Snowpack simulation using the Simultaneous Heat and Water (SHAW) model at a continental subalpine site near Fraser, Colorado, USA

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Abstract. The Simultaneous Heat and Water (SHAW) model uses a physically based, multi-layered energy balance approach to simulate water and energy fluxes within a snowpack. Although initially developed for rangeland applications, its physical basis makes it attractive for use in other environments. We applied the SHAW model for the 2004 water year at a clearcut subalpine site within the Fraser Experimental Forest, Colorado, USA. The site is on a 20° WNW facing slope at 2850 m asl. The 25-year (1979-2003) annual average precipitation is 607 mm, of which nearly 70% falls as snow from October to May. Preliminary model runs using SHAW 2.4 exposed model vulnerability to increased densification and early melt out of the snowpack relative to observations. The energy balance at this site is dominated by radiative fluxes. Examination of the simulated energy balance revealed a model tendency to underestimate snow albedo during the spring melt, resulting in elevated short wave radiation inputs to the snowpack. Adding a simple correction to the albedo model to account for the sun zenith angle improved predictive capabilities of the model considerably. Additionally, modification of a snow compaction parameter increased model performance during accumulation periods.