AGU 100 ADVANCING EARTH AND SPACE SCIENCE | FALL MEETING
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H31G-1967: Optimizing over-summer snow storage at low latitudes and low altitudes

Wednesday, 12 December 2018
08:00 - 12:20
Walter E Washington Convention Center - Hall A-C (Poster Hall)

Climate change is forcing the ski industry to modify snow-making strategies and facility operations. Over-summer snow storage is an adaptation successfully employed by high-elevation and/or high-latitude ski centers in Europe, Canada, and Asia. The process involves stockpiling winter snow and storing it beneath insulation (e.g., wood chips) through summer. Current methods are empirically-based with few studies quantifying snowmelt through summer or comparing insulation strategies.

In this project, we evaluate the feasibility of over-summer snow storage in Vermont, northeastern North America. Soil temperatures were recorded since June 2017 with sensors 5, 20, 50 cm and 1 m below the ground surface. In March 2018, two, 200 m^3 snow piles were covered in plastic and wood chips; we monitored their volume bi-weekly through the melt season using terrestrial LiDAR. We also measured air to snow temperature gradients under various insulation materials: rigid foam, open cell foam, and wet wood chips, all with and without reflective coverings.

Away from snow piles, ground temperatures at 1 m depth were ~7C in spring 2017, rising to 12C in summer, and falling to just above 0C in winter. As depth decreased, ground temperature became more responsive to air temperature; ground temperature lagged air temperature at all depths. Below summer snow piles, soil temperature at all depths remained near freezing through the summer as cold meltwater percolated into the ground.

Snow was lost from each pile at a similar rate (~1.3 m^3 day^{-1}) from late March to mid-June; melt then accelerated slightly in response to increased air temperature, solar radiation, and humidity. Large crevasses formed in both piles along the edge of the plastic sheeting which exposed snow to direct sunlight. Temperature was at or above 10C over the snow below both rigid foam and open-cell foam with a strong diurnal variation, regardless of the addition of a reflective blanket. Beneath wet wood chips covered with a reflective blanket, temperature remained close to freezing even though air temperature was > 30C. There was no diurnal variation, indicating that wood chips effectively buffered thermal swings.

It appears that a reflective surface over >20cm of wet wood chips is most effective at minimizing summer snow melt in humid, northeastern North America.

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