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Present time atmosphere-snow interaction at Dome C from size-segregated aerosol, superficial snow and hoar chemical analysis: a tool in interpreting past atmospheres from ice core stratigraphies.

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Atmosphere-snow interchanges, including wet and dry depositions of soluble and insoluble particles, uptake of gases from snow surface, species reactivity effects and possible re-emission processes, control the concentration of chemical compounds in the snow pack and their persistence as firnification processes go on. As a consequence, a reliable understanding of the present atmosphere-snow processes over central Antarctica is essential in order to reconstruct the composition of past atmospheres from ice core chemical stratigraphies. Indeed, ice core analysis is potentially able to correlate variations of load and chemical composition of the atmospheric aerosol to past climate and environmental changes, once the sources, transport processes and air-snow transfer physico-chemical mechanisms of present natural aerosol and gases are sufficiently known. Such study at Dome C (East-Antarctica) is propedeutical in interpreting paleo-data coming from the chemical analysis of the EPICA (European Project for Ice Coring in Antarctica) ice core.

Results of the chemical composition of aerosol, superficial snow and hoar samples collected at Dome C (75˚06' S; 123˚23' E; 3233 m a.s.l.) during several summer campaigns (2000/01 to 2004/05) are here reported. Aerosol samples were collected at different time resolutions (2 to 7 days) by different collectors: stacked filter systems, able to separate a coarse and a fine fraction (nominal cut-off 3.0 or 5.0 um); a low volume, pre-selected cut-off (PM10) sampler; and an inertial impactor, able to segregate aerosol particles in 8 size classes (from 10 to 0.4 um). In parallel to aerosol sampling,

superficial snow and fragile hoar crystals were also sampled. Aerosol and snow samples were analysed for major inorganic anions and cations, methanesulphonate (MSA) and some short-chain carboxylic acids. Dome C is characterized by aerosol arising from secondary atmospheric sources and long-range transport processes, the fine fraction (e.g., < 3.0 μm) representing about 80% of the total ionic budget. The main persistent ionic component of aerosol and superficial snow is nss-sulphate (mainly in acidic form), revealing that biogenic oceanic emission constitute a dominant source of Antarctic background aerosol. But uptake processes (mainly acting on the surface of hoar structure) fix relevant quantities of gas-phase nitric acid. Snowpit studies showed that post-depositional re-emission affects, with different temporal trends, the persistence of nitrate, chloride and MSA in the snow layers.