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Effects of large volcanic eruptions on Eurasian climate and societies: unravelling past evidence to predict future impacts

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Substantial evidence exists for the sulphur deposition in ice cores of Greenland and Antarctica after major volcanic eruptions but their impacts have not been documented with sufficient detail so far. This is true for temperature, of which the cooling induced by eruptions has been vividly debated in recent years, but even more so for precipitation. In the Era.Net RUS Plus ELVECS, we are currently quantifying climate disturbance induced by major Common Era eruptions, the persistence of changes and their impact on short- to mid-term temperature and precipitation anomalies by using an unprecedented dataset of tree-ring records across Eurasia and a large body of recently unearthed historical archives. We will compile a comprehensive database of tree-ring proxies and historical archives; quantify temperature and precipitation impacts of large eruptions; simulate on a case-by-case basis volcanic microphysical processes and radiative forcing induced by the eruptions as well as evaluate results against tree-ring records; quantify impacts of large volcanic eruptions on atmospheric and oceanic circulations and feedbacks; and assess impacts of possible future eruptions. The new and diversified proxy data sources and more sophisticated modelling are expected to reduce discrepancies and uncertainties related to climatic responses to some of the largest eruptions. We expect to capture persistence of anomalies correctly by climate models, even more so if they are evaluated against highly resolved proxy data of past events. This will increase our confidence in the overall reliability of climate models and help to correctly capture, and therefore predict, the cooling and precipitation anomalies of possible future, large eruptions. These predictions of climatic anomalies will then be used to quantify their likely impacts on major economy and society, including food security, migration and air traffic.

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