Reply to Ludwig Zöller's review

We are very grateful for your review, Prof. Zöller, and fully agree that paleoclimatology isotopic geochemistry requires comprehensive explanation, especially to set down fundamentals. We will take benefit of your review to be more accurate and to further develop the pre-requisite and the limitations of the method.

* We thank you to call attention on publications by Buggle et al. 2008, 2009 and 2010 and Sebe et al. (2011). We added these points of view in our discussion.

* Paleotemperature between LGM and missing modern analogs.
We agree that unfortunately modern analogue are missing and that ideal modern analogs don't exist. This equally because such cold temperatures are actually present far north under a quite different diurnal cycle than what can be found at mid latitude in the past. This long daylight during summer (growing season) decreases a little bit the stress induced by the low temperature and won't anyway provide good modern analog of past climate. We added the speculativeness of this part (§4.2). Nevertheless by looking at Hatté et al. (2009) we forgot to mention, ecological niche under low CO_2 concentration and at equivalent latitude (run was performed at 47°40'N 6°30'E) for Dwarf Shrub Tundra and Shrub Tundra (expected biomes for the glacial period) yields for mean annual temperature lower by 10-15°C than reference point set at 9.5°C, i.e. MAT of -5 to 0°C. Such a range can not be associated to more than 8 months of temperature lower than 0°C. We also added this reference in the revised manuscript (§4.2).

* Gocke references
We will refer to Gocke study to illustrate the strict difference between typical loess where we authorize paleoclimatic interpretation and paleosol where Gocke et al use to work and where we know and write that only general paleoclimatic trends can be extracted. We already included Zech et al. reference that is more relevant by using equivalent geochemical tools than Gocke et al. but from the paleoclimatological point of view instead of the modern soil science one, taking into account the clear difference between both facies. Modern soils are associated to a more than 15kyrs temperate forest vegetation, no mineral accumulation, temperate humid climate and are the result of strong and efficient pedogenesis that might lead for 2 meters deep, highly organic soils. This is quite different from last glacial conditions with high mineral sedimentation, very weak and short rhizospheric vegetation, drastic cold and dry climate that all didn't provide conditions to develop real pedogenesis and led for few pseudo-gleys of few centimeters (presumably during the most developed interstadials) intercalated between typical loess without any pedogenesis and without any soil. Knowledge from modern soil science can not be directly transposed to the past. To partly illustrate this point, we also added recent papers of Finke and collaborators (Finke et al., 2008, 2012; Yu et al. 2013) who clearly show that conditions to elaborate modern and developed paleosol soils are quite different from what was available during glacial times.
A paragraph is added in introduction.
We also added information along the manuscript.

* Technical corrections

page 190, line 2: we effectively missed palynology. We added it.

page 191, line 25: it is the "stronger". both can be adapted but the one who can deliver the highest NPP is the one that will take the place.

page 192, line 19: "... that main outcropping ..." is replaced by "... that mainly outcrop ..."
page 192, line 20: "other" is removed

page 195, line 17: "copper" is replaced by "cupper"
page 195, line 18: "(± 4 cm)" is replaced by "(± 4 cm diameter)"

page 197, line 9: we added the reviewer proposed explanation of the 9kyr shift between organic and OSL chronologies.

page 198, line 17: we removed "cal" for all dates older than 50kyr if individually presented (i.e. if only one unit is used for several ranges we kept cal. yr BP as 3 out of the 4 ranges are within the ^{14}C ranges. That is the case of 2 occurrences within the text.).

page 199, lines 21 and 22: "current" is the wrong word, it should have been "typical". We corrected it.