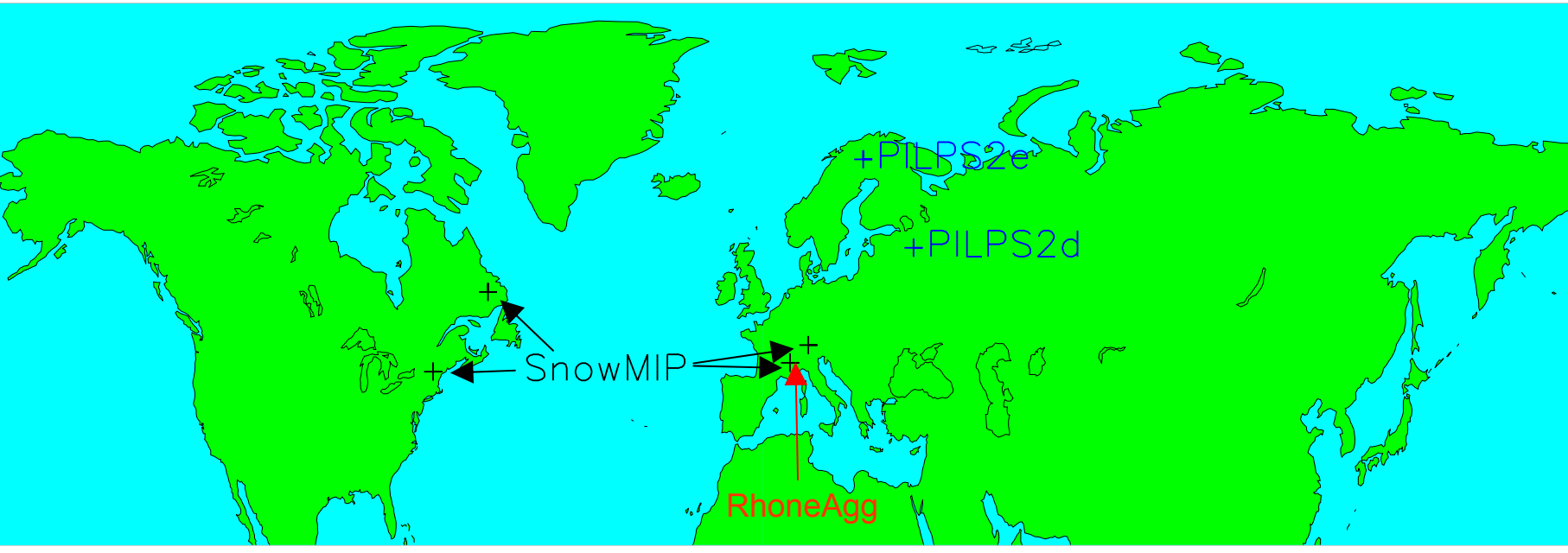
Intercomparison of Forest Snow Process Models

Richard Essery (University of Wales Aberystwyth, UK)
Alan Barr (Meteorological Service of Canada)
David Gustafsson (KTH, Sweden)
Manfred Stähli (WSL, Switzerland)
Erin Thompson (Climate Research Branch, Environment Canada)
Kazuyoshi Suzuki (JAMSTEC, Japan)

