

Simulation of snowpack ablation at two mid-latitude subalpine sites using SnowModel and Fast All-Season Soil STrength (FASST)

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Abstract. This study uses SnowModel, a physically-based snow evolution model, and Fast All-Season Soil STrength (FASST), a one-dimensional state-of-the-ground model, to simulate snow ablation within the Fraser Experimental Forest, Colorado for the period from March to June, 2003. The primary objective of this study is to use SnowModel and FASST to generate point estimates of snowpack ablation at two forested mid-latitude subalpine sites with different physiographic characteristics.

SnowModel is a spatially-distributed snow accumulation and depletion modeling system designed for application in a variety of landscapes where snow occurs. SnowModel is an aggregation of four sub-models: MicroMet, a quasi-physically based model which assimilates and interpolates meteorological forcing data from a variety of sources; EnBal, a surface energy exchange model; SnowTran-3D, a three-dimensional blowing snow model, which takes terrain and vegetation into account; and SnowPack, a simple one-layer snowpack evolution model.

FASST was originally designed to predict soil strength and surface friction for vehicle mobility and personnel movement. FASST performs two fundamental calculations: an energy and water budget quantifying both the flow of heat and moisture within the soil, and the exchange of heat and moisture at all interfaces (ground/air or ground/snow and snow/air). FASST uses up to nine modules, including a Snow Accretion-Depletion Module which predicts snow depth and amount of water available from snowmelt.

Each model was initialized using snowpack data collected near peak snow water equivalence (SWE). Hourly meteorological data, including air temperature, relative humidity, air pressure, wind speed and direction and incoming and outgoing solar radiation from the meteorological tower at each site were used or, when necessary, estimated within the models. Precipitation data used were from nearby gages. Hourly snow depth output from each model was compared to observed snow depth at each site. Results indicate that both SnowModel and FASST successfully simulated snowpack ablation at each site.