Clim. Past Discuss., 5, C423–C426, 2009
www.clim-past-discuss.net/5/C423/2009/

Climate of the Past Discussions

Interactive comment on "The MIS 11 – MIS 1 analogy, southern European vegetation, atmospheric methane and the "early anthropogenic hypothesis"" *by* P. C. Tzedakis

Anonymous Referee #2

Received and published: 7 July 2009

In his manuscript Tzedakis compares astronomical parameters, ice core and tree pollen data over the last 800,000 years as a basis for discussing the analogy of MIS 19 and MIS 11 to the current interglacial period (MIS 1). Identifying a past time period of similar astronomical parameters suggests climate responding similarly to the radiative forcing without additional anthropogenic forcing. How early the human influenced global climate in the course of the Holocene can not be finally answered. In the introduction Tzedakis summarizes very accurately the ongoing discussion of the "early anthropogenic hypothesis" over the recent years. The manuscript is well written and easy to understand.

Tzedakis adds pollen records representing southern European vegetation changes to test the quality of the analogy of MIS 11 resp. MIS 19 to MIS 1. Unfortunately, the presented pollen records do not deliver new insights on this analogy. Comparisons between different time periods are not very robust. They confirm what is known already from ice core and marine records.

The study uses the fact that the presented European tree pollen records are well correlated to the global atmospheric methane concentration reconstructed from the EPICA Dome C ice core. This is based on the assumption, that tree population is sensitive to the hydrological cycle in a similar way as microbial activity for methane production, methane oxidation, methane transport in the soil and extent of potential methane source regions. The correlation is certainly true for millennial scale variations and there are mechanisms that can explain it, as presented in Tzedakis et al., 2009. However, it has been shown that temperature variations during rapid Dansgaard-Oeschger events lead to variations in Northern Hemispheric sources that alone could explain the observed methane concentration variability at millennial time scales. But glacial-interglacial changes in atmospheric methane in addition certainly involves tropical source changes on a global scale. Looking at Fig. 3 I'm not convinced that, despite the proposed mechanisms, the presented regional pollen records (located north of 35°N) do well reflect the tropical climate signal and thus variations in tropical methane sources. I doubt that there is a strong correlation for interglacials between pollen records and atmospheric methane before or after removing common millennial scale variations. But this has to be shown.

Given the fact pollen records do co-vary with atmospheric methane except for the Holocene does not help very much in terms of aligning different time periods, this can be done easier using the methane record alone. Is there a reason why atmospheric carbon dioxide concentration has not been presented in the plots? It certainly has a bigger effect on the amplification of net radiative forcing than methane. Including carbon dioxide, a well integrated biochemical tracer of the climate system, in this analysis,

would help to improve the characterization of interglacials. In addition, how does the changing carbon dioxide fertilizing effect on plant growth affect the vegetation distribution of trees and grasses? Is this of importance for glacial-interglacial carbon dioxide changes in the order of 100 ppm?

The highlighted decrease in the abundance of trees in southern Europe and the atmospheric methane increase in the late Holocene are difficult to compare with their counterpart in MIS 11 and MIS 19. While in MIS 11 any statement depends on the alignment of the records, the conclusion for MIS 19 is rather weak due to the very low time resolution of the single temperate tree pollen record. This leaves the reader with some criticism concerning the terrestrial pollen record from Charco da Candieira and its agreement with the records from the deep sea cores. Is there an overlapping period for these records that could be shown in a graph? Do the pollen data sets from the different cores represent the same vegetation area?

Concerning the periods MIS 11 and MIS 1 it would be very interesting to plot all data in one figure using an alignment based on greenhouse gases and Antarctic temperature. Then leads and lags of pollen records and astronomical parameters could be discussed in a mechanistic way. Comparisons like in Fig. 4, where glacial-interglacial temperature increases are separated by more than 10 kyr are not really insightful. This is crucial, especially if one considers that ice core dating uncertainty is in the order of +/-1% or better. Generally, absolute and relative dating uncertainties of the presented data sets should be provided and included in the discussion.

It is well noted that any alignment for MIS 11 and MIS 1, using either precessional or orbital periods, does not lead to a convincing agreement in the paleo records and thus MIS 19 is the time period to consider as an analogue. As mentioned above the current analysis of the presented pollen records do not give strong evidence for or against the "early anthropogenic hypothesis" and needs to be improved qualitatively and quantitatively.

Interactive comment on Clim. Past Discuss., 5, 1337, 2009.