



Tephra constraints on Rapid Climate Events (TRACE): precise correlation of marine and ice-core records in the North Atlantic region

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Little has challenged our understanding of climate change more so than the abruptness with which large-scale shifts in temperature occurred during the last glacial period. Atmospheric temperature jumps occurring within decades over Greenland were closely matched by rapid changes in North Atlantic sea surface temperatures and major re-organisation of the deep ocean circulation. Although these climatic instabilities are well-documented in various proxy records, the causal mechanisms of such short-lived oscillations remain poorly understood, largely due to the dating uncertainties that prevent the integration of different archives. Synchronisation of palaeoclimate records on a common timescale is inherently problematic, and unravelling the lead/lag responses (hence cause and effect) between the Earth's climate components is currently beyond our reach. TRACE - a 5 year project funded by the European Research Council - exploits the use of microscopic traces of volcanic events to precisely correlate the Greenland ice-cores with North Atlantic marine records. Tephrochronology has experienced a considerable step-change in recent years, with invisible layers of volcanic ash traced over much wider geographical regions than previously thought. What is more, recent work has identified new, previously unknown eruptions within both marine and ice-core records - several of which fall close to rapid climatic jumps imprinted in the proxy records. Here we draw upon examples of how these time-lines can be used to constrain the lead/lag responses between the atmospheric and oceanic systems during the last glacial period as well as some of the challenges that arise in the application of tephrochronology. Led by Swansea University, this project involves collaboration with groups at the University of Copenhagen, Aberystwyth University, Bangor University, University of St Andrews, Stockholm University, University of Tromsø and the University of East Anglia.