



Climate and vegetation change during the Holocene in southern Iberia

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Detailed pollen analysis has been carried out on several sediment cores taken from high-elevation alpine lakes and bog areas located in Sierra Nevada and coastal and offshore environments from southern Spain. The early Holocene is characterized in these records by the highest abundance of arboreal pollen, indicating the warmest and wettest conditions in the area at that time. The pollen records show a progressive aridification trend since the beginning of the middle Holocene through a decrease in forest species and the increase in xerophytes. The progressive aridification is punctuated by millennial-scale periodically enhanced droughts that coincide in timing and duration with well-known arid events in the Mediterranean and other areas. A relatively humid period occurred during the Iberian-Roman Humid Period. The Medieval Climate Anomaly (900-1300 AD) was characterized by a wet phase at first, coinciding with a solar minimum, and a later arid phase, coinciding with the Medieval solar Maximum and a positive NAO. The Little Ice Age (1300-1850 AD) was markedly wetter than earlier, as shown by the increase in tree pollen, coinciding with a phase of negative NAO and the Maunder solar minimum. This study shows that vegetation and climate in the Western Mediterranean are modulated by solar and atmospheric factors. Out-of-trend vegetation changes are observed in the last centuries, which probably indicate the high-impact of humans in the Sierra Nevada, with pasturing leading to nutrient enrichment and eutrophication of the wetlands, Olea cultivation at lower elevations and Pinus reforestation.