

Climatology of New Zealand: A Guide to Multi-proxy Climate Reconstruction

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Past climate variability in the mid-latitudes of the southern hemisphere is poorly constrained. In particular the manifestation of abrupt climate changes such as the Younger Dryas (YD) and North Atlantic Heinrich events is of particular interest because they provide important constraints on how rapid reorganizations of the climate system are transmitted through the global climate system. Ongoing work by our research group is focused on a 55 ka annually laminated sediment record from Lake Pupuke, an anoxic freshwater maar lake located on the north Island of New Zealand. Critical to interpreting this record is an understanding of the regional climatology of New Zealand, the limnology of Lake Pupuke and the influence of these processes on lake sediment climate proxy indicators. Here, we characterize the seasonal variability of modern New Zealand regional climate and its' relation to large scale oceanic and atmospheric circulation systems in order to interpret our multi-proxy records. Modern precipitation and temperature records from the National Institute of Water and Atmospheric Research (NIWA) is interpolated across New Zealand and compared to wind and ocean circulation patterns such as the South Westerly Winds (SWW). Strong seasonal variability in precipitation is seen related to the position and strength of the SWW. In austral summer the SWW contract pole-ward and strengthen, increasing precipitation in the south island and decreasing in the north. In winter the SWW expand equator-ward but weaken, leading to decreased precipitation in the south but increases in the north. These seasonal patterns can provide a guide to interpretation of precipitation and temperature proxy responses in the sedimentary record of Lake Pupuke. Preliminary proxy reconstructions are presented and interpreted using this guide. The regional climate response is linked to long-term variations in southern hemisphere climate.

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