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Can gridded climate data be used to calculate equilibrium-line altitudes on a global scale?

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In the next decades, a decrease in the ice volume stored in glaciers and ice caps will significantly contribute to sea level rise. In order to quantify this contribution, projections of the temporal and spatial distribution of glacier change are needed. Models used for such projections should be able to capture the characteristics of energy and mass exchange between the atmosphere and the glacier surface in a large diversity of climates. On the other hand, the large number of glaciers and ice caps and the sparse glaciological and meteorological data available confine the complexity of the model. In the framework of the ice2sea project, we aim to apply a mass balance model with a simple energy balance approach on a global scale. The model was calibrated for a number of glaciers with detailed meteorological data and is well able to simulate measured seasonal cycles of the energy and mass balance. To identify possibilities and restrictions of a global-scale application of the model, we calculated equilibrium-line altitudes (ELAs) for all land areas excluding Antarctica, based on gridded climate data. For most glacierized regions, the model is able to reproduce measured ELAs. Deviations can be ascribed to uncertainties in the model parameters and meteorological input data not representing the climate at the glacier. The model tends to overestimate ELA values for glaciers without a seasonal shift from accumulation to ablation-dominated mass balance, which can be attributed to the simple climatological data used in this study.