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Interactive comment on "Abrupt climate variability of eastern Anatolia vegetation during the last glacial" *by* N. Pickarski et al.

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Interactive comment on "Abrupt climate variability of eastern Anatolia vegetation during the last glacial" by N. Pickarski et al.

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This manuscript is quite interesting and provides a high-resolution pollen study with new elements for the knowledge of the paleoclimate of the Near East during last glacial.

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Interactive Discussion
Discussion Paper

In my view this is a valuable contribution to the understanding of how a far away region could respond to North-Atlantic changes. I encourage the authors to take into consideration the following general comments and the specific points included in the attached file. General considerations Considering the chronology of the record (already established and published in other articles) I wonder about the perfect correspondence existing between PAZ and MIS.

Many papers demonstrated that vegetation phases are not always synchronous with marine isotope stratigraphy. I guess this is due to the criteria used to establish the chronology of the core, that mostly consisted in synchronization of marine lowering/increasing of temperature and terrestrial reduction/expansion of AP. The authors should admit they could not be always in phase. They just discussed it for the (obvious and expected in my opinion) lack of correspondence between the timing of some Dansgaard–Oeschger (DO) events and pollen expansions. We are still far away by obtaining correct chronologies and we have always to admit that lacking of perfect matching could either be due to problems in dating or to time-lag between terrestrial response to ocean changes.

Dear Laura Sadori,

Thank you very much for your insightful suggestions and useful recommendation to improve the quality of this manuscript. I believe that we can make essentially all of the modification easily and it would be our pleasure to do so. Concerning your question about the perfect match between PAZ and MIS, we admit that our chronology is not independent. It is chronology based on event-stratigrapgy. As already discussed and described by Stockhecke et al. (2014), the independent proxy records based on high-resolution XRF measurements (Kwiecien et al., 2014), TOC (Stockhecke et al., 2014), and pollen data (Litt et al., 2014) were used for the age-depth model construction. This proxy record was correlated and finally visual synchronized by using 'age control points' to the e.g. NGRIP sequence (to avoid misunderstanding, we add some more information about the construction of the age-depth model in section '3.1. Chronology').

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However, the age-depth model of Stockhecke et al. (2014b) is based on tuning with the NGRIP event stratigraphy. The correlation points of the Lake Van sedimentary record have been mainly defined by abiotic proxies (i.e. TOC) caused by a higher time resolution of this data set in comparison to the pollen samples available during that time. Even if we present a high-resolution pollen record in this manuscript, leads and lags between different biotic and abiotic proxies related to climate events have to be taken into account.

'In any case, we cannot expect a perfect matching between biotic and abiotic proxies related to climate events due to their different response time. In addition, the lack of correspondence between the pollen signal and the timing of some DO events could also be explained by uncertainties in the current age-depth model. Still, as expected from various eastern Mediterranean pollen records, the Lake Van pollen record documents that temperate taxa tend to reach their maxima after the onset of a warming phase and, therefore, lag behind the Ca/K increase, which responds immediately to climate changes (Fig. 5).' We considered the mismatch between climate changes and vegetation responses an now expand this issue in the discussion.

Page, Line: Comment

Introduction

3344, 1-2: See also the crater lakes from Lazio: Valle di Castiglione, Lagaccione, Lago di Vico, Stracciacappa (e.g. Follieri et al. 1998, Quaternary International) and Lake Prespa (Panagiotopoulos et al. 2014, Climate of the Past. 10: 643-660) and Lake Ohrid (Lezine et al. 2010. Palaeogeography, Palaeoclimatology, Palaeoecology 287, 116-127).—- We have added the crater lakes in Italy, Lake Prespa, Lake Ohrid and their related references.

3344, 19-20: Detailed high-resolution pollen analysis for the last interglacial (between ∼100 and 800 year) is documented in (Pickarski et al., 2015).—- Changed to: 'A detailed high-resolution pollen analysis (between ∼100 and 800 years) for the last inter-

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glacial (131.2-111.5 ka BP) is documented in Pickarski et al. (2015).'

Regional setting

3345, 2: . . .lake (max. depth > 450 m, surface area $\sim$ 3600m^2), situated. . .—- Changed to: '... lake (3,574 km^2; max. depth >450 m), situated. . ..'.

Material and methods

3347, 12: no previous ones? —- Thank you very much for this important hint. We added Reille (1998, 1995).

Results

3349, 15: documented —- Changed.

3349, 15: In which types have been oaks divided? What about the abundant semideciduous oaks that can be distinguished by deciduous ones and provide a different climate signal? —- At Lake Van, we were able to distinguish between deciduous Quercus and evergreen Quercus (as described in Wick et al., 2003 and Litt et al., 2009). During the last glacial-interglacial cycle mainly deciduous oaks occured. In this manuscript, evergreen oaks were not presented in the pollen diagram due to their negligibly low percentages during the last interglacial (Pickarski et al., 2015) and their total absent during the last glacial period (this study).

