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A statistical model for estimating monthly snow water equivalent anomalies from temperature and precipitation predictors under changing climatic conditions

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A statistical model is proposed to estimate monthly mean snow water equivalent (SWE) interannual anomalies based only on temperature and precipitation data and the month of snow onset. The model derives from a multiple linear regression of parameterized coefficients. The parametrization is largely independent of climate trends, allowing one to estimate SWE anomalies in a changing climate. The focus is on March mean SWE anomalies, for which estimates with the statistical model are shown to be comparable to that of a dynamical regional climate model and in good agreement with a blended observation-based dataset, as measured by the anomaly correlation coefficient and the variance ratio. Because of its simplicity, this statistical model can be readily used for snow-covered regions where temperature and precipitation data are available, thus avoiding the implementation of complex snow schemes as is often done with reanalyses and other snow data products. The model provides a means for assessing the changing roles of temperature and precipitation in driving SWE variability in a warming climate, with important implications for ecosystems and economic activities dependent on snow. Its limitations and potential for improvements are discussed.