

We would like to thank the referee 1 for valuable comments on our article. Please find below our point-by-point replies (in blue) to the comments (in italics)

-My main concern with this paper is about the lack of discussion of the estimates obtained by the pollen data. This is a very common behavior: the authors estimate climate parameters with their pollen data but do not explain what pollen changes triggered those changes in the climatic parameters and if they make sense. For example, in these estimations the summer precipitation maxima occurred during the Holocene climatic optimum. Following this study, precipitations were higher than 200 mm at ca. 7000 cal yr BP (Fig. 3). This was estimated based on what pollen species?

We used the Modern Analogues Technique to infer the precipitation estimates. In this method, the reconstructions are not based on only one taxon but are rather based on pollen assemblages (with the whole dataset) and on their comparison to present-day pollen assemblages (modern samples) and related climate. Therefore it is difficult to link climate changes to a specific pollen taxon. However we state that the increase in summer precipitation is correlated to the extension of the deciduous *Quercus* forest expansion on the Adriatic borderlands. The modern analogs selected around 7000 cal BP are samples collected in temperate deciduous forests from Italy, Bulgaria and Germany). According to the relevant comments from the referees, and because our concern is to provide a robust reconstruction, we have applied to the dataset a second method: the WAPLS which is also commonly used in paleoclimatology and which is a real transfer function (in contrast to the MAT). The resulting new figure now includes results based on both methods with errors bars (for the MAT); the figure shows unambiguously very similar results obtained with the MAT and the WAPLS. A short paragraph on the WAPLS description and on the method comparison has been added in the text.

This is quite a lot of summer precipitation. On the other hand, winter precipitation was lower (around 150 mm)? However, the area was then characterized by a Mediterranean climate (Fig. 1)? Could this be due to the river pollen transport from the Alps? Or are you assuming a summer monsoon? This is a very controversial topic reviewed by Tzedakis (2007).

Yes we reconstruct an important increase in summer precipitation which is corroborated by independent data collected in south Italy: we note at the same time high lake-levels (see Magny et al., 2012, Magny et al. this issue) which has been interpreted by M. Magny as an increase in summer precipitation.

In a new figure, the results based on the MAT and the WAPLS show unambiguously an increase of summer precipitation during the mid-Holocene. The climatic trend is very similar; however the range is quite different: for example, with the WAPLS the area was still characterized by a Mediterranean climate during the mid-Holocene. The MAT summer precipitations may thus be slightly overestimated while the winter precipitations being underestimated. We think that the most important findings is that the climate trends inferred from both methods are very comparable, both evidencing an increase in summer precipitation at ca 7000 BP even if the reconstructed range is different.

We know the Tzedakis hypothesis. However, in this study we are not able to validate or not the Tzedakis assumption because it will be very ambitious to correlate the summer precipitation increase to a possible summer monsoon from our single record.

What is probably correct is to state that the Adriatic marine core is located at the junction of North-South and west-east climate influences, which may have caused the complex pattern characterizing the mid-Holocene. The core was then possibly influenced indirectly by the monsoon but our data alone do not allow to validate/refute this hypothesis so far. Further investigations are needed.

Concerning the river regime, the clay mineral record indeed evidences enhanced supply from the Po River (high I/K ratio) and/ or from local Rivers (high S/K; CPD submitted paper, figs 7 and 8) during the mid-Holocene. Such riverine supplies result either directly from increased precipitations over the drainage basin and/or from seasonal snowmelt flooding – both ultimately reflecting enhanced precipitations over the studied area.

Were temperatures (TANN) higher during the YD than during the Holocene? The lowest TANN of the past 13 ka was reached at ca. 7.5 ka? Please explain.

The new figure shows that the temperatures using the WAPLS were lower during the YD than during the Holocene, which makes sense. It suggests that the MAT might not to be relevant for reconstructing climate changes during the Younger Dryas and Preboreal (Ortu et al, 2009). However, the results obtained for the Holocene period are very consistent with both methods. Furthermore, the lowest temperature value reached at ca 7500 also makes sense. The anomaly pattern depicted here follows the “classic” pattern of the Holocene climate as shown by Davis et al (2003) (see the comparison between our curve and the reference ones from this work in old Figure 6 and new Figure 7) in which the lowest temperature anomalies occurred during the mid Holocene

Section 6.2. Precipitation

-What pollen species are giving us information about summer and winter precipitation?

Pollen based reconstruction are not based on only one or two species but on the whole assemblages. The composition of the assemblages and the associated climate is detailed in the table 2.

-The maximum in precipitation (PANN) is reached during the Holocene climate optimum. That makes sense. However, how do you know that the precipitations did not occur during winter, as indicated by the speleothem records (lines 21-23)? How do you explain climatically such high summer precipitations, higher than during the winter? –

Comparing reconstructed temperatures obtained using the MAT/WAPLS methods may help puzzling out such contrasted observations. Indeed, summer precipitations as reconstructed by the WAPLS are high but still lower than winter precipitations (see new Figure). Moreover, both methods indicate that precipitation occurred all year-long during the mid-Holocene: the amount of winter precipitation shows a regular increasing trend during the whole Holocene, while maximum precipitation that characterized the mid-Holocene seems to results mainly from summer precipitation increase (Fig. 3), as evidenced by the development of the altitudinal forest (Abies for example) associated with deciduous forest taxa (Fagus, Corylus, Quercus, ...). The

contribution of summer precipitation thus appears to be most important during this specific time slice. The climate explanation for such high summer precipitations is thoroughly discussed in a paper based on the southern core studied in the LAMA project (off Tunisia, Desprat et al, 2013) and in the synthesis paper (Magny et al., 2013) of this special issue. Then it will have been redundant to include the same discussion in our paper and we thus refer to these two papers for an extensive and detailed debate on the subject.

