

### 3.3 HYDROLOGICAL PROCESSES IN COLD REGIONS

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#### **Ablation of Seasonal Snowcovers**

1. Field monitoring of point and areal albedo, radiative and turbulent fluxes and other components of the energy budget during snowcover ablation at Saskatoon, SK and Trail Valley Creek near Inuvik, NWT in spring of 1995/96. Micrometeorological instrumentation installed, soil moisture and snow survey data collected at Prince Albert National Forest, Waskesiu, SK, Wolf Creek Basin, Whitehorse, YT, and Trail Valley Creek near Inuvik, 1996/97.
2. Development of:
  - (a) first-generation model for simulating the areal depletion of shallow seasonal snowcovers during ablation based on the melt flux and spatial frequency distribution of the snow water equivalent.
  - (b) combined energy balance-aerodynamic approach for estimating the flux of sensible energy to complete snowcovers during large-scale advection.
  - (c) methodologies for classifying and stratifying landscapes according to their snow retention properties based on terrain and vegetative variables. Correlations between snow depth density, and water equivalent.
  - (d) methodologies for synthesizing and scaling the spatial distribution of snow water.
3. Evaluation of a two-dimensional model for estimating small-scale advection of a patchy snowcover.
4. Measurement and modelling the energetics of snowmelt in Borel Forest canopies.

#### **Coupled Heat and Mass Flow in Frozen Ground**

1. Field monitoring of snowcover properties and soil temperature and moisture distributions during fall, winter and spring in forested and cleared sites in boreal forest at Prince Albert National Forest, Waskesiu, SK and Whitehorse, YT.
2. Development of a physically-based, numerical simulation of coupled heat and moisture flow during snowmelt infiltration into frozen soils.
3. Development of first generation parametric equations describing snowmelt infiltration into frozen silty clay and sandy loam soils from measurable soil physical properties.
4. Initial assessment of the role and importance of infiltration into frozen soils on snowmelt runoff from the Wolf Creek Basin, Whitehorse, YT.
5. Initiation of studies directed to the development expressions for snowmelt infiltration in Boreal Forest (Waskesiu, SK; Whitehorse, YT) and Arctic tundra (Inuvik) ecoregions.

## Wind Transport of Snow

1. Field monitoring of snowcover accumulation, micrometeorological variables and blowing snow fluxes at Waskesiu, SK, Whitehorse, YT and Inuvik, NWT.
2. Development and initial testing of:
  - (a) monthly time-step, distributed, blowing-snow model for an Arctic environment using a landscape classification derived from LANDSAT imagery and a digital elevation model.
  - (b) algorithms for PBSM to estimate the threshold wind speed for snow transport as a function of air temperature and snow wetness and to estimate the probability of blowing snow occurrence as a function of wind speed, air temperature, snowpack age and snow wetness. The routine also includes new features that include a correction for snowfall under measurement at high wind speeds, a mid-winter snowmelt routine, improved snow density estimates and improved estimation of the effect of exposed vegetation on aerodynamic roughness height during blowing snow.
3. Initial development and testing of a snow interception model for Boreal forest canopies.