

Interactive comment on “Climate warming and vegetation response at the end of Heinrich event 1 (16 700–16 000 cal yr BP) in Europe south of the Alps” by S. Samartin et al.

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General comments

The manuscript submitted to The Climate of the Past by Samartin et al. presents new data of chironomid-derived July temperatures from Lago di Origlio (southern Alps) for the interval between 17,500 and 11,000 cal yr BP. This manuscript is clearly written and well organized. The take-home message of the authors is that a Pre-Bølling warming, between 16,500–16,000 cal yr BP, occurred south of the Alps just after the end of Heinrich event 1. While this result is interesting and deserves publication, it relies heavily on how accurate the age model is. Terrestrial sequences such as that from

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Lago di Origlio do not preserve direct tracers of Heinrich events, i.e. layers of ice-rafted debris. Therefore, it is difficult to correlate reliably vegetation and climate changes on land with episodes of freshwater input in the North Atlantic. It is also for this reason that there is a major inconsistency in the manuscript between the title and the conclusions. The authors refer in the title to a climate warming “at the end of Heinrich event 1” while in the conclusions section they suggest the occurrence of a warming “after the Heinrich event 1”. A problem of terminology is added to this inconsistency. The term Heinrich event defines the rapid (less than 200 years, Roche et al., 2004) iceberg discharges in the North Atlantic while the Heinrich stadial (HS) is the climate impact of these discharges that can last a few millennia (Sanchez Goñi and Harrison, 2010). It is more appropriate to use in this manuscript the term Heinrich stadial and give its chronological boundaries which, following different authors, encompasses the period between ~19,000–15,000 cal yrs BP (~15,000–13,000 14C yr BP) (Naughton et al., 2007, 2009; Sanchez Goñi and Harrison, 2010; Standford et al., 2011). Using a direct correlation approach between marine and terrestrial (pollen) climatic tracers Naughton et al. (2009) have clearly demonstrated that the second part of HS 1, just before the sharp expansion of deciduous tree forest at the onset of the Bølling/Allerød interstadial, was warmer (and drier) in southwestern Europe than its first part. During the second phase iceberg melted south of the Ruddiman belt that is the preferential zone for iceberg melting. Naughton et al. (2009) proposed that during the second part of HS 1, as the second part of HS 2 and HS 4, the intensification and more northerly direction of the westerlies was the atmospheric configuration explaining the observed warming. Surprisingly, this work is not cited in the Samartin et al. manuscript. The authors should therefore refer to the work by Naughton et al. discuss their results in the light of this contribution.

Specific comments

Section 3.2: I wonder whether this section can be replaced by a table. Section 4.1: The authors introduce for the first time in the manuscript the term Pre-Bølling. This

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term should be defined in section 2.3 “Radiometric dating and vegetation history”. In this section, the authors say “The onset of the Bølling-Allerød interstadial (GI-1) has an age of 14,650 cal yr BP...”. The authors should rephrase this sentence and say that “the onset of GI 1, considered the equivalent of the onset of the Bølling-Allerød interstadial, has an age of 14,650 cal yr BP...”. Also in this section, the authors state that the Ammersee $\delta^{18}\text{O}$ record parallels the trend of the NGRIP $\delta^{18}\text{O}$. I am surprised about this statement. Von Grafenstein et al. (1999) and later Jouzel et al. (2007) state that the cooling in Greenland is contemporaneous with stable temperatures in central Switzerland, paralleling the d-excess record from Greenland ice core. Genty et al. (2006) and Combourieu-Nebout et al. (2009) also point out from speleothem and pollen data the contrasting trend between Greenland and midlatitude European palaeoclimatic records. The authors should change this part of the text accordingly. The authors use indistinctly “onset of the Bølling” and “onset of the Bølling/Allerød”. They should be consistent in the manuscript and chose one of the terms. In the conclusions section, the authors say that forest expanded at $\sim 13,000$ - $11,000$ cal yr BP in central and southern Italy. The original papers that the authors cite do not show that. Samartin et al have taken the 14C ages presented in Magri et al. (1999), Magri and Sadori (1999) and Allen et al. (2002) as ages in calendar years. The related paragraph on the relevant role of moisture for forest growth in Italy should therefore be modified. Finally, at the end of the conclusions the authors cite twice Stanford et al. 2011 referring to changes in the meridional overturning circulation during the period encompassing HS 1 and the Bølling/Allerød interstadial. The appropriate reference is that of McManus et al., 2004 who have provided the first Pa/Th record, indicating changes in this circulation. The authors should replace Stanford et al., 2011 by McManus et al., 2004.

Additional references to discuss and include in the manuscript

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