3349, 19: Here charcoal concentration is properly expressed, see my note in fig. 2 —- Thank you very much for this advice. We corrected the issue with our inconsistent expression throughout the manuscript.

Discussion

3350, 9: do you really think that only temperature was a key-factor? What about humidity? —- We added: '. . .and/or too cold or dry to reach the climate optimum. . ..'

3350, 10: and dry —- Done.

3350, 21: again, you do not consider the role of wetness —- Done.

3351, General comment: the diagram of fig. 3 starts with 5e. Even if I understand why, you should include some comments on it. —- The reviewer is fully right. We rewrote the first section of 'MIS 5e-5a' and added some more information/comments of the last interglacial stage.

3351, 11: 'continentality', again, also for this definition wetness is important —- Changed.

3351, 12: 'In accordance with the last interglacial (MIS 5e),. . ..', please make it clear, rephrase. —- Changed. See reply above.

3351, 17: insert space —- Done.

3351, 27: conifers —- Changed.

3352, 3: I agree. Most studies pointed out that the available fuel (plant biomass) made the difference in fires (e.g. Vanniere et al. 2011, Holocene; Sadori et al., 2015- Plant Biosystems). —- Thank you very much for your comment. We added the publications you mentioned.

3352, 8-10: I agree with this interpretation. —- Thank you very much.

3353, 1: present-day —- Removed. See reply below.

3353, 1-4: Please say it in a clearer way. You use present-day precipitation to infer past vegetation conditions. —- We have revised the entire section "5.2. Abrupt climate changes during 4-2" to place the work more clearly in the context of the existing body of knowledge. Therefore, we removed the sentences about the present-day precipitation in eastern Anatolia.

3353, 5: why cf.? I wonder with what it could be confused. —- This is a very valuable remark, thank you. We changed 'Carpinus cf. betulus' into 'Carpinus betulus'.

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3353, 7-9: Is this a speculation of yours? —- Yes, it was a speculation of ours. We removed this sentence from the manuscript.

3354, 18-19: Can it be a problem of chronology? Which are the tie points used in this period? —- Yes, it can be a problem of the chronology. The lower resolution pollen record from Litt et al. (2014) was not used as tie points during the last glacial. Here, for clarity, we revised this section as follows: 'In general, the abrupt variability of temperate AP from Lake Van and δ18O NGRIP values are more or less synchronous (Fig. 4). Leads and lags between the proxy records, illustrated in detail in Fig. 5, are difficult to assess due to their heterogeneous resolution. Here we have to mention again, that the Lake Van pollen record was not directly used for determination of 'tie points' for the chronology of the last glacial due to its low resolution (Litt et al., 2014; Stockhecke et al., 2014a).'

3354, 19: Still, as expected, we recognized ....—- We revised the entire section 5.2., see reply above.

3357, 16-22: Please consider that this is also clear in many pollen records from central Italy (Follieri et al. 1998, Quatern Int 47/48, 3-20). Even if the sequences are plotted only against depths, a number of C14 ages is supporting the existence of a number of significant mesophilous trees expansions. —- We added the pollen records from Italy and rephrase this sentence as follows: 'Despite the intensive aridification in eastern Anatolia during glacials, the vegetation composition of Lake Van and the Levantine Basin differs from the terrestrial Mediterranean pollen records. Firstly, drought-sensitive taxa such as Ulmus, Carpinus betulus and Fagus were frequently present in Italy, e.g., at Lago Grande di Monticchio, Valle di Castiglione, Stracciacappa and Lagaccione (Allen et al., 1999; Follieri et al., 1998) even during stadials. Secondly, the high-resolution Tenaghi Philippon and Ioannina sequences (Müller et al., 2011; Tzedakis et al., 2002) show that thermophilous trees (deciduous Quercus) increased rapidly during each interstadial without migrational lags (Fig. 4G, F).'

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Figures

Figure 2:

3370: the unit of measure is not cc, but pollen grains/ccX1000. It has to be adjusted also for other taxa. —- Changed, see reply above.

Figure 3:

3371: Total oaks? —- We changed ‘Quercus’ into ‘deciduous Quercus’.

