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Estimations of the age of the ice beneath Dome A, Antarctica

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The drilling of a deep ice core at the Chinese Kunlun station, Dome A, East Antarctica, is about to start with high expectations on obtaining the oldest possible ice so far. The Alpine type bedrock of the Gamburtsev mountains in combination with a largely undetermined geothermal heat flux distribution raises questions on the basal thermal conditions that via the melting rate have a strong feedback on the vertical flow velocity and in consequence on the age/depth horizons. Additionally, the undetermined ice fabric introducing anisotropic effects in rheology have to be taken into account. By deploying a full Stokes ice sheet model (http://elmerice.elmerfem.org) we investigate the influence of those parameters, namely anisotropy as well as geothermal heat flux values, on the spatial distribution of the age close to the bedrock. Results are compared with dated radar isochrones in the upper one third of the ice sheet. We find that a non-unique combination of parameters is able to closely reproduce those measured values, leading to the conclusion, that without additional information, the basal age beneath Kunlun station remains undetermined. However, our simulations suggest that vast spatial variation of basal melting rates and, in consequence, the age/depth distribution over a relative small domain exists, increasing the motivation for ice coring, obtaining both high resolution as well as possibly oldest ice from the same site.