Clim. Past Discuss., 8, C3350–C3358, 2013
www.clim-past-discuss.net/8/C3350/2013/

Climate of the Past Discussions

Interactive comment on "Deglacial and Holocene vegetation and climatic changes at the southernmost tip of the Central Mediterranean from a direct land-sea correlation" *by* S. Desprat et al.

S. Desprat et al.

s.desprat@epoc.u-bordeaux1.fr

Received and published: 13 February 2013

A- Response to major comments:

1- Chronological uncertainties:

Referee 1's comment: "Ln 251. The age-depth model is published elsewhere, but it is also necessary to discuss uncertainty here. Could the approximate GS-1 age boundaries be due to chronological uncertainty? Where other sites in the region appear to show a response to cooling, is there the same age range as in your study site? Ln

316 You discuss age uncertainty here. The start of GS-1 is also 300 years 'too old'. If you have an estimated reservoir effect of several hundred years, then this difference does not seem so large. This is worth more critical discussion, since the difference compared to MIS/ice core stage boundaries is not consistent. With this number and regular frequency of shifts in the early to mid Holocene, there is a danger of erroneous pattern matching"

The apparent age offset of the PZ3 zone compared to the NGRIP GS-1 may rely on dating errors. In particular, the age of PZ3 zone lower boundary does not appear significantly different from the age of the GS-1 onset in NGRIP, considering the dating uncertainties. Enhancement of the reservoir age during that event of reduced North Atlantic deep water ventilation may also be involved. We have applied a reservoir age of 400 years according to estimations from Siani et al. (2001) for the southern Adriatic Sea which do not show such an increase. However, similar offsets are observed in Fletcher et al. (2010) and attributed to increase of age reservoir of 200 years in agreement with estimations of North Atlantic surface water age reservoir (Cao et al, 2007). Surface water at our site is under the influence of the Atlantic modified water which may contribute to an increase of 200 years. However, further investigations based on independent dating methods have to be done to accurately estimate the GS-1 reservoir age change in the Mediterranean Sea.

We have added in the text: "Apparent age offsets between PZ-3 and GS-1 boundaries may be related to uncertainties on radiocarbon dating calibration and correction for reservoir age." We have changed section 4.3.1. accordingly.

Holocene reservoir age is not such a matter of debate as for the Late Glacial. We agree that matching centennial-scale variations of far distant records always remain tentative. However, changes in all records align quite neatly for most of the events. In addition, there are 5 radiocarbon dated levels for constraining the interval 9.5-5.5 kyrs and each of them have been dated twice, decreasing the uncertainties on dating. Several events in the Early - Mid-Holocene are located nearby to a dated level,

CPD

8, C3350–C3358, 2013

increasing the confidence in the age of these intervals. In Figure 7 (cf. Fig.2), we have added the calibrated dates with the dating errors of our sequence and in the text, we have made clear that Holocene centennial events from different records parallel within chronological uncertainties.

2-Paper length

Referee 2 recommends condensing the text. We acknowledge that it is a long manuscript with a large amount of information, although there is no length restriction for Climate of the Past papers. We have, however, considerably shortened section 2 and simplified some paragraphs in the discussion. The manuscript is one page and a half shorter with the modifications.

B- Response to other comments from Referee 1

1- Reviewer's on MAT results: "it is a shame that the Peyron paper, which comprises the most important aspect of the data analysis, has been presented separately."

Referee 1 finds regrettable that MAT analyses and results are presently separately in a paper of this volume. However, they are part of a complete work performed by two of the co-authors. Peyron et al.'s paper will present a compilation of the Holocene reconstructions from marine and terrestrial pollen records from the Mediterranean region.

The paragraph on MAT reconstructions has been revised following referee 1 suggestions: "Quantitative climatic reconstructions based on the Modern Analogue Technique (MAT) have been performed from the pollen dataset by considering the relative proportion of the different taxa in each pollen spectrum (Guiot, 1990). The methods and results for MAT application to our data are presented separately in Peyron et al. (this volume-a). We show, in the present paper, synthetized results of the annual, winter and summer temperatures (TANN, MTWA, MTCO) and precipitation (Pann, Psum, Pwin) estimations."

2- "Fig 2: y axis should read Age (cal yr BP). Caption should explain what the error

CPD

8, C3350–C3358, 2013

envelope is."

We have added: "Grey lines indicate the 1ïĄş error envelope."

3- "Ln 222 Why were only four samples analysed in PZ1? This seems to be a variable zone, so it would be valuable to analyse at a higher resolution to allow closer comparison with the pollen signals of PZ2 and PZ3."

