

Simulating Heterogeneous Snow Cover in JULES

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Heterogeneous Snow Cover at Sub-grid Scales

Elevation



Aspect



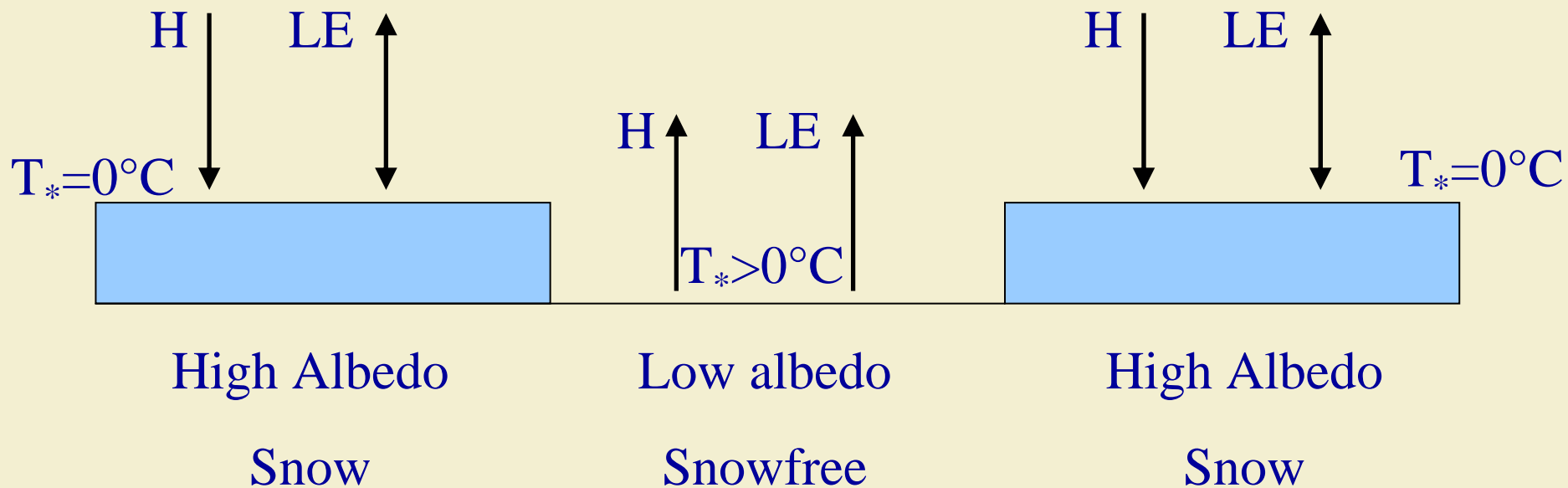
Vegetation and Complex Topography



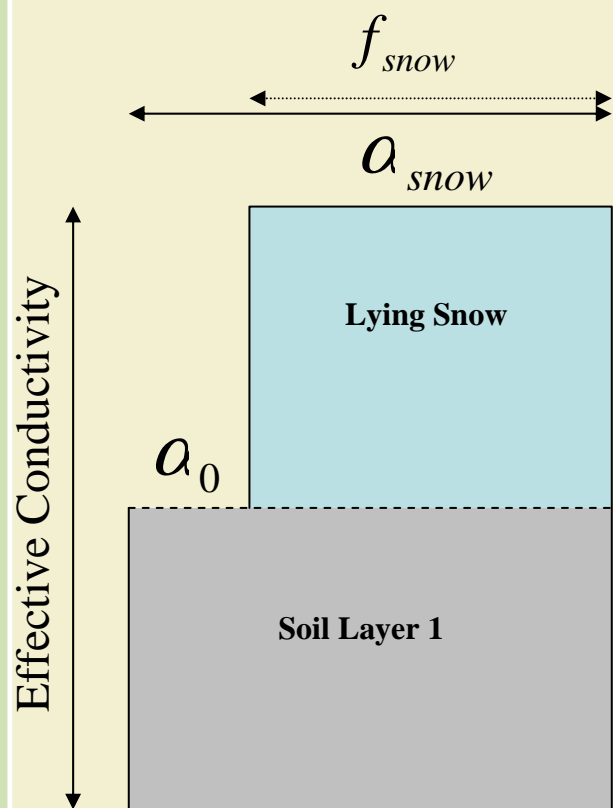
Topography



Surface Energy-Balance of Melting Patchy Snow Under High Radiation



JULES Snow Model

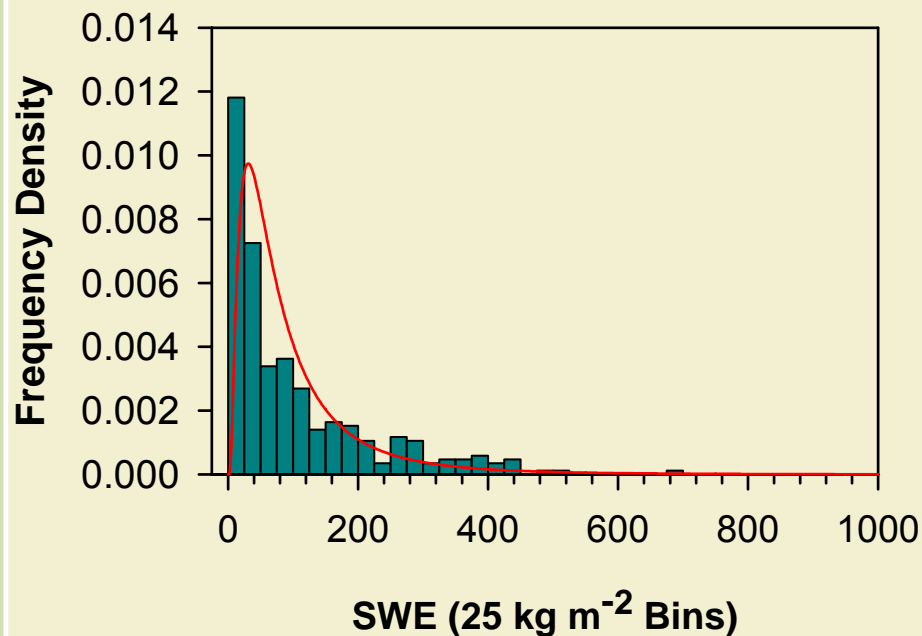


$$a_{effective} = f_{snow} a_{snow} + a_0 (1 - f_{snow})$$

