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East Antarctic dust size reveals a regional variability of atmospheric circulation patterns during Termination I

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The aeolian mineral dust input to East Antarctica has been investigated from three ice cores recovered at Dome B (DB, 77˚05' S, 94˚55'E, 3650 m a.s.l), Dome C (EPICA-Dome C ice core, EDC, 75˚06'S, 123˚21'E, 3233 m a.s.l.) and Komsomolskaia (KMS, 74˚05' S, 97˚29' E, 3500 m a.s.l) for the time period spanning the Last Glacial Maximum (LGM) to Holocene transition (20 to 10 kyr B.P.).

Both the dust $^{87}Sr/^{86}Sr$ versus $^{143}Nd/^{144}Nd$ isotopic signature (indicator for dust provenance) and the dust concentration (flux) profiles and are remarkably uniform among the three sites. In particular, a clear indication of the 800-1000 years long pre-Holocene dust concentration minimum (11.3 to 12.1 kyr B.P.) is present in all the ice cores, thus representing a very useful stratigraphic marker.

Conversely, the size distribution of dust grains shows considerable dissimilarities among the East Antarctic sites investigated, large dust characterizing the end of LGM at DB at the same time as fine particles reached EDC and KMS. The profile of particle size changes during Termination I highlights also different timing of changes and regional trends unequivocally opposite. Moreover, out-of-phase sub-millennial scale oscillations of microparticle size are ubiquitous in the three records.

Dust grading can be considered a first-order proxy for transport since it is associ-

ated to the length of the atmospheric trajectory of particles in the three dimensional space (zonal and meridional paths as well as altitude of transport). In the case of very fine particles carried high in the troposphere and having long atmospheric residence times like those reaching East Antarctica, subsidence is particularly important. Smaller particles would be associated to preferential subsidence from upper levels, as corroborated by the dust size changes observed during a volcanic event recorded in East Antarctic ice.

Despite the low temperatures during LGM made the subsidence more pronounced everywhere in Antarctica with respect to the Holocene, the data obtained in this work suggest for that time a preferential upper air subsidence over the EDC-KMS region and penetration of relatively lower air masses to the DB and probably Vostok (78˚28'S, 106˚48'E) regions.

In the line of this interpretation, the glacial/interglacial atmospheric circulation arrangements likely reflect a southward displacement of the polar vortex. The scenario proposed is consistent with the glacial to Holocene regional changes of snow accumulation, and it likely operates also at sub-millennial frequency.