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/11/C1988/2015/cpd-11-C1988-2015-supplement.pdf

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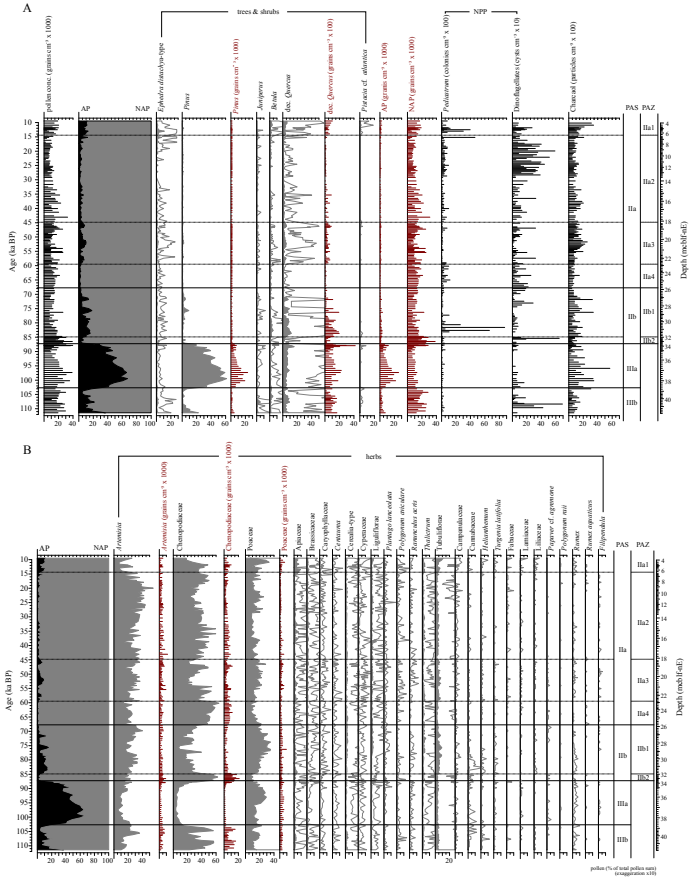

Fig. 1.

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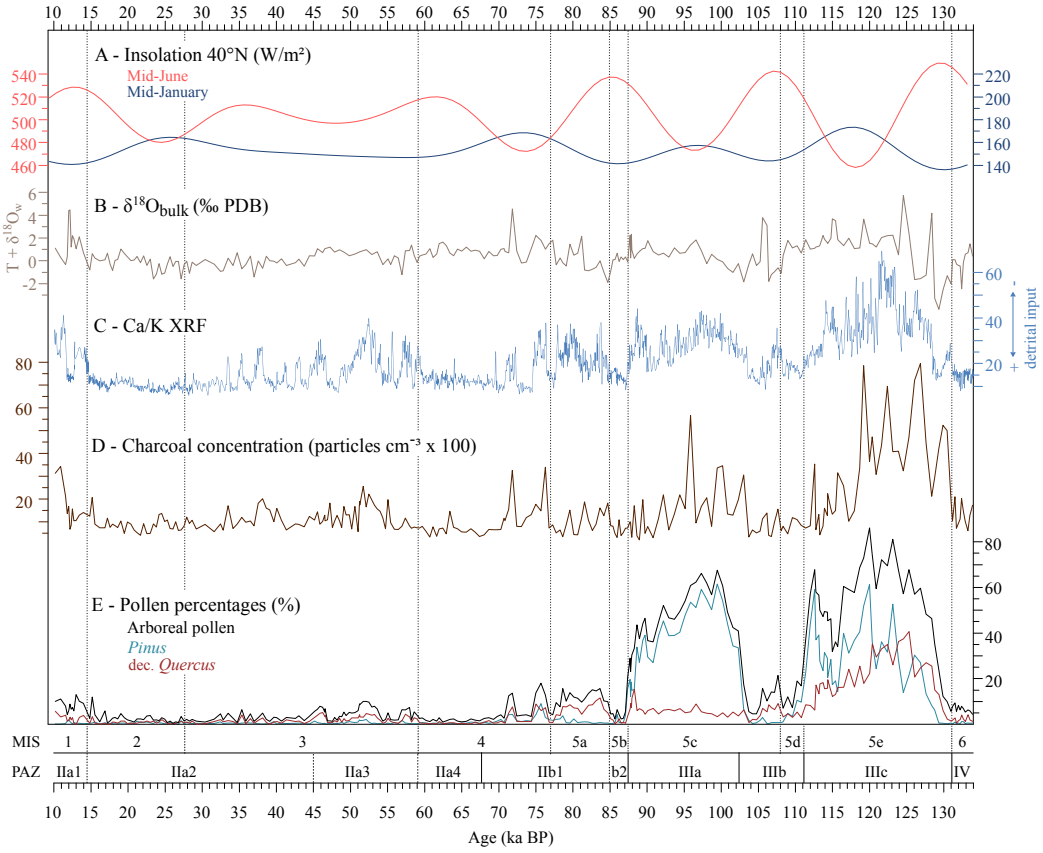

Fig. 2.

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