Geophysical Research Abstracts
Vol. 17, EGU2015-2568, 2015
EGU General Assembly 2015

Pronounced warming in the Indian and Pacific sectors of the Southern Ocean during the 1970s

Chris Turney (1), Chris Fogwill (1), Jonathan Palmer (1), Erik van Sebille (1), Zoë Thomas (1), Matt McGlone (2), Sarah Richardson (2), Janet Wilmshurst (2), Pavla Fenwick (3), Lionel Carter (4), Richard Jones (5), Melanie Harsch (6), Kerry-Jayne Wilson (7), Graeme Clark (1), Ezequiel Marzinelli (1), Tracey Rogers (1), Eleanor Rainsley (1), Laura Ciasto (1), Stephanie Waterman (1), and Australasian Antarctic Expedition 2013-2014 Members ()

(1) School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia (c.turney@unsw.edu.au), (2) Landcare Research, PO Box 40, Lincoln 7640, New Zealand, (3) Gondwana Tree-Ring Laboratory, P.O. Box 14, Little River, Canterbury 7546, New Zealand, (4) Antarctic Research Centre, University of Victoria, Wellington, New Zealand, (5) Department of Geography, Exeter University, Devon, EX4 4RJ, United Kingdom, (6) Department of Biology, University of Washington, Seattle, Washington, USA, (7) West Coast Penguin Trust, P.O. Box 70, Charleston 7865, West Coast, New Zealand

Occupying some 20% of the world's ocean surface, the Southern Ocean is home to a diverse and unique biota and plays a fundamental role in global oceanic circulation, climate variability, Antarctic ice sheet stability and carbon cycling. Significant warming has been observed over recent decades, most prominently in the Antarctic Circumpolar Current (ACC). The mechanism(s) behind this warming, however, remain uncertain. Here, we integrate historic ocean and atmospheric observations and climate-sensitive tree growth on subantarctic islands from the northern limit of the ACC to extend historic and satellite measurements to produce a unique proxy record of temperature across 4˚ of latitude in the southwest Pacific. We demonstrate a hitherto unobserved abrupt warming during the 1970s that is unprecedented over the past 130 years, coincident with a significant decline in marine vertebrate populations and wider warming across the Indian Ocean. Comparison between our reconstruction and high-resolution ocean modelling provides a possible mechanism, suggesting warmer waters resulted from a poleward migration of the subtropical and ACC fronts. Projected increases in the strength of westerly winds are likely to continue the fronts' migration, driving warming in the Southern Ocean (>50˚S), with significant impacts on biota.