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Environmental Chemistry

The Chemistry of Terrestrial Cold Environments

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The temperature of a substance is defined by the average kinetic energy of all the atoms or molecules of that substance. It is believed that in warmer environments, chemical reactions are likely to be more rapid than in colder environments. However, cold environments (snow and ice particularly) could be an excellent substrate to promote reactions owing to the high specific surface area of the snow and the capability of the ice to concentrate impurities between ice crystals.

In remote areas on Earth (for example, highly elevated mountains and the polar regions), elements and compounds, dust particles, black carbon and other chemical components (such as radicals) are transported by air and deposited onto snow surfaces and are archived in snow and ice. Through standard analytical measurements techniques, such as ion chromatography and inductively coupled plasma mass spectrometry, and more innovative and recently developed analytical methods, more and more chemical information is being extracted to understand current changes in the cryosphere and, more generally, in the cold Earth environment. This information aids in understanding environmental and chemical ongoing processes in these cold environments and is essential for understanding future changes under a global warming scenario and better refining climate change predictions.

In this Research Front, 'The Chemistry of Terrestrial Cold Environments', we present novel and rigorous science highlighting these concerns and developments in detail. The first paper (Bruschi *et al.* 2022) presents a chemical characterisation of the seasonal snowpack sampled for four consecutive years at the Calderone, the southernmost glacier still surviving in peninsular Italy. Seasonal snowpack chemistry is shown to be strongly affected by dry and wet deposition of contaminants associated with recognised anthropogenic and natural sources. The second paper (He 2022) provides a unique review of the fundamental science, recent advances, challenges and future research directions in the modelling of light-absorbing particles–snow–radiation interactions and impacts on snow albedo. The next paper (Rashid *et al.* 2022) reports on analyses of aerosol variability, models of potential aerosol sources and assessments of physicochemical characteristics of glacier ice in the local region, all of which will facilitate studies on aerosol impacts on the glacier melt and climate change. Research in remote areas is also important for evaluating the concentration of trace gases with possible greenhouse potential and with an active role in atmospheric chemistry. The final paper (Chen *et al.* 2022) presents an evaluation of variations in tropospheric ozone sinks and their implications for surface ozone in the region of south-east Tibet.

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Conflicts of interest. Jing Ming is an Editor for *Environmental Chemistry* and for the Chemistry of Terrestrial Cold Environments Research Front. Andrea Spolaor is a Guest Editor for the Chemistry of Terrestrial Cold Environments Research front. The authors declare no further conflicts of interest.

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