

Interactive comment on “South Atlantic island record reveals a South Atlantic response to the 8.2 kyr event” by K. Ljung et al.

Anonymous Referee #1

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General Comments

The study presents a highly valuable investigation to improve our understanding of induced climate changes by using proxy data series together with climate model simulations. The authors present a detailed analysis of a lake sediment core in the central South Atlantic spanning the entire Holocene. The focus is on the early Holocene and, in particular, on a climate anomaly in the time interval between 8275 and 8025 cal. yrs BP, which coincides with the 8.2 ka cold event. The 8.2 ka cold event is most pronounced in Greenland ice core records and the connection with distant climate anomalies is subject of still many investigations and is subject here. The present study uses the ECBilt-CLIO model which was forced in accord with a likely driver of the 8.2 ka event, i.e., by an abrupt meltwater pulse released from Lake Agassiz, which involves a

reduction in meridional overturning circulation in the North Atlantic. However, the conclusions drawn on a potential physical relationship between the 8.2 ky cold event and the observed climate anomaly in the South Atlantic appear not to be fully convincing as discussed below.

Specific conclusions

The multi-proxy record of the South Atlantic lake sediment is carefully and convincingly analysed and leads to the conclusion that during the time interval of the 8.2 ka cold event more precipitation occurred in the South Atlantic together with higher temperatures. The ECBilt-CLIO simulations also show a positive anomaly in precipitation and temperature in the southern Atlantic which is suggested to be an indication of the so-called bipolar seesaw.

The existence of a bipolar seesaw is widely discussed in literature but the processes involved and their temporal behaviors are still not conclusive as pointed out by the different papers listed by the authors. To obtain a better insight into the mechanisms related to the so-called bipolar seesaw the 8.2 ka event seems to represent a sub-optimal case study. This is because the 8.2 ka event has a relative short duration in comparison with the time scale of the interhemispheric Atlantic ocean circulation and a very high dating precision is required to resolve leads and lags. Also as mentioned by the authors, a more extreme freshwater forcing experiment (1 Sverdrup over 100 years in Stouffer et al., 2006) leads to a modestly increased precipitation in the South Atlantic between 35-40 S.

It is difficult to imagine that the climate anomaly derived from lake sediment data in the South Atlantic can happen with no time delay as displayed in Fig. 3. A further difficulty to identify the effect of the 8.2 ka cold event in the Southern hemisphere is evident from Fig. 3 where the EPICA deuterium curve shows a progressive cooling from the beginning of the Holocene until about 8100 cal. yrs BP.

Another point of concern is the presentation of the simulated temperature and precip-

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itation changes in the Southeast Atlantic enclosing the measurement site. It is hard to understand why the temperature and precipitation start already to grow before the freshwater pulse is released to the North Atlantic (Fig 6). This needs further clarification.

It could be helpful, to further analyse the model output by comparing the simulated temperature anomalies in the North Atlantic with temperature and precipitation anomalies in the South Atlantic to describe space-time relationships between a climate anomaly in the North Atlantic and a climate anomaly in the South Atlantic.

In summary, the analysis presents new information of climate changes, mainly precipitation changes, in the central South Atlantic at 37 S over the Holocene. The attempt to link the measured climate anomalies around 8.2 ky BP to the 8.2 ka cold event recorded in Greenland is not fully convincing. This also follows from the many abrupt changes in the magnetic susceptibility occurring over the Holocene (Fig. 2) for which the importance of an asymmetric North/South relation is questionable.

Technical corrections

The article is well written. The description of the data is sufficiently complete while the analysis of the model simulation appears insufficient.

Interactive comment on Clim. Past Discuss., 3, 729, 2007.

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