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Studying the ice sheet stratigraphy to reconstruct past accumulation and ice dynamics.

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The internal layering of ice sheets is the result of accumulation and the lateral flow of ice. In theory, past variations of accumulation and changes in ice dynamics are recorded in this stratigraphic archive, but in a very convoluted way.

To test the feasibility of reconstructing past variations from the modern stratigraphy, we use a two-dimensional ice sheet model that explicitly represents the isochronal layering. We present a series of sensitivity simulations with variations in the distribution and magnitude of the surface mass balance. We then analyze the reaction of the internal layering and the differences with regard to the unperturbed reference simulation. This difference can be observed for several thousands of years after the event took place by looking at the isochronal layering of the ice sheet, thus keeping a memory of the past events.

Theoretically this could be useful to reconstruct the surface mass balance, but the interpretation of a recorded signal in the isochronal layers is complicated. In our experiments, the flow of ice overwrites, spreads and even reverses the sign of the differences between our perturbed and reference simulations. Yet before this effect becomes critical, it is possible to identify the past events by looking at the internal layering. We quantify for how long changes are observable before the effect of dynamics erases the differences. We also examine which areas of the ice sheet are ideal for giving us the most informations.