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Identification of mineral dust layers in high alpine snow packs

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Deserts serve as a major source for aerosols in the atmosphere with mineral dust as a main contributor to primary aerosol mass. Especially the Sahara, the largest desert in the world, contributes roughly half of the primarily emitted aerosol mass found in the atmosphere [1]. The eroded Saharan dust is episodically transported over thousands of kilometers with synoptic wind patterns towards Europe [2] and reaches Austria about 20 to 30 days per year.
Once the Saharan dust is removed from the atmosphere via dry or wet deposition processes, the chemical composition of the precipitation or the affected environment is significantly changed. Saharan dust serves on the one hand as high ionic input leading to an increase of ionic species such as calcium, magnesium or sulfate. On the other hand Saharan dust provides a high alkaline input neutralizing acidic components and causing the pH to increase [3]. Based on these changes in the ion composition, the pH and cross plots of the ion and conductivity balance [4] we tried to develop a method to identify Saharan dust layers in high alpine snow packs.
We investigated seasonal snow packs of two high alpine sampling sites situated on the surrounding glaciers of the meteorological Sonnblick observatory serving as a global GAW (Global Atmospheric Watch) station located in the National Park Hohe Tauern in the Austrian Alps. Samples with 10 cm resolution representing the whole winter accumulation period were taken just prior to the start of snow melt at the end of April 2016.
In both snow packs two layers with clearly different chemical behavior were observed. In comparison with the aerosol data from the Sonnblick observatory, these layers could be clearly identified as Saharan dust layers.
Identified Saharan dust layers in the snow pack allow calculations of the ecological impact of deposited ions, with and without Saharan dust, during snow melt. Furthermore the chemical characteristics for the identification of Saharan dust layers allow a retrospective evaluation of previous snow chemistry data of snow packs of previous years or different locations. Thus the unique time of almost 30 years of snow chemistry data from glaciers surrounding the Sonnblick observatory [5] can be evaluated, focusing on the intensity and frequency of the occurance of Saharan dust layers in high alpine snow packs.

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