Clim. Past Discuss., 7, C1272–C1276, 2011
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Climate of the Past Discussions

Interactive comment on "Temperature variability at Dürres Maar, Germany during the migration period and at high medieval times, inferred from stable carbon isotopes of *Sphagnum* cellulose" *by* R. Moschen et al.

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Received and published: 18 August 2011

Responses to the interactive comment of the editor:

Dear Dr. Fuchs,

According to your request, we have addressed and replied to all comments of the two anonymous referees. Despite our diligent work on the results of our study at Dürres Maar, in our CPD manuscript cp-2011-13 entitled "Temperature variability at Dürres Maar, Germany during the Migration Period and at High Medieval Times, inferred from

stable carbon isotopes of Sphagnum cellulose" we have located a serious error in our approach of transferring the Ménot and Burns (2001) temperature coefficients of -0.20‰ and -0.41‰ to the palaeorecord of Dürres Maar. This error has not been noticed by the referees. However, because of the request of referee #1 to mention the uncertainty associated to the temperature coefficients and to propagate the uncertainties to our own temperature reconstruction the error was located:

In our CPD manuscript cp-2011-13 we have used the Ménot and Burns coefficients to calculate the past temperature variability at Dürres Maar. Our approach, however, was a misuse of the coefficients since we have calculated temperature variability from Dd13C/DT. In the revised manuscript we have addressed to this issue and have eliminated the error. Instead one has to use the opposite approach to reconstruct past temperature variability (DT) from the stable carbon isotope composition of Sphagnum cellulose (Dd13C) by using the DT/Dd13C approach. In the revised manuscript we have used the data concerning the d13Ccellulose values of S. capillifolium and S. magellanicum shown in figure 2 of Ménot and Burns (2001) and the corresponding temperature data of table 1 of Ménot and Burns (2001) to estimate –instead of temperature coefficients– transfer functions regarding the DT/Dd13C relationship for both species (T = –2.35 * d13Ccellulose – 46.35 for S. capillifolium (R2 = 0.51) and T = –0.82 * d13Ccellulose – 8.969 for S. magellanicum (R2 = 0.28)). The first transfer function was applied on the S. capillifolium var. rubellum dominated peat section developed from AD 1 to ∼AD 1450, the second on the S. magellanicum dominated section grown after the rearrangement of the bog ecosystem in the first half of the 19th century. The used transfer functions enable us to reconstruct a local Sphagnum related growing season temperature stated in centigrade (Fig. 5). For both time intervals the corresponding 95% prediction intervals were calculated, they are discussed in the text of the revised manuscript, and are shown in figure 5b.

Due to their annual resolution and the relatively easy supply of multiple time series, tree ring-based temperature reconstructions offer the highest accuracy possible for terres-

trial palaeoecological and palaeoclimatological reconstructions of the late Holocene. Regarding a comparison of our temperature reconstruction with a prominent tree ring-based reconstruction we have decided to modify figure 6. In the revised manuscript the tree ring-based northern hemispheric temperature reconstruction of Esper et al. (2002) is replaced by the also tree ring-based central European summer temperature reconstruction recently published by Büntgen et al. (2011). A comparison of our reconstruction with the Büntgen et al. (2011) data has several advantages: First, Büntgen et al. (2011) have reconstructed summer temperature variability. This improves the comparability with our reconstructed Sphagnum growing season temperature. Second, the Büntgen et al. (2011) time series is a more regionalised reconstruction of central European summer temperature and, therefore, substantially better suited to be contrasted with our local reconstruction from the West Eifel Volcanic Field located in western central Europe. Third, the Büntgen et al. (2011) time series depict the entire time span from presence to the turning point AD/BC. This corresponds precisely to our period under investigation.

References:

Büntgen, U., Tegel, W., Nicolussi, K., McCormik, M., Frank, D., Trouet, V., Kaplan, J.O., Herzig, F., Heussner, K.-U., Wanner, H., Luterbacher, J. and Esper, J: 2500 years of European climate variability and human susceptibility, Science, 331, 578-582, 2011.

Ménot, G. and S.J. Burns: Carbon isotopes in ombrogenic peat bog plants as climatic indicators: calibration from an altitudinal transect in Switzerland, Organic Geochemistry, 32, 233-245, 2001.

Interactive comment on Clim. Past Discuss., 7, 535, 2011.

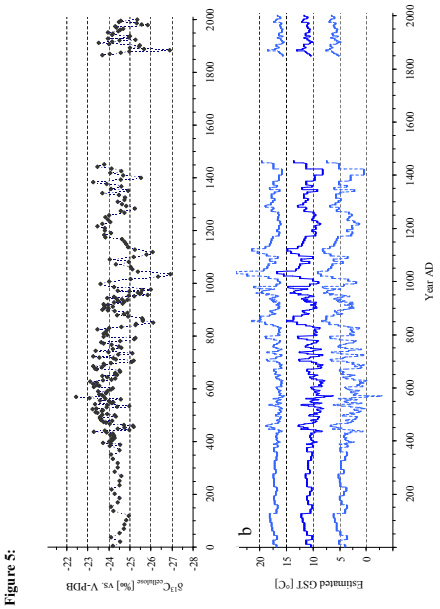

Fig. 1. revised figure 5

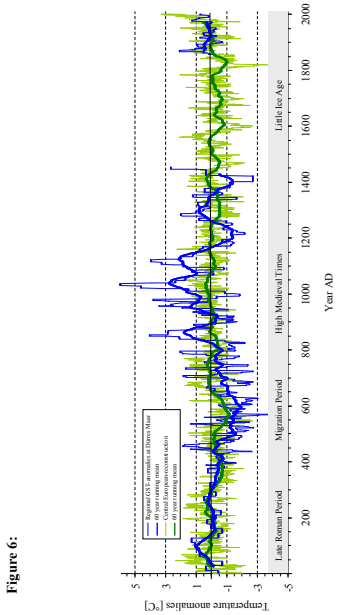

Fig. 2. revised figure 6