Holocene temperature in northern New Zealand: a southern imprint on the northern mould?

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The Holocene has been subdivided based on climate events best seen in the Northern Hemisphere that are thought to manifest globally (Walker et al., 2012). Due to its distal location from northern drivers, New Zealand (NZ) is ideally placed to test this assertion. We hypothesize that Holocene climate variability in NZ is mainly influenced by 'southern' features, like Southern Hemisphere insolation and summer duration, El Niño Southern Oscillation (ENSO) activity and the Southern Annular Mode (SAM). We test this hypothesis by comparing new preliminary pollen and chironomid temperature reconstructions from Lake Pupuke, Auckland, representing mean annual and summer temperatures, respectively, with integrated summer insolation (Huybers, 2006) and independent proxy evidence for ENSO and SAM. Our Pupuke pollen record shows that, after an initial warming phase leading into the Holocene, mean annual temperatures remained stable. The main shift in pollen assemblages is thought to reflect a change in moisture availability, rather than temperature, with driest conditions occurring in the last ca. 5000 yr. These patterns are broadly consistent with evidence for stronger ENSO variability during the late Holocene. In contrast, summer temperatures, reconstructed using an expanded version of the Dieffenbacher-Krall et al. (2007) chironomid training set, follow integrated summer insolation with minimum values between 14,000 and 12,000 yr BP, increasing to a late Holocene maximum around 3000 yr BP. Additionally, we find preliminary evidence of a late-Holocene cold phase, which potentially coincides with the Little Ice Age period as defined in the Northern Hemisphere. Therefore, whilst the global Holocene subdivision of Walker et al. (2012) provides a broadly applicable template, southern drivers are likely to dictate the precise timing and amplitude of Holocene climate variability in the South.