The Cryosphere Discuss.,
doi:10.5194/tc-2016-159-RC1, 2016

The Cryosphere Discussions
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Interactive comment on "Age of the Mt. Ortles ice cores, the Tyrolean Iceman and glaciation of the highest summit of South Tyrol since the Northern Hemisphere Climatic Optimum" *by* P. Gabrielli et al.

Anonymous Referee #1

Received and published: 1 August 2016

The manuscript (MS) presents an age scale of three ∼75m deep ice cores drilled from near the summit of Alto dell'Ortles glacier in the Italian Alps. The MS is generally well written and argues convincingly for the suggested age scale that is based on radiometric ages and nuclear fallout products. The deepest meters of the ice cores contain ice that is more than 1000 years old, and the MS argues that the glacier was formed during the Northern Hemisphere Climatic Optimum (NHCO). I have a few suggestions for the authors to consider:

In Figure 5, the orientation of the coordinate system is unclear to me. Are the X and

Y directions following the GPR lines in Figure 1c or are they respectively along and perpendicular to the ice flow as stated in the main text? The best would probably be to show the orientation of the X-profiles and Y-profiles in a map. Are the units on the abscissas of Figure 5 meters?

In section 6.2, the authors argue that the only way the obtained age profile can come about is if the glacier flow pattern has recently changed significantly. I have difficulties following the argumentation of this section as not many details are given. A simple model is applied, but no results are presented. There is one observation in Figure 5 that seems important to me in this context. The inclination of the 45 m deep melt layer seen in the GPR profile and in the cores is very steep. This isochrone suggests that the oldest ice of the glacier probably is to be found in right hand side of figures 5 (X-profiles), which is under the ice divide, if I got the geometry right. Alternatively, it suggests that the oldest ice is to be found in higher depth resolution below the ice divide. I'm uncertain if the authors take this observation into account, but to me the steep inclination of the melt layer suggests a significant increase in snow accumulation the further one gets away from the ice divide. Could it be that snow is blown away from the ice ridge and (re-)deposited further down the slope (on the lee side?). An increasing accumulation away from the ice ridge would probably lead to strong inclination of the deeper layers of the glacier and possibly explain why old ice is preserved close to the ice ridge where accumulation may be very low?

In section 3, it is mentioned that limestone rock particles and pebbles are observed in the lowest meter of the ice cores. At the same time, the oldest ice is found in stratigraphic order in the same lowest meter of the cores. Indeed, the proposed age scale does look convincing based on the obtained C-14 ages, but still I am wondering how those pebbles got entrained in the ice if the ice is not disturbed (folded)?

In section 2.2.2 it is suggested that the glacier bed could be lubricated by summer meltwater. This scenario seems rather implausible to me. If the ice is -2.8 C at 75 m depth, it seems highly unlikely that there is summer melt. There is no seasonal

temperature variability possible at this depth.

In section 2.3 it is mentioned about the bedrock step that 'this feature does not completely enclose the drilling site in every direction'. In fact, the bump is only to one side of the cores, so I would suggest a reformulation.

In Figure 3 it is hard to see details around the drilling sites in the main image. There is a white spot right below what appears to be BH3 and BH4. Is this a col, or does the spot indicate something else?

The authors argue that the ice started to form during the Holocene climatic optimum and that this same optimum is observed in the isotopic signature of nearby stalagmites. Is the NHCO seen in the isotopic signature of the deepest ice core ice? If the high frequency signal is removed? I cannot judge this from Figure 10.

In Tables 2 and 3 it is difficult to see which samples correspond to each other as depth is transferred between the cores. Would it be possible to assign a unique name to each sample, so the reader can trace them from one table to the other?

The conclusion seems to state the main findings in a bit disorganized way. In point 6) is says the accumulation at the drilling site is 850 m/year. Probably this should be 850 mm/year?

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-159, 2016.