Geophysical Research Abstracts
Vol. 19, EGU2017-18335, 2017
EGU General Assembly 2017

Rapid ocean-atmosphere response to Southern Ocean freshening during the last glacial period

Christian Turney (1), Richard Jones (2), Steven Phipps (3), Zoë Thomas (1), Alan Hogg (4), Peter Kershaw (5), Christopher Fogwill (1), Jonathan Palmer (1), Christopher Bronk Ramsey (6), Florian Adolphi (7), Raimund Muscheler (7), Konrad Hughen (8), Richard Staff (6), Mark Grosvenor (2), Nicholas Golledge (9,10), Sune Rasmussen (11), David Hutchinson (12), Simon Haberle (13), Andrew Lorrey (14), Gretel Boswijk (15), and the Alan Cooper16 Team

(1) School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia (c.turney@unsw.edu.au), (2) Department of Geography, Exeter University, Devon, EX4 4RJ, United Kingdom, (3) Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, Hobart, Tasmania, Australia, (4) Waikato Radiocarbon Laboratory, University of Waikato, Private Bag 3105, Hamilton, New Zealand, (5) School of Earth, Atmosphere and Environment, Monash University, Victoria 3800, Australia , (6) Research Laboratory for Archaeology and the History of Art, University of Oxford, Dyson Perrins Building, South Parks Road, Oxford OX1 3QY, United Kingdom, (7) Department of Geology—Quaternary Sciences, Lund University, 22362 Lund, Sweden, (8) Woods Hole Oceanographic Institution, MA, USA, (9) Antarctic Research Centre, Victoria University of Wellington, Wellington 6140, New Zealand, (10) GNS Science, Lower Hutt, 5011, New Zealand, (11) Centre for Ice and Climate, Niels Bohr Institute, University of Copenhagen, Juliane Maries Vej 30, 2100 Copenhagen, Denmark
, (12) Bolin Centre for Climate Research and Department of Geological Sciences, Stockholm University, 10691 Stockholm, Sweden, (13) Department of Archaeology and Natural History, College of Asia and the Pacific, Australian National University, ACT 2601, Australia, (14) National Institute of Water and Atmospheric Research Ltd., Auckland, New Zealand, (15) School of Geography and Environmental Science, The University of Auckland, Private Bag 92019, Auckland, New Zealand , (16) Australian Centre for Ancient DNA, School of Biological Sciences, The University of Adelaide, SA 5005, Australia

Contrasting Greenland and Antarctic temperature trends during the late last glacial period (60,000 to 11,703 years ago) are thought to be driven by imbalances in the rate of formation of North Atlantic and Antarctic Deep Water (the 'bipolar seesaw'), with cooling in the north leading the onset of warming in the south. Some events, however, appear to have occurred independently of changes in deep water formation but still have a southern expression, implying that an alternative mechanism may have driven some global climatic changes during the glacial. Testing these competing hypotheses is challenging given the relatively large uncertainties associated with correlating terrestrial, marine and ice core records of abrupt change. Here we exploit a bidecadally-resolved 14C calibration dataset obtained from New Zealand kauri (Agathis australis) to undertake high-precision alignment of key climate datasets spanning ~28,400 to 30,400 years ago. We observe no divergence between terrestrial and marine 14C datasets implying limited impact of freshwater hosing on the Atlantic Meridional Overturning Circulation (AMOC). However, an ice-rafted debris event (SA2) in Southern Ocean waters appears to be associated with dramatic synchronous warming over the North Atlantic and contrasting precipitation patterns across the low latitudes. Using a fully coupled climate system model we undertook an ensemble of transient meltwater simulations and find that a southern salinity anomaly can trigger low-latitude temperature changes through barotropic and baroclinic oceanic waves that are atmospherically propagated globally via a Rossby wave train, consistent with contemporary modelling studies. Our results suggest the Antarctic ice sheets and Southern Ocean dynamics may have contributed to some global climatic changes through rapid ocean-atmospheric teleconnections, with implications for past (and future) change.