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Representing snow-vegetation interactions in the alpine tundra of Norway

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The seasonal snow cover in alpine tundra controls much of the land-atmosphere fluxes of energy and carbon dioxide, calling for an adequate representation of snow-vegetation-atmosphere interactions in land-surface models. To test and improve these models in snow-rich environments, we established the first eddy covariance (EC) flux measurements in alpine Norway, on the Hardangervidda mountain plateau at Finse (60 degree N, 1220 m asl). These measurements include a stationary and a mobile EC tower, and are here used for a data-model comparison with the land-surface model CLM4.5-BGC. We show how the measured flux magnitudes, quality flags and the degree of energy balance closure change with measurement height and footprint heterogeneity. While this underlines the challenges connected with data-model comparisons in mountainous terrain, our CLM results show realistic flux magnitudes and seasonal patterns. We further explore the energy flux partitioning and its dynamics after episodic disturbances by snowmelt and heavy rain events, aiming to pinpoint possibilities for improvements of the parameterizations in CLM. Finally, we integrate Finse into the larger context of tundra ecosystems through a flux comparison to arctic sites on Svalbard and Greenland.