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The ice-core record of volcanism: Status and future directions

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Radiative forcing resulting from stratospheric aerosols produced by major volcanic eruptions is a dominant driver of climate variability in the Earth's past. Accurate knowledge of the climate anomalies resulting from volcanic eruptions provides important information for understanding the global and regional responses of the Earth system to external forcing agents.

Based on a unique compilation of newly obtained, high-resolution, ice-core measurements, as well as palaeo-climatic evidence inferred from existing tree-ring records and historical documentary sources, we revised the dating of ice-core based reconstructions of past volcanic eruptions and confirmed the dominant role of explosive volcanism on short-term summer temperature variability throughout the past 2,500 years. Continuous weekly surface snow measurements obtained from Summit, Greenland (2005-2014) further allow placing volcanic sulphate emissions arising from a series of moderate volcanic eruptions during the last decade into a multi-millennial context.

While these updated ice core records provide a more accurate constraint on the timing and magnitude of volcanic eruptions, there is also new data emerging on the geographic locations of past eruptions, atmospheric transport of volcanic fallout and climatic consequences (e.g. sea-ice; hydro-climate) from studying volcanic deposits (e.g. extent of volcanic ash deposition), proxy data and historical records. On the basis of selected case studies we will discuss the role volcanic eruptions have played in the Earth's climate system during the past and identify potential additional constraints provided by ice cores.