- Uniform snow layer across surface tile extent (GCM 2.5° by 3.75°)
- Effective albedo used to account for vegetation exposed above snow layer and snow-free ground
- Surface Temperature limited to less than or equal to 0°C whilst snow is on the ground
- Snow layer is a composite layer with top soil layer
- No representation of snow hydrology

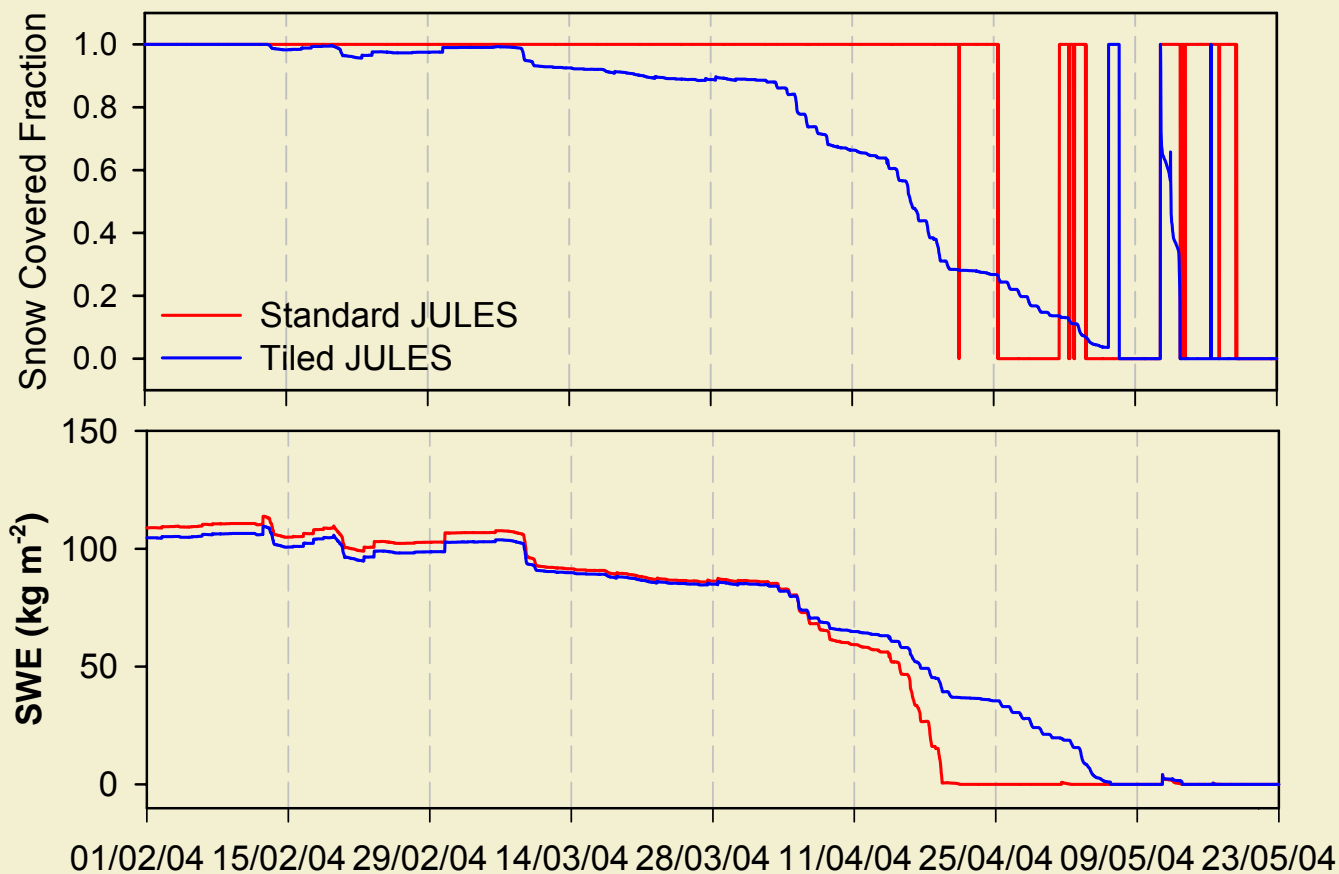
Separate Tiles for Snow and Snow-free Surfaces