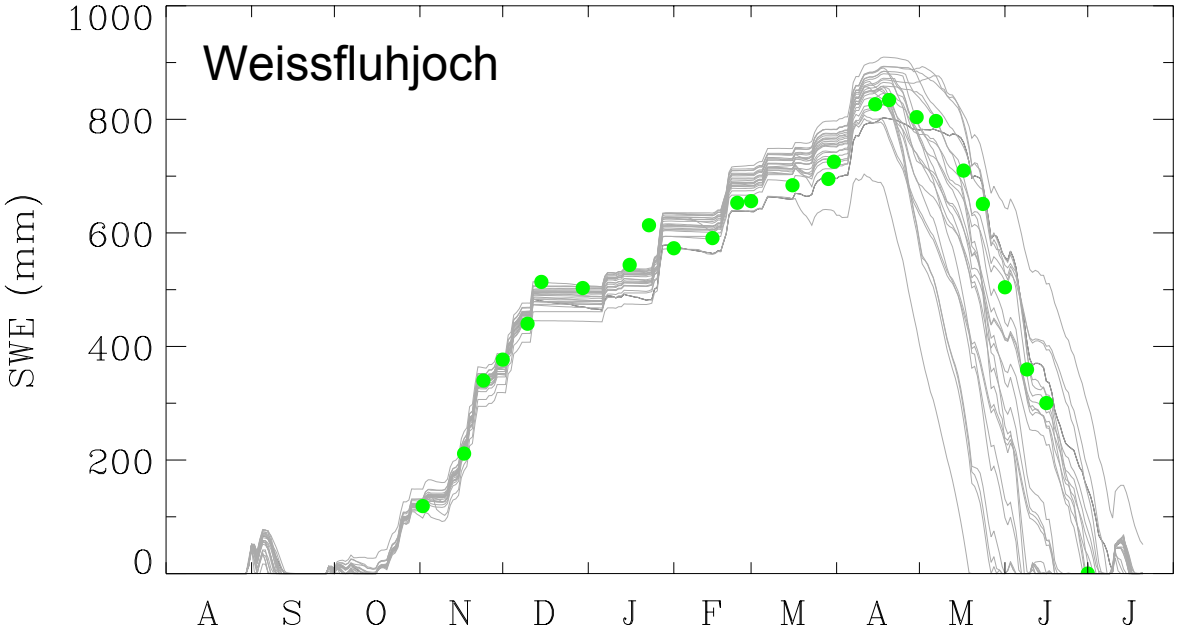
Previous Snow Model Intercomparisons

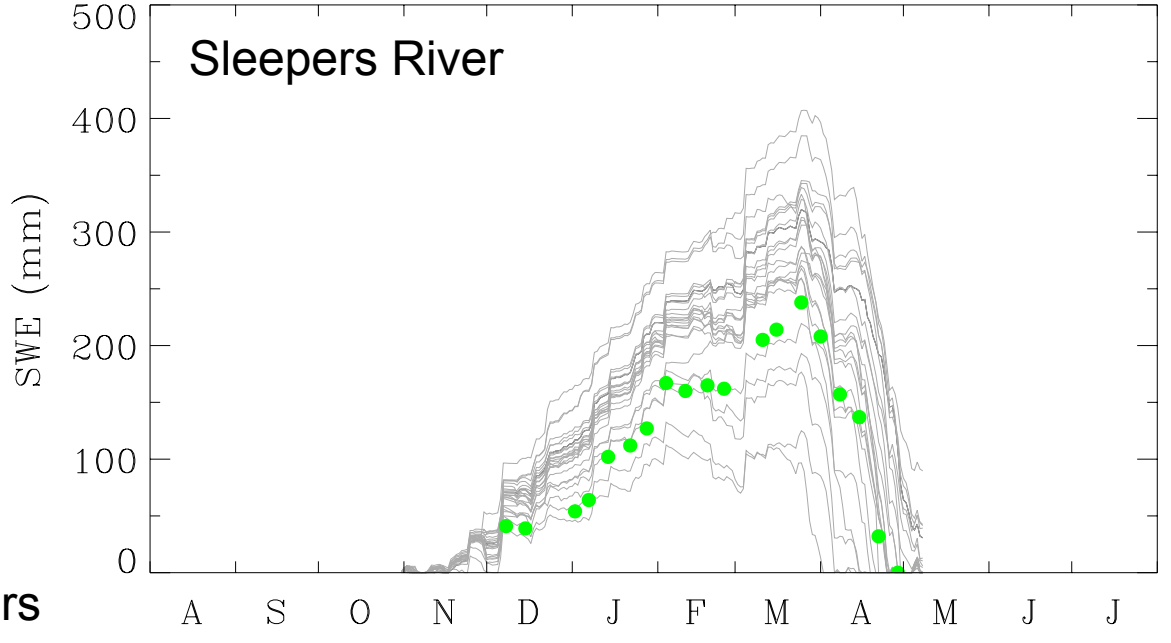


SnowMIP 1

- Commissioned as a 4-year working group by ICSI in 1998
- Endorsed by 14th Session of CAS/WGNE, November 1998
- Intercomparison of point simulations at four sites with short vegetation
- 24 models participated, including sophisticated snow models

