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Interactions between stationary waves and ice-sheets

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A two-layer quasi-geostrophic model is employed to examine interactions between the atmospheric circulation and the surface mass balance of a single idealised ice sheet. In particular, the influence of temperature anomalies, induced by topographically-forced stationary waves on the surface mass balance is examined for a wide range of zonal wind speeds and ice-sheet extents. The model includes a simple parameterisation of the impact of baroclinic eddies on the mean temperature structure, which infers that larger vertical wind shear is balanced by stronger static stability. It is found that the stationary-wave feedback is positive for the range of examined zonal wind speeds, and that its strength is sensitive to the zonal wind as well as the vertical wind shear. Furthermore, it is shown that the strengh of the stationary-wave induced temperature anomaly and hence the ensuing feedback increases almost quadratically with respect to the length of the ice-sheet. The possibility of a stronger static stability as a consequence of a larger vertical wind shear, along with the new insights of the stationary-wave feedback, may be of relevance for the evolution of Pleistocene ice-sheets.