EGU2020-7285
https://doi.org/10.5194/egusphere-egu2020-7285
EGU General Assembly 2020

Holocene 6000-yr climate cycles in temperate and sub-tropical SST records – a cosmic ray connection?

Michael Asten
Monash University, School of Earth Atmosphere and Environment, Melbourne, Australia (michael.asten@monash.edu)

Temperature cycles with periods > 2000 yr, including peaks of order 6000 yr, has been reported in 14C proxy records in sediments for Fennoscandia (Olsen et al, 2005) and in glacier geochemistry for the Greenland ice-sheet (Mayewski et al, 1997, 2004). Similar spectral peaks are also seen in 14C and 10Be isotopes in Greenland GRIP ice-cores (Xapsos, 2009); these cycles have been attributed to solar sunspot activity (Solanki et al, 2004). Complicating the question of existence of global millennial cycles, a comparison of d18O data in ice cores for Greenland (NGRIP) and Antarctica (EDML) has shown that for events prior to the Last Glacial Maximum (LGM), variations on the scale of 2-6kyr are markedly stronger in northern hemisphere records, associated with ice dynamics and Dansgaard–Oeschger (D-O) and Heinrich events (EPICA, 2006).

This paper discusses ocean sediment cores from three temperate zone and sub-tropical sites which provide sea-surface temperature (SST) histories using the UK37 proxy. The available time spans are 20, 70 and 136 ka. This study restricts the three records to 0-20ka thus avoiding complexities of D-O and Heinrich events, and of the associated phase changes between hemispheres which have been discussed by EPICA (2006). We apply Lomb-Scargle spectral analysis and find that all three sediment SST records (Okinawa Trough, Murray Canyon south of South Australia, and Iberian Margin) show a high-confidence 6000 yr period spectral peak for the time span 0-20ka; we may conclude that this post-LGM peak is unlikely to be related to glacial-epoch ice dynamics. The same 6000 yr spectral peak also shows in 0-20ka EDML d18O data from EPICA (2006).

The three SST records also show spectral peaks in the range 1000 to 3500 yr periods. The high-resolution Okinawa Trough shows a clear 2300 yr (Hallstatt) peak and the Iberian Margin similarly. The peak is visible on southern hemisphere Murray Canyon data but is of doubtful significance. A unique feature of the Iberian Margin data is a strong 3400 yr spectral peak. This peak is also visible but much weaker on the other SST records, and on the 0-20ka EPICA d18O data. We hypothesize the strong peak for the Iberian Margin is a consequence of effects of ocean and ice dynamics in the north Atlantic.

Similar spectral analysis of limited 10Be data from McCracken et al 2013, (available length limited to 0-10ka) supports the hypothesis that millennial cycles in temperature (especially the 6000 yr and 2300 yr periods) are global and associated with cosmic ray/solar magnetic activity. This is in contrast with the longer Milankovich cycles which are well established as being primarily related

to forcing associated with variable solar insolation.