

Alison Criscitiello

Review of: "Impact of subsurface crevassing on the depth-age relationship of high- alpine ice cores extracted at Col du Dôme between 1994 and 2012"

I will keep this third review brief in the interest of expediency. Preunkert et al. compare records from three ice cores from Col du Dôme drilled in 1994, 2004, and 2012. The 1994 (C10) age scale is intact, while the 2004 (CDK) and 2012 (CDM) age scales are disturbed during the 1950s/60s. Chronologies are largely established by annual layer counting of ammonia, with the disturbances identified by the H_3 and ^{137}Cs records. Disturbances are attributed to the presence of an upstream (to flow) crevasse, which did not intersect the flow path reaching the core site in 1994 (but it did subsequently). During times when a snow bridge covers the top of the crevasse, ^{210}Pb accumulates in the crevasse and surrounding firn. I find the discussion and suggested mechanisms for both the observed layer doubling (or missing layers) and the impact of the two crevasse states on ^{222}Rn and ^{210}Pb accumulation novel and fairly well supported. This is an interesting and new theory for processes occurring at this site, and I enjoyed reading the mss.

In the revised mss, I can see huge improvements in the edits and additions made in response to the previous referee and editor reviews. Really like the added Fig.2 b and c panels. A few questions and comments below.

- I think there was a core drilled on Dôme de Gouter, correct? Is there an archive stick left, that perhaps ^{210}Pb could be measured on (for comparison to CDD)?
- Fig. 2 is rather confusing. Not sure how to simplify it or make it more readable. Perhaps the insets could be moved to a separate figure? Worth a think. I don't like the NO_3 offset which is an artifact of drilling year, I understand, but could perhaps be corrected for so the records line up?
- "In the C10 core, ^{210}Pb was determined by gamma-spectrometry (Vincent et al., 1997), whereas for the CDK and CDM cores ^{210}Pb was analyzed by alpha-spectrometry of its decay product ^{210}Po after chemical enrichment, which is the much more sensitive method." This is one of the more concerning aspects of the mss I found. Uncertainties arising from utilizing ^{210}Pb data obtained by more than one method should be discussed in more detail.
- "After having additionally discarded very high peaks in NO_3^- values (1.5% of CEP data), which were not present in the DRI dataset and could be attributed easily to contamination, mean NO_3^- values from 45.3-86.0 m were 263 ppb (CEP) and 255 ppb (DRI). The agreement is somewhat weaker for NH_4^+ likely because only 80% of the depth range is covered by the CEP measurements. After discarding additionally 8 % of the CEP NH_4^+ data consisting of high NH_4^+ peaks which were not present in the DRI dataset, the mean NH_4^+ values of 101 ppb (CEP) and 95 ppb (DRI) were in good agreement." I find the discarding of what amounts to quite a lot of data concerning. Was a threshold technique used? How did you determine that clear contamination had occurred? You assume the DRI CFA is the benchmark, and any large deviations that don't align with that record must be contamination? It currently reads as a bit subjective.

- Was the winter to summer layer thickness ratio obtained just from ammonium? Were other glaciochemistry time series used as well?
- “The dating of the C10 ice core back to 1925 obtained from annual layer counting of the ammonium record was initially established by Preunkert et al. (2000). More recently, the availability of additional measurements such as lead, cadmium and thallium allowed the dating to be extended back to 1890 without changing the original dating back to 1935 (Legrand et al., 2018).” This implies (with no mention of it) that you changed the original dating between 1925 and 1935, yes? Maybe say a bit more about this (how did you identify a dating error? etc).
- The bomb test horizon insets shown in Fig.4 are really lacking. I certainly understand only looking in certain sections of the core for bomb horizons (where they’re expected), but why are there so few measurements? There are so few that it isn’t actually possible to confidently pick 1963 (or <1954) at CDM or CDK. Were only wings (bag averages) available?