.7 years). As ^{224}Ra is produced from the decay of its ^{228}Th parent, there are two points of "entry" for ^{224}Ra to exist in the surface open ocean away from coastal or bottom influence: the decay of the standing stock of ^{228}Th in the water column and the rapid desorption from dust deposited at the surface. Yet, we are unaware of any previous studies employing the ^{224}Ra isotope exclusively to dust deposition to the surface ocean. Efforts taken to study the fate, composition, and distribution of aerosols are critical for understanding their effects on climate, as well as their role in land and marine-based interactions. For example, atmospheric deposition of dust to the oceans is linked to numerous biogeochemical processes within the surface ocean (Duce et al., 1991; Prospero et al., 1996; Mahowald et al., 2005; Jickells and Moore, 2015). Using the 2010/2011 GEOTRACES GA03 North Atlantic Transect dataset, we applied a potentially new tracer method using a core isotope to investigate aerosol flux to the open ocean. To test the applicability of the method, we compared flux rates of total Fe (Fe_T; insoluble + soluble) as well as other key trace elements to our station of interest. Initial data indicates the possibility that short-term depositional events can be observed via the ^{224}Ra surface signal and translated to an estimated flux. While existing datasets are extremely limited for our needs, we feel that initial results support further research.