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Aeolian dust as a recorder of climatic changes

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Continental dust transported in the atmosphere can be used as a tracer for atmospheric circulation and transport, as well as providing information on climate in dust source areas. Aeolian dust records can therefore contribute to document environmental change on various geographical and temporal scales. Different examples are presented and discussed. For present-day studies, satellite imagery, air-mass back trajectories and models can be used to trace dust deposits indirectly back to their source area. A direct observational method consists in comparing the composition of the dust itself (mineralogical, elemental, isotopic etc.) with that of soils and sediments in possible source areas. This method has the advantage of being useable for paleo-atmospheric circulation and paleo-dust transport studies on various time scales. For example, isotopic studies of mineral dust extracted from recent snow deposits in Greenland have shown a seasonal variability in the source areas: in spring, the largest annual pulse of dust is derived from north-western China, while in the low-dust seasons (fall and winter), dust is provided from deserts within the north-central Chinese province of Inner-Mongolia (Bory et al., 2002-2003). On millenial time-scales, Dansgaard-Oeschger and Heinrich climatic events are clearly expressed in the Greenland ice-core dust records (Mayewski et al., 1997). On longer time scales, Greenland (Fuhrer et al., 1999) and Antarctic (EPICA Community Members, 2004) ice cores have shown that dust transport to polar regions was increased by about 2 orders of magnitude in glacials (such as the LGM) compared to interglacials (like the present Holocene). Antarctic glacial dust revealed an Argentine provenance (Grousset et al., 1992) and Greenland glacial dust revealed a Chinese provenance (Biscaye et al., 1997; Svensson, 2000), whereas dust deposited during interglacial periods displayed more complex signatures, revealing multiple sources and significant reorganization of atmospheric circulations (Delmonte et al., 2004). Finally, on million-year time scales, it appears that dust fluxes accumulated in oceanic sediments varied greatly with time (from $<$10 to

$>$500 mg.cm^{-2}.ky^{-1}) depending on variations in wind intensity, in source aridity (Rea,1994), and in the latitude of atmospheric transport corridors (Blank et al., 1985). For example, Asian dust started to impact significantly the central Pacific after 3.5 million years B.P. (Pettke et al. 2000, 2002).