This study has been achieved in the framework of the ANR project LAMA which focuses on the Holocene climate variability. This is why we have not been able to achieve a higher time resolution analysis of the PZ1 interval which corresponds to the beginning of the last deglaciation.

4- "Ln 249 PZ3 seems mainly to be characterised by a peak in Ephedra and a decline in temperate tree taxa. In Fig 4, there is not a clear second peak in semi-desert plants."

The second peak in semi-desert plants does not appear as prominent as the first one because of a decrease in Chenopodiaceae which is included in this group. However, it represents an increase of 13% at the transition GI-1/GS-1.

5- "Please discuss in more detail. PZ3 has some cereal-type grass pollen. Does this mean it is too difficult to split cereal type off, feeding into discussion below of agricultural signals?"

Cereal occurrence in PZ3 only corresponds to a single pollen grain in only one sample. We do not think it is not worth discussing it in more detail in the manuscript considering the recognized uncertainties on the cereal pollen identification. We have based cereal-type pollen identification on classical criteria based on grain size and pore and annulus diameter. However, separating cultivated from wild grass pollen is a difficult task. Some wild Poaceae also produce large pollen grains that are undistinguishable from the domesticated grass pollen (Tweddle et al., 2005; Behre et al., 1981).

6- "Fig 4: caption should specify whether Pinus is excluded here from the tree sum."

CPD

8, C3350–C3358, 2013

"Figure 4: Vegetation and climatic changes on land over the last 18,000 years. From the bottom to the top: tree (excluding Pinus) and shrubs (grey) and total (white) pollen concentrations"

7-"Ln 294 This argument assumes no time lag in response here and in the Alps. Would be useful to add some discussion linked to distance away from refugia. Alps are more likely to have lower altitude Quercus, which might cause differences in apparent response time to climate shifts?"

We have demonstrated p. 9 that oak populations were present in northern Tunisia during HS1, at least in NW Tunisia, supporting that refugial zones for oak were close to our site. This implicitly involves that time-lag due to migration from refugia is not affecting the forest expansion in our record. This is also valid for the SW Mediterranean pollen records from the Alboran Sea. For Lago Piccolo di Avigliana which is located at 350 m asl at the southern edge of the Alps, Finsinger et al. (2011) stated the delayed Quercus expansion during GI-1 is not resulting from time-lag due to migration from refugia but actual climate change. We will not add discussion on site distance away from refugia to avoid complicating the manuscript section on deglacial abrupt climatic changes.

8- "Ln 367 This statement is not clear – please reword."

We have replaced this statement with: "After 5 ka, while dryness increased on land, the SSTs show a moderate warming. This is confirmed by increasing abundances of warm water dinocysts (Rouis-Zargouni et al., 2010)."

9- "Fig 6: It would be useful to extend this diagram back to before GS-1, if some of the other records extend that far back?"

Amongst the six records shown in Figure 6, only the Tunisian speleothem record properly covers the entire deglaciation. The sequence from Lago di Pergusa also extends back to the Last Glacial period. However, PRG1 core has apparently a gap or a very

CPD

8, C3350–C3358, 2013

reduced sedimentation rate for the interval of the last deglaciation (Sadori et al., 2008).

11- “Can you justify correlating pollen with the mid-Europe inferred lake-level data, however, since you note the seasonality effects earlier on.”

We acknowledge the potential contrasting seasonality of precipitation signals between the Mediterranean (winter-dominated) and mid-European (summer-dominated) records. Fletcher et al. (2012) who proceeded to a similar comparison between changes in Western Mediterranean vegetation and Mid-European lake levels proposed that several mechanisms may be implicated to link precipitation changes in both seasons. In particular, they call upon studies using recent climatological data and modeling showing inter-seasonal climate memory, an influence of winter climate on summer circulation patterns and links between Mediterranean winter rainfalls and mid-European summer dryness and warmth (Ogi et al., 2003; Wang et al., 2011; Vautard et al., 2007).

C- Response to other comments from Referee 2

1- “Title: I find the present title less than ideal with regard to its content and also too long/complex.” We have changed the title as follows:

“Deglacial and Holocene vegetation and climatic changes in the southern Central Mediterranean from a direct land-sea correlation”

2- “I suggest to add an additional figure or to significantly modify Fig. 1 in order to enhance clarity.”

As recommended, we have added a map showing all the sites mentioned in the text.

3- Referee 2 states that dry conditions during the first millennia of the Holocene are not only recorded in the southernmost areas of the Mediterranean region, but also in the NE Mediterranean region.

We have modified this sentence accordingly: “In addition, delayed forest expansion in some parts of the Mediterranean region suggests that dry conditions may have per-

CPD

8, C3350–C3358, 2013

sisted into the Holocene (Tzedakis, 2007; Kotthoff et al., 2008a)."

