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Time series analysis of long term palaeoecological records for the understanding of climate change impacts on vegetal ecosystems

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To investigate the impacts of global climate change on plant ecosystems, forest response to natural climate variability through glacial-interglacial cycles is explored using long-term records from Antarctica and Greece. 414,000 years of atmospheric CO2 concentrations and temperatures (T) derived from the Vostok ice core (Antarctic) are utilized as a climate dataset and compared with the high-resolution arboreal pollen (AP) record at Tenaghi Philippon (Greece) to establish phase relationships. 1,000 year timestep time series analysis is performed to study AP autocorrelation and lagged cross-correlations with CO2 and T. Results show an expected AP significant positive correlation with atmospheric CO2 concentration, and a non significant negative correlation to Vostok-Southern Hemisphere temperature record. The non significance T-AP correlation could indicate the localisation of the Southern Hemisphere regional signal of the Vostok temperature record. A lagged response to CO2 is very significantly positively correlated to AP. It appears the 3,000 years previous global atmospheric CO2 concentration was important for forest build up at this Greek site. Further analysis shows a surprising significant positive correlation of Philippon arboreal pollen to standard deviation in T over the last 10,000 years at Vostok. This result highlights the positive effect of a Vostok noisy climate to Greek forest formation. These analyses show the potential contribution of time series analysis on long term palaeoecological records to understand ecosystem response to climate change. However, better world

wide distributed records are needed for this purpose and the next stage of this promising analysis. Work performed thanks to the NERC grant NE/C514474/1.