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Present-day mineral dust depositions in East Antarctica: indicators of a growing contribution of local dust and emissions from Southern Africa

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Mineral dust serves as a crucial tracer of past and present atmospheric circulations, offering insights into climate change and atmospheric processes, particularly in polar regions.

In this context, our study aims to identify the provenance (Potential Source Area -PSA-) of modern dust deposition and its temporal (three year-round sampling) and spatial evolution in East Antarctica (EA). To achieve this goal, dust samples were collected from snow, passive Sigma-2 type collectors, and active collectors at seven sites along a ~200 km transect from the Belgian Princess Elisabeth Station to the coast from 2017 to 2020. Analyses of grain-size, shape, mineralogy, geochemistry (trace elements, especially Rare Earth Elements -REE-), as well as strontium (Sr), neodymium (Nd) and lead (Pb) isotopes were performed on these modern dust samples.

The atmospheric particles mainly show a submicronic size (> 98% of particles < 5µm, n=2500) and angular shape. Mineralogical (SEM-EDS) observations suggest a clear distinction between inland dust depositions (Fe-Mg silicates > 50 %) mainly due to erosion of the local Sør Rondane Mountains, and coastal dust depositions (dominated by aluminosilicates and quartz, with <20% of Fe-Mg silicates) that are produced by distant PSAs dust emissions. Implementation of our novel statistical mixing model based on REE patterns [1] with data from modern EA dust compared to PSAs further confirms the contributions from these PSAs. In addition, the new Sr, Nd, and Pb isotopic compositions observed in modern dust at the EA coast align with those found in Holocene interglacial dust deposits (at Vostok and EDC; [2]), highlighting the contributions from two main distant PSAs: Southern South America, especially the dominant input from Patagonia (and the Puna–Altiplano Plateau), in combination with Southern Africa, where dust inputs appear to have increased in recent times compared to the past.

[1] Vanderstraeten et al. (2023), *Science of the Total Environment*, 881, 163450; http://dx.doi.org/10.1016/j.scitotenv.2023.163450

[2] Gili et al. (2022), *Nature Communications earth & environment*, 3 :129 ; https://doi.org/10.1038/s43247-022-00464