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High-Resolution Snow Distribution Modeling in the Mountains of Southern Norway

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The distribution of seasonal snow not only affects soil temperature, permafrost, soil moisture, runoff and the vegetation distribution but also makes an impact on the radiation balance and atmospheric temperature. In wind exposed and sparsely vegetated mountainous regions, snow is prone to extensive redistribution, and accurate assessments of the distribution of snow water equivalent (SWE) over wide areas are lacking, due to a scarcity of operational precipitation gauges in mountainous areas and the shortcomings of the available methodology. The distributed snow-evolution model SnowModel (e.g., Liston and Elder, 2006) has been used in a variety of different terrains and climates. In this study, SnowModel is used to simulate snow distributions in rough topography at the high mountain environment at Finse, Norway. Our objectives are (1) to test the validity of SnowModel for Norwegian conditions, (2) to develop appropriate parameterizations to ensure such validity, and thereby (3) to improve knowledge of snow cover distributions in areas of Norway where wind redistribution plays an important role and few measurements are available. The simulations were run at a 4 m resolution and evaluated using a comprehensive data set of monthly repeated Ground Penetrating Radar (GPR) surveys together with snow depth and density measurements over the two winter seasons of 2011 through 2013. GPR surveys were performed on both a 1-by-1 km area with 250 m grid spacing and a finer resolution 250-by-250 m area with 50 m grid spacing. GPR surveys show a strong effect of wind redistribution, and initial model simulations correlate with observed distributions.

References:
Liston, G. E., & Elder, K. (2006). A distributed snow-evolution modeling system (SnowModel). Journal of hydrometeorology, 7(6), 1259.