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Aeolian dust tales of Quaternary climate from the EPICA-Dome C ice core

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Long and detailed sequences of Quaternary windborne terrigenous material constitute unique archives for paleoclimatic and paleoenvironmental information. The East Antarctic Plateau is special, in this respect as minerals entrapped in ice layers are exclusively of aeolian origin and snow accumulation rate is very low, thus allowing recovery of time series reaching far back in time. Here we present the EDC (European Project for Ice Coring in Antarctica - Dome C; 75˚06'S; 123˚21'E, East Antarctica) aeolian dust record, which is the longest of its kind from polar ice cores by spanning the last ∼800 ka and going back to Marine Isotopic Stage (MIS) 20.2.

Glacial-interglacial cycles are characterized by a higher (glacial) and lower (interglacial) dust input, which is remarkably homogeneous over the East Antarctic interior as shown by matching with the Vostok dust record. MIS 14 appears to be a globally atypically weak glacial stage. Comparison of EDC dust flux with winter sea ice extent in the South Atlantic suggests that the primary source area for glacial dust, which is southern South America, was probably less active at those times.

The anticorrelation between dust and deuterium is strong during glacial periods while it is relatively weak during interglacial periods. Thus, during glacial periods, polar climate influence extended north beyond the polar circle and affected the dust source region (southern South America), whereas southern South American and East Antarctic climate were independent during warm periods. The time spent in a state of weak coupling passes from 12% before the Mid-Brunhes Event (MBE, 430 kyr BP) to 30% after the MBE, thus showing a partial loss of the Antarctic influence on southern South

American climate, coinciding with warmer temperatures.

Particle size data also suggest an increasing atmospheric isolation of Dome C during the past half million years possibly due to a deepening of the Antarctic polar vortex. Such atmospheric circulation tendency occurred in tandem with intensification of atmospheric regimes in other parts of the globe.

High-resolution analysis of glacial Terminations reveals a slight decoupling between temperature in central East Antarctica and dust, revealing tight sensitivity of this proxy to the whole process of deglaciation that occurred at high Southern latitudes, involving sea ice, atmospheric circulation, as well as climate and environmental conditions on land. A comparison of Termination I and Termination V shows that the ACR and the cold event at 420 ka BP occurred at similar dust concentration levels, yet had a weak effect on southern South American climate.