

Parameterising Snowmelt Processes in Two Mountain Watersheds

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Introduction

Question: How do we parameterise a snow melt model? Can the model be transferable to two mountain watersheds?

Objectives:

1. Determine dominant watershed characteristics.
2. Discuss differences between the two watersheds.
3. Develop four modules that can be linked to snow melt processes within the two watersheds.
4. Discuss transferability to other sites...

Study Area Characteristics

Granger Basin

- High Latitude
- Mountainous
- North facing permafrost
- Contains alpine tundra, boreal forest, low LAI.
- Primarily glacial till, bedrock at ~20 m.
- Precipitation ~350 mm
- Tair -17 – 12 degrees C.
- 750 to 1600 m elevation
- Ave snow depth 1.5 m

Marmot Creek

- Low Latitude
- Mountainous
- Seasonal frost, no peat
- Contains montane subalpine meadow, higher LAI
- Glacial till, bedrock, and exposed alpine.
- Precipitation ~500 mm
- Tair - 10 – 15 degrees C
- 1500 to 2500 m elevation
- Ave snow depth 1.5 m

Development of Four Modules: Linking to Snow Melt Processes

What are the most important inputs for snow melt processes at Granger Basin and Marmot Creek?

1. Topographic Influences
2. Landcover Type
3. Climate
4. Soil/Geology

Topographic Influences

- Slope
- Aspect
- Upland vs. Lowland
- Heterogeneity of surface (e.g. numbers of hills)

Development of a **S**lope **A**ngle **A**spect **I**ndex (SAAI) – A topographic index that characterizes basin parts...

Determined using DEM and GIS...

Landcover Type

- Effective leaf area index (LAI)

Index that describes Landcover type, LAI, and vegetation type (e.g. conifer, deciduous, shrub, wetland, open water, grassland, etc.)

May be integrated using remote sensing land classification within HRUs (as dominant landcover type).

Climate

- Important meteorological drivers (ranked) per HRU:
 1. Tair and net radiation (may be modelled)
 2. Precipitation & type (may be modelled)
 3. Prevailing wind direction
 4. Humidity

Variable: snow density, SWE, and albedo.

These may be modelled from observed...

Soil and Geology

- Soil structure
- Physical and hydraulic properties, drainage
- Permafrost
- Frost table depth
- Water table depth.

****Not a primary module...yet...**

Some Thoughts on Transferability...

- There are many similarities and differences between Granger Basin and Marmot Creek: These may be used as endmember sites for certain parameterisation schemes (e.g. Latitude/solar radiation, elevation, landcover type). These may be varied and compared with measured snowmelt.
- Indices (e.g. Slope Angle Aspect Index...or better ones) may be a good way to **aggregate** or describe a number of different processes in individual HRUs and at varying spatial scales.