Spatiotemporal Assessment of Snow Density and Snow Water Equivalent (SWE) using the Cone Penetration Test (CPT) and/or Ground Penetrating Radar (GPR)

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ABSTRACT

In situ tests such as the Cone Penetration Test (CPT) are useful for establishing stratigraphy and physical properties of frozen geomaterials such as snow and ice. Particularly, snow density can be estimated using CPT and these data can then be spatially extrapolated using Ground Penetrating Radar (GPR). Further, GPR can potentially be used in isolation to assess spatiotemporal variability of snow surface and sub-surface snow density, enabling changes in snow water equivalent (SWE) to be estimated. Almost 100 CPTs conducted in Antarctica demonstrated the potential to assess snow density and mass balance variability, directly from CPT data, and GPR testing in the Australian Alps suggested the ability to estimate both surface and sub-surface snow-density, by assessing amplitude variation from air-coupled GPR surveys. Combination of these tests may enable efficient spatiotemporal estimation of snowpack density and SWE variability.

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