It seems we have here expression of the regional climate. Perhaps it corresponds to an indirect influence of the monsoon given that the core is located at the junction of the North/south and West/east climate influences. In that frame, the discrepancies between our data and the speleothem records may thus reflect regional versus local climatic patterns.

Lines 11-13: If climate was driven by insolation changes the estimated temperatures would not record minima at ca. 7.5 ka.... they would record maximum values. -It is interesting to see how the authors explain the observed vegetation changes mostly triggered by changes in summer precipitation. However, this would imply important atmospheric reorganization during the Holocene, as summer precipitation is basically zero in the Mediterranean area Today and what really controls the humidity and thus vegetation is winter precipitation (and the North Atlantic climate dynamics).

It has already been shown that the temperature were lower at the mid Holocene in the south Europe and our record fit well with the general pattern developed by Davis and Brewer which is based on more than 500 pollen data. The observed vegetation at this time is not really a strict Mediterranean forest as lot of deciduous trees (Fagus, Corylus, Quercus, ...) and conifers (Abies) were more developed than the classic Mediterranean taxa (Q. ilex, Pistacia, Olea..), suggesting summers with more precipitation, associated with higher (up to 900 mm) than today PANN (annual precipitation).

Other minor comments:

Minor comments are taken into account in the revised version of the paper and I address below to specific questions.

Abstract: Change “to” for “look at” . Pollen data is plural: correct “allow us” Remove the second “vegetation” from line 10 Change “southern-western” for “southwestern”.

Corrections have been done in the revised manuscript

Introduction: Change “heat” for “warming” (line 4). The last sentence needs to be rewritten: the authors analyzed the clay fraction, not just “dust” so I would change that sentence for: “By examining the clay fraction we will be able to discuss...”.

Corrections have been done in the revised manuscript

Text (section 2) and Table 1: AMS 13C ages? Radiocarbon dating is based on 14C decay...not 13C! Correct in page 14 (line 20) and also the reference by Siani et al., 2004!!!

The mistake between 13C and 14C was a typology error that has been repeated again and again in the text. We apologize for that.

Section 3.3. Line 17: what does “ecological significance” mean? How does it control the vegetal organization? Do you mean elevation?

Ecological significance means requirements. We will change this term in the revised version.

Section 3.4. Line 21: Italian “coast”.

OK.

Section 4.1. The lack of pollen in the upper 80 cm of the core is very interesting. The authors believe is due to poor pollen preservation, but related to what process? More oxygenation? Is this somehow related with climate change?

We have no specific explanation about this decrease in pollen preservation. We observed less pollen and the rare grains are badly preserved. May be it is related to oxygenation but the other proxies performed on the same samples do not bring any information that allows to explain that. So it remains uneasy to link this pollen lack to climate influences.

Section 5. Sentence starting in line 7: Please change: “This supports the paleoecological inferences coming from the MD 90-1917 core, revealing regional vegetation changes due to climatic events during the last 13000 cal yr BP in the central Mediterranean area.”

We have changed the sentence in the revised manuscript

-Line 18: Change “prevailing” for “prevailed”. Correct: “in the Adriatic basin”.

OK

-Paragraph starting on line 20: Add some discussion about why the Preboreal oscillation occurred earlier in this record than globally. For example, is it due to age control uncertainties?

We are not sure that this apparent time lag is linked to age uncertainties: it is a working hypothesis. Nevertheless it is really surprising that our pollen record is consistent with continental vegetation data whereas pollen data displays a time lag when compared to ice core record and though marine data appear rather in accordance with the ice core record. If we have a look of the age error bars in the studied core, the time lag during the Preboreal when compared with the ice core record may be less significant as we have only two dates in this part of the core. In addition, Foramifer study experiences a low resolution during this time-slice and then could be less detailed to show the PB event.

-Line 23: I don't think Quercus, Carpinus, Corylus or Abies are thermophilous taxa...maybe "more" thermophilous taxa than the steppe plants but they are mostly temperate. I would then add "more thermophilous" taxa there.

We will change the term of thermophilous taxa in temperate.

-Page 14, line 20: 14C!!!

The mistake between ^{13}C and ^{14}C was a typology error that has been repeated again and again in the text. We apologize on that.

-In page 14 the authors discuss about the inferred SST records obtained by foraminifera and alkenones from the same core. Why are these plots not shown here? I think they would be very useful for comparison and interpretation of the pollen data.:

SST plots are included in another paper already published in the same special volume and we refer to this paper for convenience. However, we have added the foraminifer SSTs in the revised version of the paper to make the comparison easier.

-Line 23: Please explain why. Are planktonic foraminifera only affected by temperature? With respect to the vegetation, what kind of precipitation changes? An increase? Please specify.

Planctonic foraminifers are also sensitive to salinity changes that may be due to river inputs.

In fact, the PB – PBO events succession is marked first by increase in precipitation followed by a slight decrease before the general improvement of climate.

-Line 25: rewrite the sentence: "...dominated by Quercus with regular occurrences of Corylus, Carpinus...".

Corrections have been done in the revised manuscript

Page 16: Please use past tense when talking about the past. For example in line 2: "Quercus became less abundant while...increased".

Corrections have been done in the revised manuscript