

## ***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 #1**

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The manuscript by Tzedakis compares data from MIS 1 to data from MIS11 and MIS 19. MIS 11 is often referred to as an analogue for the present Holocene. The manuscript elaborates on two questions: 1) How do MIS 1 and MIS 11 data have to be aligned so that the records show the reaction to the same forcing. The major question here is how long the present interglacial would last without human influence. Alignment by orbital frequencies offers two very different answers to this question. With precessional alignment the Holocene would be about to end now while it continues for another few millennia with orbital alignment. 2) Is the Holocene methane record already significantly influenced by human activities 5 kyr before now?

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The analysis by Tzedakis is based on the assumption that there is a strong correlation between the global methane concentration and the abundance of trees in Europe. This seems indeed to be the case for the last 800 kyr, the period covered by ice core records. However, this is not really a surprise since glacial interglacial changes leave their imprint on pretty much any paleo record. Also that there is a millennial scale change in the tree pollen records is not really surprising. It has been shown that so called Dansgaard-Oeschger events, millennial temperature changes in Greenland, represent large scale changes in the ocean and atmosphere from the northern polar region to the tropics and beyond. In that respect I would expect, and that has been demonstrated in Tzedakis et al., 2009, a correlation between the abundance of vegetation (here tree pollen) in the northern hemisphere and the northern hemispheric (Greenland) temperature record (represented by the methane record in Tzedakis et al., 2009). However, the correlation that is seen on glacial-interglacial levels and on the big, at least hemispheric, changes over Dansgaard-Oeschger events do not prove that such a correlation is also given for the relatively small changes observed over an interglacial period. Looking at Figure 3 I really have difficulties seeing the correlation between methane and temperate tree pollen, and methane and Ericaceae. There are some trends which can be found between some records. However, I would like to see a correlation plot. Even excluding the Holocene period I am convinced that there is no significant correlation between Ericacean and methane and not a very good one for tree pollen and methane.

I have a serious problem with the precessional alignment of the records. MIS 11 covers 2 precessional cycles. Is it clear which one to synchronize to once you persuaded yourself that precession is the orbital parameter to tune the records to? I think not. So just for the fun of it I propose an alternative precessional alignment (see figure 1). The consequence is that the Holocene still has a long time to go. Principally I think it is problematic to align the time periods according to orbital parameters. We do not really have a good understanding how glacial interglacial changes are triggered. Therefore the better alternative is probably to align cores according to the local temperature record. Taking into account the uncertainty of time scales we can then discuss what the orbital

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parameters are doing at times of glacial-interglacial change.

Detailed comments:

p. 1346, line 1-9: The Holocene records are from a different source than the rest of the pollen records. Is the land sequence quantitatively representative for the same region as the marine record? Whether or not Charco da Candieira reflects natural changes is a different issue. First the question must be if this site supposedly undergoes similar natural changes as the area which is represented in the ocean cores.

p. 1342: EDC time scales as any time scale comes with an uncertainty. EDC3 at termination V has an uncertainty of  $\pm 4$ kyr. This needs to be taken into account in the discussion.

p. 1343, line 11-14: I would agree if we would have a full understanding of the orbital forcing mechanisms leading to terminations. Since we don't I suggest synchronizing the terminations and taking into account the time scale uncertainties relative to the absolute time scale and see if we can find similarities in the orbital parameters.

p. 1348, line 25- p. 1350, line 7: I would like to see the termination I tree pollen before 14kyr and the termination V data before 425 kyr BP on figures 4 and 5. It looks like the tree pollen increase a couple of thousand years after methane increases. To me that is a clear sign that the tree pollen can not be taken as a proxy for local methane sources. We know that high latitude methane sources are responsible for a significant part of the glacial interglacial increase of the methane concentration. Clearly this is not represented in tree pollen records.

p 1342: As far as we understand from climate records going back to roughly 100 kyr the methane record can be taken as a good proxy for the northern hemispheric temperature. In fact pretty much everywhere except for Antarctica. In that respect the precessional alignment as of figure 2 shows a global delay of termination I vs. termination V by more than 10 kyr. How does that fit into the idea that MIS11 being an

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analogue for MIS 1?

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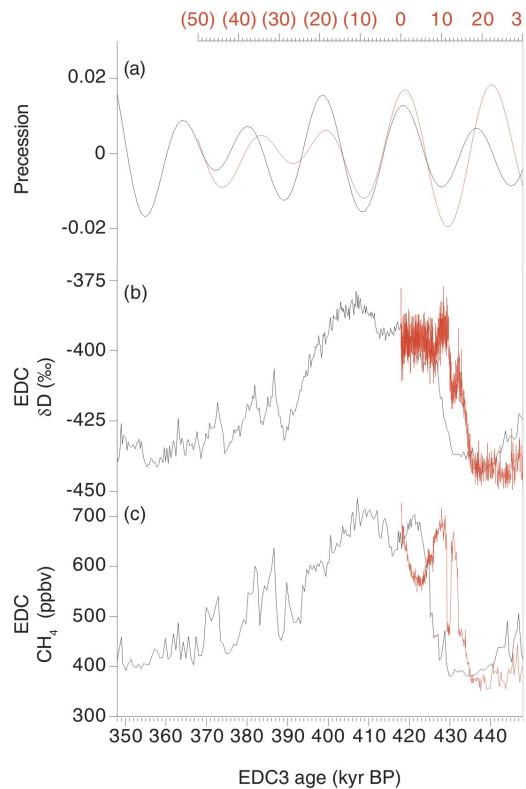
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**Fig. 1.** Alternative Precessional synchronization

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