

A Holocene temperature reconstruction from northern New Zealand: a test of North Atlantic Holocene climate patterns as a global template

Valerie van den Bos (1), Andrew Rees (1), Rewi Newnham (1), and Paul Augustinus (2)

(1) School of Geography, Environment and Earth Sciences, Victoria University of Wellington, New Zealand, (2) School of Environment, The University of Auckland, New Zealand

Holocene climate variability has been well defined in the North Atlantic (Walker et al., 2012), but the global extent of this climate change stratigraphy is debatable. If the North Atlantic serves as a global template for Holocene climate, then New Zealand (NZ) is ideally positioned to test this assertion, as it is distal from the northern drivers. Additionally, it is one of the few landmasses in the Southern Hemisphere that is influenced by both sub-tropical and extra-tropical climatic regimes, which may be more important controls in the southern mid-latitudes.

Although much work has been done to characterise the Holocene in NZ using pollen, most of these records lack the resolution or sensitivity to determine whether abrupt or short-lived events occurred. The NZ-INTIMATE climate event stratigraphy lacks a type section for the Holocene (Alloway et al., 2007). Records from northern NZ typically show little change, other than a possible early Holocene warming. Here, we present a combined pollen and chironomid temperature reconstruction from Lake Pupuke (northern NZ), the first of its kind in NZ that covers the entire Holocene.

By comparing mean annual temperatures reconstructed from fossil pollen and mean summer temperatures inferred from chironomid remains, we can assess changes in seasonality. Mean summer temperature was reconstructed from the chironomid record using a weighted averaging partial least squares (WA-PLS) model ($n_{\text{comp}} = 2$, $r^2_{\text{boot}} = 0.77$, $\text{RMSEP} = 1.4^\circ\text{C}$) developed from an expanded version of Dieffenbacher-Krall et al. (2007)'s chironomid training set. Preliminary results show evidence for cool summers during the early Holocene as well as around the period of the Little Ice Age as defined in the North Atlantic region. These and other climate patterns determined from the Pupuke chironomid and pollen records will be compared with other evidence from northern New Zealand and with the North Atlantic record of Holocene climate variability.

References:

- Alloway, B.V., Lowe, D.J., Barrell, D.J.A., Newnham, R.M., Almond, P.C., Augustinus, P.C., Bertler, N.A.N., Carter, L., Litchfield, N.J., McGlone, M.S., Shulmeister, J., Vandergoes, M.J., Williams, P.W., and NZ-INTIMATE members. 2007. Towards a climate event stratigraphy for New Zealand over the past 30 000 years (NZ-INTIMATE project). *Journal of Quaternary Science*, 22, 9-35.
- Dieffenbacher-Krall, A.C., Vandergoes, M.J., Denton, G.H. 2007. An inference model for mean summer air temperatures in the Southern Alps, New Zealand, using subfossil chironomids. *Quaternary Science Reviews*, 26, 2587-2504.
- Walker, M.J.C., Berkelhammer, M., Björck, S., Cwynar, L.C., Fisher, D.A., Long, A.J., Lowe, D.J., Newnham, R.M., Rasmussen, S.O., Weiss, H. 2012. Formal subdivision of the Holocene Series/Epoch: a discussion paper by a working group of INTIMATE (Integration of ice-core, marine and terrestrial records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). *Journal of Quaternary Science*, 27, 649-659.