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Volcanically induced increase in extra-tropical cyclone frequency

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Volcanic eruptions are well known to influence Earth's temperature, however, how eruptions influence the atmosphere's circulation pattern, especially on the scale of everyday weather is poorly understood. Changing Earth's temperature can affect temperature gradients which in turn could affect baroclinicity and hence high- and mid-latitude weather. Yet, to what extent volcanic eruptions do in fact exert such an influence is not clear.

To answer this, we followed two independent lines of investigation: First, we query the Greenland ice-core proxy record for Indications of increased extra-tropical cyclone frequency that correlates with evidence for volcanism. This is done by comparing the storm proxy sea salt (a substance transported to the ice sheet by wind) with the volcanological proxy sulfur. Secondly, we simulate eruptions with the MPI-ESM1.2 Earth System Model and use the TRACK algorithm to explore how extra-tropical cyclone frequency is affected in the model experiments. Both approaches suggest that volcanic eruptions impact high- and mid-latitude weather by increasing the number of extra-tropical cyclones especially at higher latitudes. A detailed interrogation of the simulated eruption scenarios suggests that this increase in cyclone frequency is associated with features such as an increase in isentropic slopes and sea-ice extent most commonly found under colder climate regimes and is the reverse of what one finds in more equable climates such as that projected for the future.