4- Referee 2 asks to better constrain the pollen sources

In section 2, we have added information on winds during the main pollination season which reinforces that northern Tunisia is likely the main pollen source region.

5- The reviewer asked to specify information on volume of the samples and TOC content.

We have indicated the volume of the processed samples. However, TOC content has been analyzed at very low resolution and we do not discuss these data in the present paper. TOC content data are already presented in Rouis Zargouni et al. (2010).

Interactive comment on Clim. Past Discuss., 8, 5687, 2012.

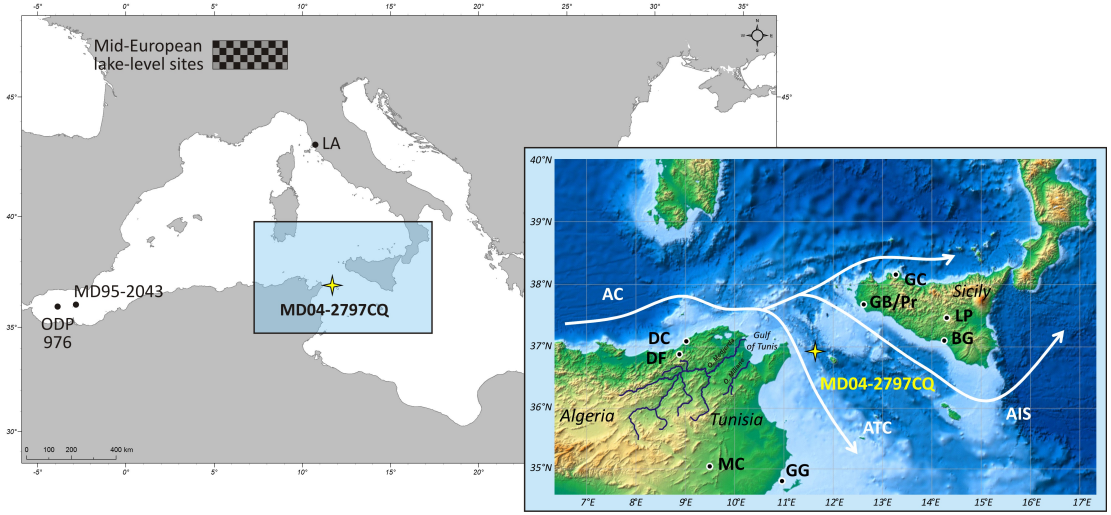

Fig. 1.

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

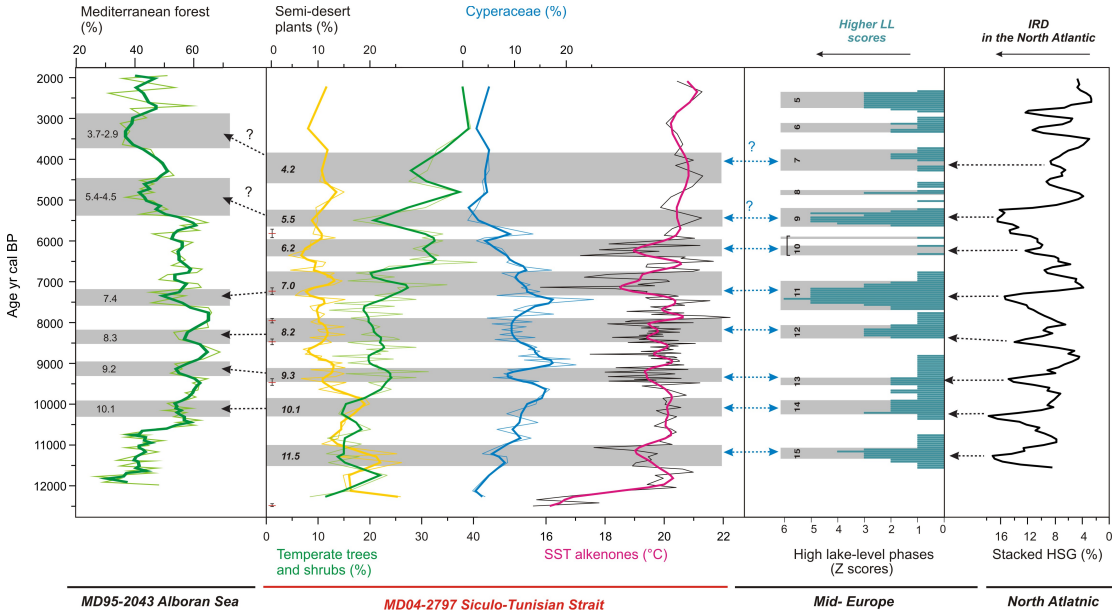

Fig. 2.

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper