

Dear editor,

Many thanks for having consulted another reviewer for the dating of the ice core. As asked, we added our tests in the supplementary materials, and refer to it in main text, in section 3.1 “Firn core chronology”, page 13 lines 13-19: “Peaks in $\delta^{18}\text{O}_{\text{TA}}$ or $\text{d-exces}_{\text{STA}}$ were not used in our layer counting, so that our age scale is independent of a climatic interpretation of water stable isotopes (e.g. assumption of synchronicity between temperature seasonal cycles and water stable isotope records). We note an uncertainty in layer counting of 3 years when comparing the outcome of layer counting using chemical records with $\delta^{18}\text{O}_{\text{TA}}$ peaks, which have nonetheless been excluded from our dating, as they do not improve the correlations, neither between the reconstructed SMB and the stake data, nor between our records and the ECHAM5-wiso simulations (Tables S1 to S3 in the Supplementary Material).”

To the comments made by the third reviewer concerning the chemistry, here is our response:

Calcium and magnesium were measured together with sodium. The level of calcium is of a few ppb (less than 5 ppb) and this species has a double origin (sea-salt and long-range transport of terrigenous aerosol). Both low level and double origin of calcium render delicate its use to date Antarctic snow and ice (Legrand and Mayewski, 1997). Magnesium is present at higher level than calcium, and under present-day climatic conditions only originates from sea-salt. Its measurement does not provide additional information with respect to sodium. Particle counts and liquid conductivity were not measured here. The powerfulness of particles counts for dating is not obvious (insoluble organic particles coming from the ocean, volcanic glass, long-range transport of terrigenous aerosol). The liquid conductivity strongly depends on the proton level (related to the presence of acidic compounds like nitrate, non-sea-salt sulfate and MSA) (Legrand, 1980; Legrand and Delmas, 1984) and to weaker extent to sea-salt concentration. Therefore again no additional information can be derived from such a measurement.

We hope that this revised version will be appropriate for publication in The Cryosphere.

Best regards,

Sentia Goursaud

Legrand, M.: Mesure de l'acidité et de la conductivité électrique des précipitations antarctiques, 1980.

Legrand, M., and Delmas, R.: The ionic balance of Antarctic snow: a 10-year detailed record, *Atmospheric Environment* (1967), 18, 1867-1874, 1984.

Legrand, M., and Mayewski, P.: Glaciochemistry of polar ice cores: a review, *Reviews of geophysics*, 35, 219-243, 1997.