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Soil surface changes during winter and snow melt

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Microtopography is an important driver for runoff and erosion and deposition processes. The morphology of agricultural soil surfaces changes throughout the year. During the growing season, this is mainly due to tillage operations. Little is known about the changes that occur during winter and immediately after that when the snow pack has molten. In this trial, a terrestrial laser scanner was used on a 100 m^2 run off plot in south-western Norway to compare the soil surface before and after snow cover. The obtained point clouds were filtered and used to construct Digital Terrain Models of a resolution of 0.02 m. Terrain analysis of the multi-temporal dataset showed that three processes could be distinguished and quantified: roughness reduction, frost heave and erosion/deposition. Terrain indices were used to find correlations between the observed surface changes and the processes presumed to be connected to these changes. The indices used were slope, curvature, aspect, relative hill slope position, stream flow convergence and a sedimentation index (based on slope and curvature). Good correlations were found between surface elevation change and curvature and the sedimentation and convergence indices, respectively. Similarly a good correlation was found between roughness reduction and slope. After correcting the surface elevation change for frost heave, calculated net soil loss from the plot was 20% under average annual soil loss that is reported for the plot.