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Reconstruction of trace element sources from Cerro Negro ice core, Central Chile

Content

Ice cores from alpine glaciers serve as important archives that provide information about the composition of past and present atmosphere. Due to their geographical location, they give evidences on anthropogenic emissions in addition to natural signals. Trace elements (TE) in glacier ice reflect the composition of deposited aerosols and thus allow determining their origin, e.g. from oceans (sea salt), desert areas (mineral dust), volcanoes and anthropogenic pollution.
The analysis of mineral dust provides information on dust sources, climate (humidity conditions), circulation changes and anthropogenic land use. By determining the TE composition, the source of the mineral dust can be identified and thus a reconstruction of the wind conditions and/or atmospheric circulation patterns can be achieved. The climate itself plays a decisive role in the formation of mineral dust. Persistent droughts lead to the spread of deserts and therefore to a raise in dust mobilisation. The anthropogenic destruction of natural vegetation for land use results in extended wind erosion of the soil surface and increased dust emission. Vice-versa mineral dust and other aerosols can also affect the climate itself, through the absorption and scattering of incident solar radiation and indirectly by influencing cloud and precipitation formation.
To determine TEs in ice cores, we use two instruments, an inductively coupled plasma-sector field-mass spectrometer (ICP-SF-MS, located at Paul Scherrer Institute) and an inductively coupled plasma-time of flight-mass spectrometer (ICP-TOF-MS, located at University of Bern). The ICP-SF-MS allows high mass resolution, is extremely sensitive and therefore often used to establish long-term TE trends, for example of anthropogenic pollution. In contrast, the ICP-TOF-MS is extremely fast, allowing measuring separately the TE composition of single particles and the dissolved fraction, which is an important information to reconstruct the mineral dust sources more precisely. We analyzed TE concentrations in a shallow ice core from Cerro Negro glacier in Central Chile with both instruments and will discuss the comparability of the results and will present first data on single particle composition to identify TE sources.

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