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# Recovering lateral variations in lithospheric strength from bedrock motion data using a coupled ice sheet-lithosphere model

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A vertically integrated two-dimensional ice flow model was coupled to an elastic lithosphere earth model to study the effects of lateral variations in lithospheric strength on both ice sheet evolution and local bedrock adjustment. We used a synthetic bedrock profile and a synthetic climate to model a characteristic ice sheet through an ice age cycle. Changes in lithospheric strength change the local bedrock adjustment up to 100 meters, the ice extent by tens of kilometers and change the ice volume by up to 15 percent. Hence, when modeling ice sheets, it is essential to have detailed information on lithospheric structure. In addition we constructed synthetic bedrock motion time series to assess their potential in resolving lithospheric structure. These inverse experiments show that the model can resolve lateral variations in lithospheric strength from bedrock data, provided that we have data from both sides of a lateral transition in lithospheric strength. The inversion which solves for a lateral transition is able to find a solution which is consistent with all data, even if they are noisy. In the presence of lateral variations in lithospheric strength, there is no solution to the inverse problem for which all data are modeled correctly for a uniform lithospheric model. The synthetic data show no sensitivity to the location of the transition. As a result we require information from independent sources about the locations of possible transitions in lithospheric strength.