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Comparison of simulated and observed vegetation for the mid-Holocene in Europe

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The mid-Holocene (8ka-6ka) has been traditionally considered as the 'optimum' climatic period, with temperatures warmer than today, and generally dryer conditions. The first indication that this may not be the case came from the continental scale reconstruction by Cheddadi et al (1997), in which the south and particularly the south-west of Europe showed cooler and wetter conditions. This was confirmed in a later study by Davis et al. (2003), which showed that this difference was not restricted to the mid-Holocene, but was part of a long-term opposition in climate changes between the north and south of Europe. Simulations of mid-Holocene climate using atmospheric general circulation models (GCMs) had little success in reproducing this difference (Masson et al 1998), with most models simulating a warmer and dryer climate across the entire continent. This has led to criticisms of the reconstructions, suggesting that the vegetation change results from wetter conditions alone. Vegetation depends on the availability of water, rather than the amount of precipitation, and this may be affected by both rainfall and temperature. A sufficient increase in precipitation may therefore be interpreted as a reduction in temperatures. Under scenarios of future change, the Mediterranean is expected to be one of the areas that is most affected. It is therefore important to understand the origins of this data-model disagreement, in order to assess their ability to predict climate in this region under different forcings. In order to test this, we have compared the vegetation of this region simulated by the vegetation model CARAIB (Otto et al, 2002; Laurent et al., 2008), run under mid-Holocene cli-

mate conditions as simulated by a new generation of coupled ocean-atmosphere and ocean-atmosphere-vegetation GCMs. This has enabled us to a) compare the output of these models; b) assess the climate forcing causing the change in vegetation by studying the output of those models in which a good match is found. The comparison shows a number of models in which similar vegetation changes were simulated, with increased presence and productivity of temperate groups and species in the western part of the Mediterranean basin. In other models, little change is seen from the present day, indicating that the inclusion of a dynamic ocean model is insufficient to reproduce the observed changes. The average GCM climatology of the models showing a good fit suggests that precipitation change is the most important parameter, with a marked increase in summer precipitation. This is, however, accompanied by a consistent reduction in winter temperatures, indicating that both changes are necessary to explain the mid-Holocene Mediterranean vegetation.

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