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Western Mediterranean vegetation and climate dynamics during the best astronomical analogues of the Holocene: evidence from a model–data comparison

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The suitability of MIS 11c and MIS 19c as analogues of our present interglacial and its natural evolution is still debated. Here we examine the regional expression of the Holocene and its orbital analogues over SW Iberia using a model–data comparison approach. Regional tree fraction and climate based on snapshot and transient experiments using the LOVECLIM model are evaluated against the terrestrial–marine profiles from Site U1385 documenting the regional vegetation and climatic changes. The pollen-based reconstructions show a larger forest optimum during the Holocene compared to MIS 11c and MIS 19c, putting into question their analogy in SW Europe. Pollen-based and model results indicate reduced MIS 11c forest cover compared to the Holocene primarily driven by lower winter precipitation, which is critical for Mediterranean forest development. Decreased precipitation was possibly induced by the amplified MIS 11c latitudinal insolation and temperature gradient that shifted the westerlies northwards. In contrast, the reconstructed lower forest optimum at MIS 19c is not reproduced by the simulations probably due to the lack of Eurasian ice sheets and its related feedbacks in the model.
Transient experiments with time-varying insolation and CO_2 reveal that the SW Iberian forest dynamics over the interglacials are mostly coupled to changes in winter precipitation mainly controlled by precession, CO_2 playing a negligible role. Model simulations reproduce the observed persistent vegetation changes at millennial time scales in SW Iberia and the strong forest reductions marking the end of the interglacial “optimum”.