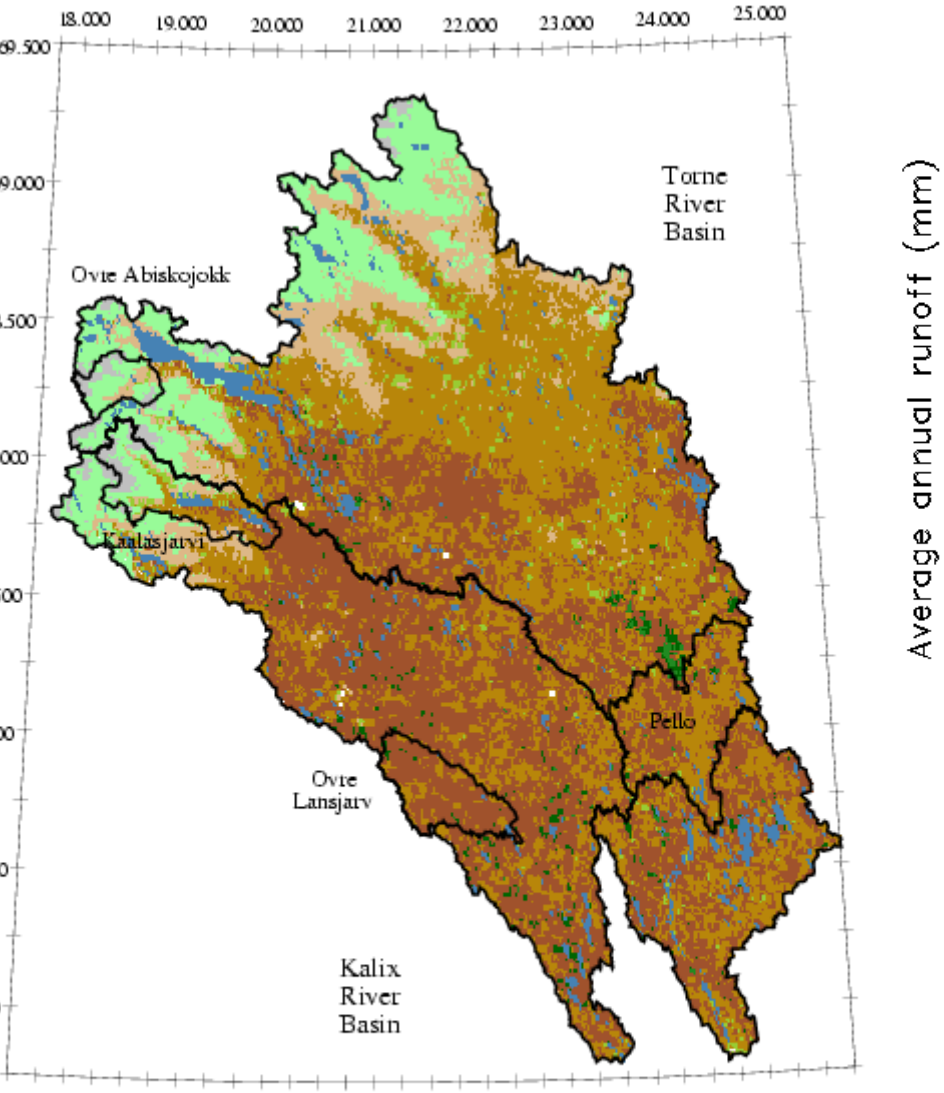
SnowMIP

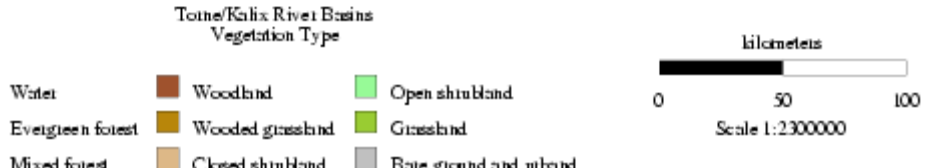


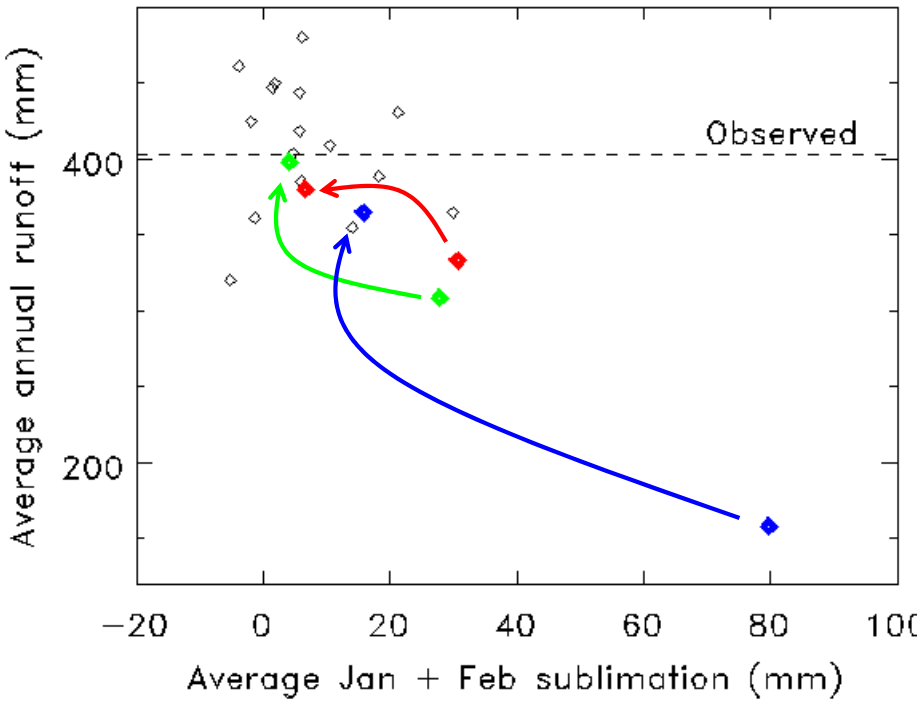


Data from
Pierre Etchevers

PILPS2e







Data from Laura Bowling

Snowcover (January 1995)

Image from NSIDC

Boreal forests

Image from Natural Resources Canada

Snow on canopy:
Larger interception capacity than for rain
Large exposed surface area
Removed by sublimation, unloading, melting
Lower albedo than open areas with snowcover

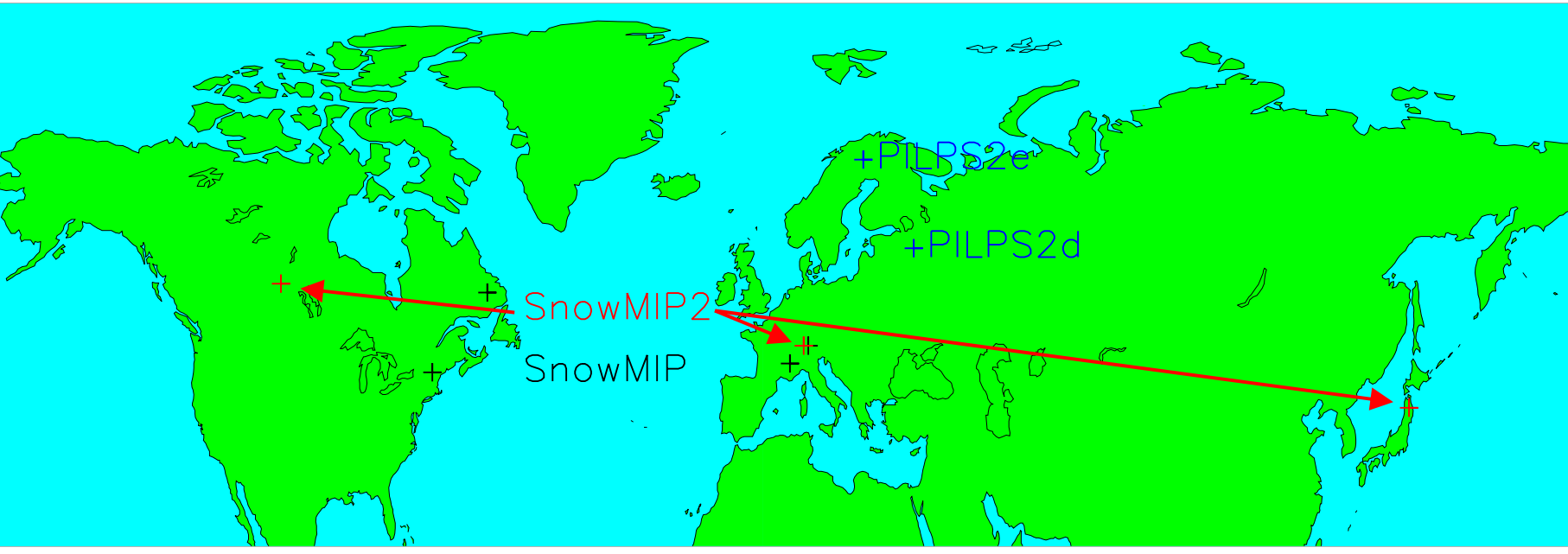
Snow beneath canopy:
Sheltered from wind and solar radiation
Increased thermal radiation from warm canopy
Snowfall decreased due to interception by canopy