Log-normal distribution fitted
to observed snow cover

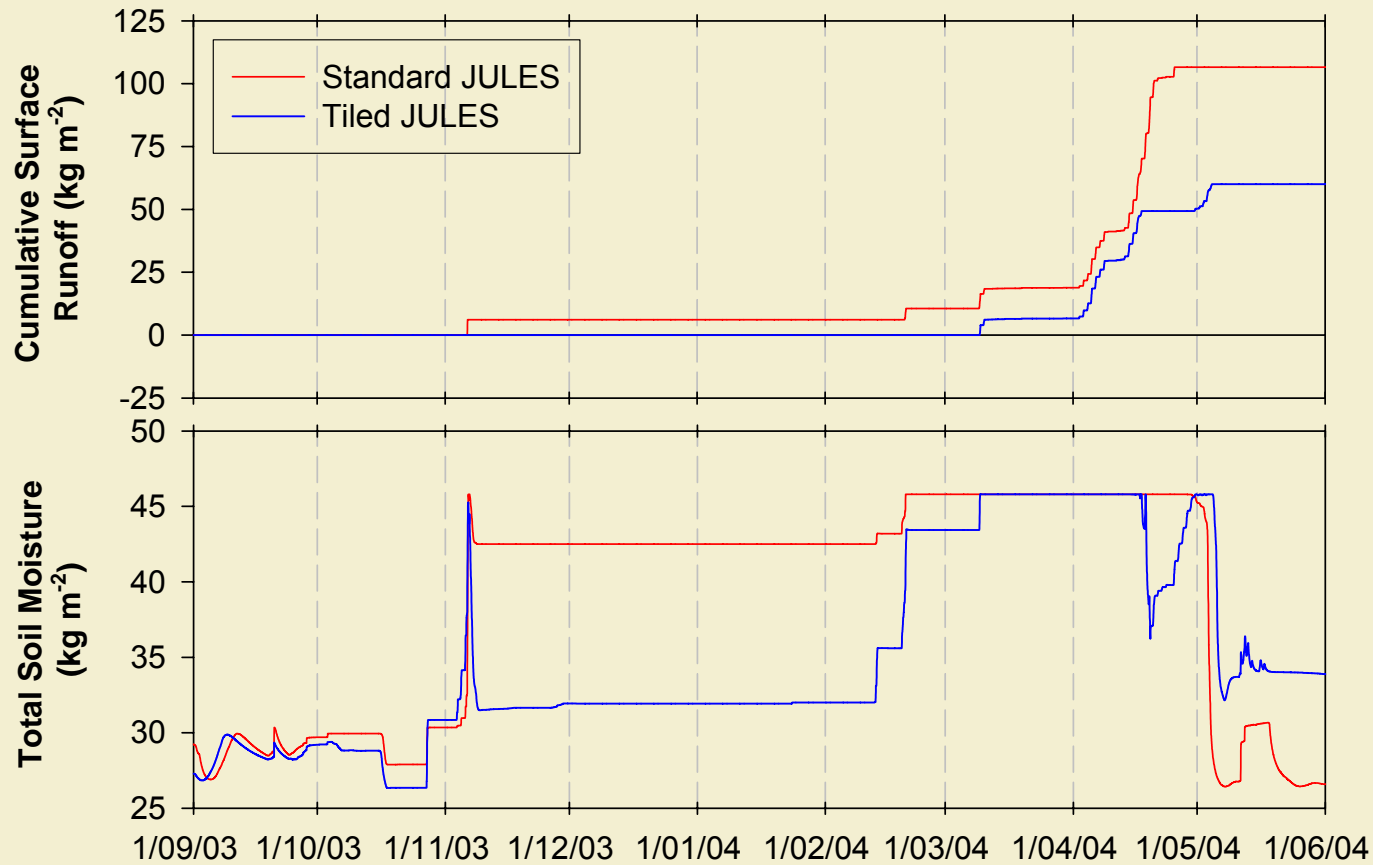


Difficulty is developing
appropriate
parameterisations of snow
covered fraction for a given
snow depth that are
globally applicable

Simulated SWE and Snow Covered Fraction



Soil Moisture and Surface Runoff



The Future

- Global JULES simulations using 1° GSWP2 driving data to test model sensitivity to snow cover parameterisations using an extended tiling scheme:
 - Separate snow and snow-free tiles
 - Elevation Tiling
 - Slope and Aspect Tiling
- Long term goal is a multi-layered snow model and dual source canopy model (snow beneath canopy).

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