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Towards modelling Holocene accumulation rate trends in East Antarctica deduced from isochronic radar layers

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East Antarctica is a region where current and past mass-balance data are sparse, but are a basic necessity for understanding past and future changes of the ice sheets. Radar-detectable englacial layers act as an archive and permit us to assess past variability in accumulation rates.

We use a three dimensional ice flow model to deduce past accumulation rates from layering, measured from the most extensive radio-echo sounding (RES) survey of East Antarctica (undertaken during several field seasons in the 1970s). The model generates velocities from modern balance fluxes, and the age equation is solved to generate ages and isochrone geometry. Temperature is also solved for using balance velocities, using an iterative algorithm which takes into account basal melting.

Using this model we deduce reconstructions for accumulation rate trends for the Holocene and investigate limitations and uncertainties of our model, such as 3D-flow effects and geothermal heat flux. For example, we found that our reconstructions of isochrone geometries were highly improved by including 2D-horizontal advection. Areas of significant anomalies in Holocene mass balance relative to the present mass balance distribution have been identified. Such deviations may be important for better constraining existing transient ice sheet models.