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Comment

Interactive comment on “Optimisation of glaciological parameters for ice core chronology by implementing counted layers between identified depth levels” by L. Bazin et al.

L. Bazin et al. lucie.bazin@lsce.ipsl.fr

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We thank the three reviewers for the in-depth comments on our manuscript.

The comments are mainly on the new methodology development brought in DATICE to implement properly the markers of age-difference and the maximum counting error at the origin of the GICC05 chronology. Several issues are raised: - P. Blackwell raises the issue of correlation implementation. This is indeed a central problem since in GICC05, the errors on each counted layer are added one with the other to provide the Maximum Counting Error (MCE). This is implicitly based on the assumption of full correlation between errors, which cannot be directly translated into a gaussian error (as needed in DATICE). Moreover, this is not fully correct since the counting errors cannot be fully correlated over the whole ice core depth. - The second reviewer wants

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us to show a validation on a simpler case (one site) since the produced shapes of the thinning function question at first sight the validity of the DATICE approach. - The third reviewer again raises the question of a correct treatment and implementation of the MCE in DATICE and also highlights the problem of the strong dependency of the output chronologies to the sampling interval of markers of age-difference.

In order to answer to these important comments, we propose a strong rework and reorganisation of the paper including numerous new tests performed with DATICE as well as a methodological development. First, we propose a detailed introduction on the MCE: how it is calculated in GICC05 with inherent limitations, and how to best implement it in Datice for further dating exercises. As mentioned by the reviewers and shown in the first version of the manuscript, this implies to correctly implement correlation between errors. In the first version of the manuscript, the error correlation was not optimally implemented since we had the same value for the error correlation over the whole ice core (very distant layers had the same correlation error as neighbour layers). We have thus implemented the possibility to consider error correlation only for a limited portion of the depth range. In order to better show the validation of the new methodological developments, we would like to first present the sensitivity tests with specific assumptions on the markers error correlation related to the MCE treatment, in the framework of a simplified experiment involving only the NorthGRIP ice core. This would follow the suggestion of reviewer 2 to present more simply how the MCE is treated, when involving correlation between markers and considering only NorthGRIP whose reference chronology (GICC05) is very well known. We propose to show several sensitivity studies on this test case on (i) different formulation of the error correlation and on (ii) different values of the variances for background scenarios and observations. We will present and discuss the differences between these produced chronologies and the reference GICC05. Then we propose to show the results of a five cores Datice experience and compare it with the AICC2012 chronology, as in the original paper, but this will not be the paper main result, only a short section. In this experiment, we propose to discuss also more deeply the reasons for the deviation of the NGRIP

thinning function from a smooth curve as questioned by reviewer 2.

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