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Impactor-Based Size Fractionation of Aerosol Particles over the Tropical Atlantic Ocean: Source Identification using Nd, Sr, and Pb Isotopes

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Airborne mineral dust is a significant constituent of the Earth's climate system that warrants detailed investigation to comprehend its impact on climate processes. This work presents a comprehensive multiproxy approach, utilizing Sr-Nd-Pb isotopes, to discern mineral dust source areas from North Africa, a region contributing approximately 55% of the global annual dust load. Our research not only focuses on identifying provenance but also explores the relationship between climate processes in source areas and aerosol properties at remote locations. We collected samples during three oceanographic campaigns in the tropical Atlantic Ocean conducted in 2020, 2021, and 2022, spanning late winter and entire spring periods. The interannual aspect allows us to capture variations, enhancing our understanding of dust emission and transport dynamics. The implementation of a sampling device that separates aerosol particles of different sizes allows for the detailed isotopic characterization of particles in each size range. Our results indicate the existence of diverse origin and transport patterns depending on the particle size. Differentiation based on particle size uncovers compelling insights into the dynamics of dust dispersion, revealing size-dependent variations in dust behavior. Notably, we observe distinctive pathways for the mass of elements at each size, elucidating the complex interplay between Nd, Sr, and Pb.