Geophysical Research Abstracts
Vol. 18, EGU2016-17567, 2016
EGU General Assembly 2016

Evaluating the link between explosive volcanism and millennial scale climate change during the Last Glacial

James U.L. Baldini, Richard Brown, and Jim McElwaine
Durham University, Earth Sciences, Durham, United Kingdom (james.baldini@durham.ac.uk)

Abrupt millennial scale climate change is one of the most characteristic features of the Last Glaciation. Despite its clear expression in a number of climate records worldwide, the mechanisms responsible for triggering these shifts remains elusive. Here we show that a strong statistically significant link exists between very large Northern Hemisphere (NH) eruptions and Greenland cooling over the interval 30 to 80 ka BP (>95% confidence). We hypothesise that following Last Glacial NH eruptions, the resulting aerosol veil cooled the NH preferentially, inducing an interhemispheric temperature imbalance, and forcing atmospheric circulation to the south. The initial aerosol-induced climate response may have been prolonged by a strong positive feedback involving NH glacier and sea ice expansion, increased NH albedo, and AMOC weakening. Regional effects of this reorganisation of atmospheric circulation included Greenland cooling, Antarctic warming, and a southward shifted ITCZ, all consistent with existing proxy evidence. Interestingly, previous research has suggested that a strong statistically significant link between evidence of Southern Hemisphere (SH) volcanism and Dansgaard-Oeschger (DO) events exists (>99% confidence), but did not propose a forcing mechanism (Bay et al., 2004). We suggest that SH eruptions occurring during the Last Glacial cooled the SH preferentially and forced atmospheric circulation to the north. A regional consequence of this was high latitude NH warming, followed by NH glacier and sea ice retreat, and AMOC strengthening. This initiated a positive feedback of NH warming, effectively amplifying the initial effects of the SH volcanic eruption, and resulting in the characteristic features of DO events.