SnowMIP2 sites:

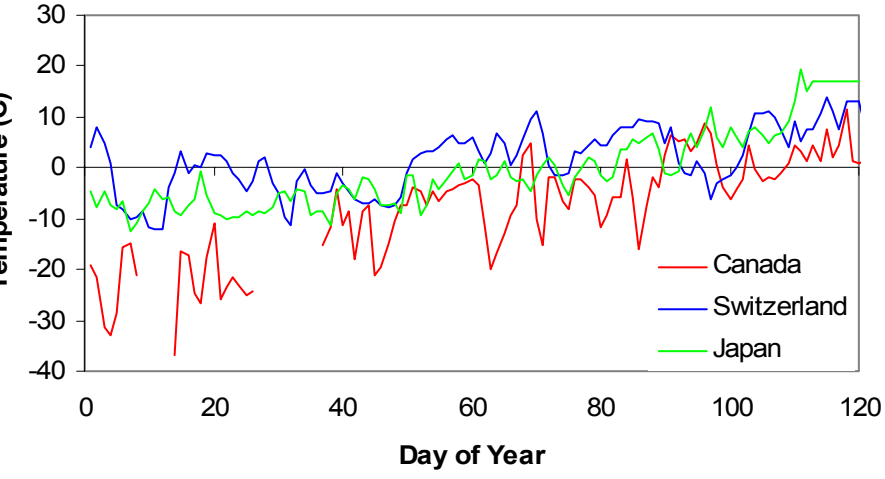
BERMS Old Jack Pine, Canada (53º55'N, 104º41'W, 579 m)
12 – 15 m pine, LAI 2.4

Alptal, Switzerland (47º03'N, 8º43'E, 1200 m)
~ 25 m spruce and fir, LAI 3.9

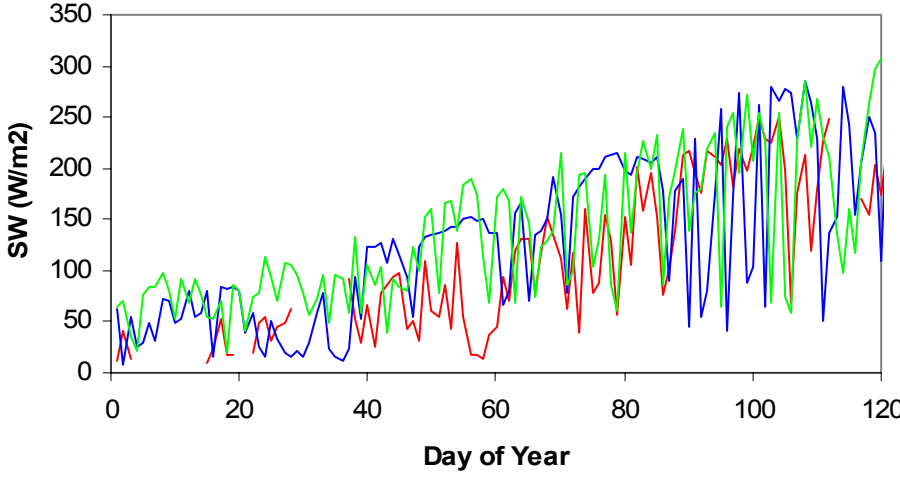
Hitsujigaoka, Japan (42º59'N, 141º23'E, 182 m)
~ 7 m fir, LAI 6



