

Interactive comment on “Large-scale drivers of Caucasus climate variability in meteorological records and Mt Elbrus ice cores” by Anna Kozachek et al.

Anonymous Referee #2

Received and published: 27 September 2016

This study is an investigation of the isotopic composition of an alpine ice core from Mt. Elbrus, Caucasus. Kozachek et al. compares the seasonally divided ice core data to meteorological observations and finds the summer d18O to be related to temperature while the winter d18O to be related to the main modes of atmospheric circulation.

While the authors presents some interesting analysis and the data is publication-worthy I find that there are some major drawbacks on the writing and the treatment of the data. Like Referee #1 I am concerned with the division of the data into seasons which is simply done by dividing the data around the long term mean value. At times I also find the writing to be imprecise, and a lack of citations of relevant previous work on related subjects (see detailed comments below).

C1

Major comments.

Seasonal d18O data. The division of the data as shown in Fig 3 is largely unmotivated, except that there appears to be an annual cycle in the data. How is the distribution of seasonal accumulation? We don't know and it seems the authors have not investigated this. I suggest that a similar approach as Vinther et al. (2010) is made. I.e. investigating the proportion of the yearly accumulation to be assigned to either summer or winter depending on the coherency with meteorological observations, be it either temperature or circulation indices. I think that before a properly motivated division of the seasons is made the effort of discussing the outcome of the analysis is not really relevant.

Detailed comments.

In the introduction in general I miss a stronger representation of similar work done for Greenland although Greenland is mentioned. Many of the research questions are similar as well as the connection to atmospheric circulation patterns. See e.g. Vinther et al. 2003, Vinther et al. 2010 and Ortega et al. 2014.

L57-63 here a lot of detailed processes are mentioned, but there are no reference to literature. Why not refer to the early isotope work by Willi Dansgaard and e.g. Persson et al. 2011 on intermittency of snowfall.

L169-176 I can't follow this section easily. I suppose the point you want to make is that you think diffusion has little influence on the isotope values. Did you calculate the variation of amplitude of the d18O annual cycle from top to bottom? It might "look" like there is no decrease in amplitude, but what are the numbers? Another way to test if diffusion plays a role is the d-excess. Since the diffusivity of HDO and H₂-18O is different there will be a phase change of d-excess with the diffusion often shifting the d-excess peak earlier in the year (depending on the annual cycle of the d-excess).

References.

Persson A, Langen PL, Ditlevsen P, Vinther BM (2011) The influence of precipitation

C2

weighting on interannual variability of stable water isotopes in Greenland. *J Geophys Res* 116:D20120. doi:10.1029/2010JD015517

Ortega, P., Swingedouw, D., Masson-Delmotte, V. et al. *Clim Dyn* (2014) 43: 2585. doi:10.1007/s00382-014-2074-z

Vinther, B., S. Johnsen, K. Andersen, H. Clausen, and A. Hansen (2003), NAO signal recorded in the stable isotopes of Greenland ice cores, *Geophys. Res. Lett.*, 30(7), 1387, doi:10.1029/2002GL016193.

Vinther, B., P. Jones, K. Briffa, H. Clausen, K. Andersen, D. Dahl-Jensen, and S. Johnsen (2010), Climatic signals in multiple highly resolved stable isotope records from Greenland, *Quat. Sci. Rev.*, 29(3&4), 522–538, doi:10.1016/j.quascirev.2009.11.002.

Interactive comment on *Clim. Past Discuss.*, doi:10.5194/cp-2016-62, 2016.