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Seasonality intensification and long-term winter cooling as a part of the Late Pliocene climate development

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Abstract

A mutual climatic range method is applied to the Mediterranean marine pollen record of Semaforo (Vrica section, Calabria, Italy) covering the period from ~2.46 Ma to ~2.11 Ma. The method yields detailed information on summer, annual and winter temperatures and on precipitation during the nine obliquity and precession-controlled 'glacial' periods (marine isotope stages 96 to 80) and eight 'interglacial' periods (marine isotope stages 95 to 81) characterising this time interval. The reconstruction reveals higher temperatures of at least 2.8 °C in mean annual and 2.2 °C in winter temperatures, and 500 mm in precipitation during the 'interglacials' as compared to the present-day climate in the study area. During the 'glacials', temperatures are generally lower as compared to the present-day climate in the region, but precipitation is equivalent. Along the consecutive 'interglacials', a trend toward a reduction in annual and winter temperatures by more than 2.3 °C, and toward a higher seasonality is observed. Along the consecutive 'glacials', a trend toward a strong reduction in all temperature parameters of at least 1.6 °C is reconstructed. Climatic amplitudes of 'interglacial–glacial' transitions increase from the older to the younger cycles for summer and annual temperatures. The cross-spectral analyses suggest obliquity related warm/humid–cold/dry 'interglacial–glacial' cycles which are superimposed by precession related warm/dry– cold/humid cycles. A time displacement in the development of temperatures and precipitation is indicated for the obliquity band by temperatures generally leading precipitation change at ~4 kyr, and on the precession band of ~9.6 kyr in maximum.

Keywords: Late Pliocene; obliquity; precession; palaeoclimate; pollen

1. Introduction

Research into the Late Pliocene climate is of especial interest as it contributes to the understanding of

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