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Depicting the atmospheric circulation mode of variability since 1800 A.D. from Talos Dome (East Antarctica) dust record.

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The year-to-year atmospheric circulation variability in the Circum Antarctic is known to be linked today to a dominant ACW-ENSO mode and to the southern annular mode (SAM). However, if the recent developments of complete and physically-consistent meteorological datasets allowed to analyze the variability of the atmospheric circulation over the Southern Ocean with confidence, much less is known for the time period prior to the availability of satellite products. Paleoclimatologists are looking therefore for proxies as much sensitive as possible to the atmospheric circulation behavior and sufficiently highly resolute in time.

Here we present the 200-years long aeolian mineral dust record from Talos Dome (Northern Victoria Land, 72˚48'S, 159˚06'E, 2316 m a.s.l.) ice core (1996 PNRA-ITASE traverse) measured at high (sub-annual) temporal resolution. More than 500 samples were measured from the first 30 m of the core through Coulter Counter technique, thus allowing to obtain a complete record of microparticle concentration and size variability. Dust concentration and size distribution almost co-vary over the period investigated high dust concentrations being generally associated to coarser dust and vice versa. The visual inspection of the record shows structured cycles of relatively short duration ($\leq$ 10 years) superposed on a long-term trend. The magnitude of these oscillations is a factor of 10 to 100 for the concentration and $\sim$3 for the size.

Spectral analyses show significant peaks for decadal (8-10 years), interannual and biennial (2, 2.4, 2.7) periods, highlighting that the mineral dust reaching Talos Dome holds the same modes of variability of the Southern and global Ocean.

Such periodicities characterize also Methanesulphonic acid (MSA) record form Law Dome ice core (Curran et al., 2003), proxy for sea ice extent. Bivariate spectral analyses between the two records highlight very high coherency with respect to these periodicities overall their common time period (1841-1989 A.D.).

Cross-spectral analyses between the Talos Dome dust concentration and MSA records, on the other hand, surprisingly show lower coherency. This could probably derive from the sensitivity of Talos Dome MSA record to the cumulated effect of the Southern Ocean and the Ross Sea.

Further investigation is needed at this step. However, the results highlight that dust variability at Talos Dome is extremely sensitive to the Southern Ocean/atmosphere coupled mode of variability, and therefore we propose the Talos Dome dust record as new proxy for depicting the past mode of variability of the atmospheric circulation in the Antarctic and circum-antarctic region.