

Interactive comment on “Duration of Greenland Stadial 22 and ice-gas Δ age from counting of annual layers in Greenland NGRIP ice core” by P. Vallelonga et al.

Anonymous Referee #2

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Manuscript summary: This manuscript contributes an annual-layer dated chronology for a deep section of the NGRIP ice core in the approximately 80 – 90 kyr age range. New continuous-flow techniques are applied to obtain <1 cm resolution records of conductivity and insoluble dust. These measurements, in combination with high-resolution visual stratigraphy are found to be suitable for annual-layer counting even for highly thinned ice with \sim 1cm annual layers. This new chronology enables a more accurate estimate of the duration of Stadial 22 in Greenland as well as more accurate estimates of Δ age for this section of NGRIP. The results are compared with estimates from other available chronologies, and have implications for understanding the North–South climatic seesaw dynamics.

General comments: This manuscript demonstrates the applicability and potential of cutting–edge continuous–flow ice core analytical techniques to the difficult and important problem of accurate dating of deeper parts of ice cores. While only a relatively short section of the NGRIP core was analyzed, the generated chronology nevertheless provides important insights into the dynamics of the unusually long Greenland stadial 22. This is a strong contribution, overall well–written, and appropriate for this special issue of CP. I recommend its publication. My comments below are fairly minor and aimed at further improving an already good manuscript.

1. I would recommend moving figure 3 up to the introduction section. It fits very well with the discussion that starts on page 2586, and would provide further clarity for the background.
2. All climatic events should be better identified for clarity in figure 3.
3. page 2590. I would recommend some more discussion on why the sodium and ammonium signals have been smoothed by diffusion, while the conductivity signal apparently was not.
4. Page 2592, lines 6–8. Give citations for these assertions.
5. page 2592 line 13. Modify to: “reported that impurity content also plays”
6. page 2593, line 5. Modify to: “the start of the $d_{18}O_{ice}$ increase”
7. It appears to me that the EDML-based estimate of the duration of Greenland Stadial 22 has many more sources of uncertainty than the estimate presented in this work. I would recommend more discussion of this and a more forceful statement in the manuscript to the effect that the presented estimate is more reliable than the estimate of Capron et al.
8. Figure 4. Horizontal depth differences on the figure should be put into the units of meters, to be consistent with the x –axis. It should also be clarified on the figure that the peaks represent the onset of GI-21

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