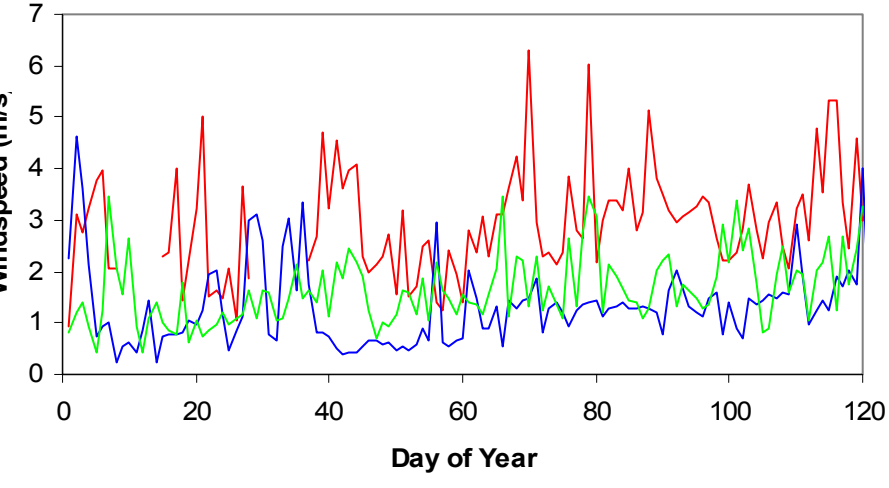
Air temperature



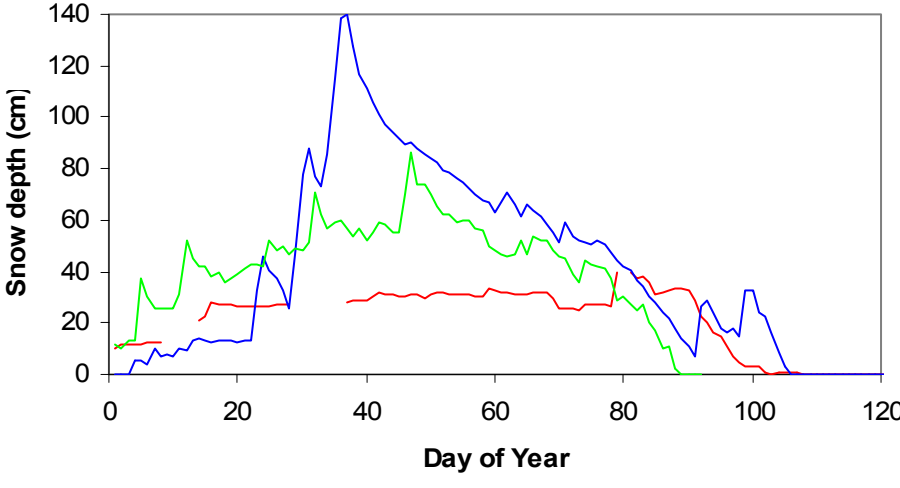
Shortwave radiation

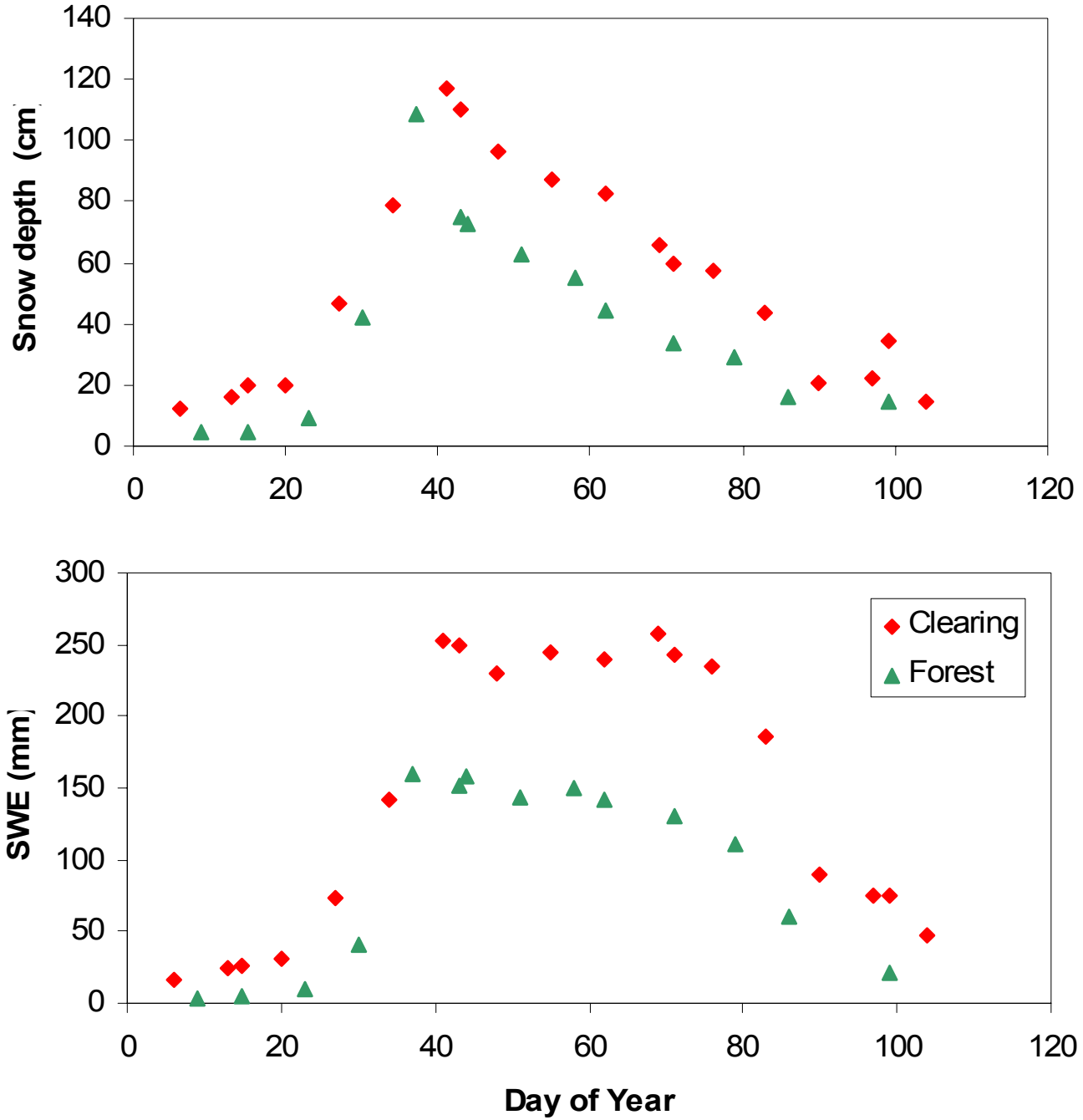


Windspeed



Snow depth




Snow depth (cm)
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
SWE (mm)
300
250
200
150
100
50
0
0
20
40
60
80
100
120
Day of Year
Clearing
Forest

Proposed SnowMIP2 activities:

- Simulations for forest and clearing at each site
- Simulations for two complete winters at each site
- Pilot study with one model
- Snow data for one winter made available for parameter selection?
- Sensitivity studies?
- Comparisons with ground and canopy snow loads
  snow, soil and canopy temperatures
  radiative and turbulent fluxes above and below canopies
  carbon fluxes?