Geophysical Research Abstracts, Vol. 7, 06495, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06495

Solar radiation exchange with a tundra shrub and snow surface

D. Bewley (1), R. Essery (1) and J. Pomeroy (2)

(1) Institute of Geography and Earth Sciences, University of Wales, Aberystwyth SY23 3DB, UK (ddb97@aber.ac.uk) (2) Department of Geography, University of Saskatchewan, Saskatoon, Canada

Much of the low Arctic is covered with shrub tundra. Shrub tundra accumulates more snow than poorly vegetated tundra and there is increasing evidence that snowmelt rates are substantially different between shrub and other tundra. Snowmelt energy exchange under shrub canopies is strongly influenced by the transmission of short wave radiation through the canopy and the reflectance from snow under the canopy. Radiation reflection and extinction by deciduous shrub canopies over a melting snowcover are the focus of the current study. An alder shrub tundra covering a valley bottom in the Wolf Creek Research Basin, Yukon Territory, Canada was studied. Shrub heights were approximately 2 m and the canopy was discontinuous and highly heterogeneous. Analysis of aerial photographs covering an area of 900 square metres indicated shrub and gap fractions of 0.4 and 0.6 respectively. Transmissivity observations were made using an array of upward looking pyranometers, 10 below canopy and one above canopy. These showed substantial diurnal and spatial variations, with only a small dependence on solar angle. Areally-averaged transmissivity through the shrub canopy ranged between 0.05 and 0.95, with a mean of 0.43, increasing under overcast conditions. Radiative transfer was modelled by segregating the surface into three dynamical fractions: shrub, gap and shaded gap. The shaded gap fraction was derived by simulating the shadows generated by the shrubs, for which distributions of shrub height and width were measured. Transmissivity through the shrub canopy was calculated for both shrub and shaded gap fractions. Net short wave calculations were completed by applying observed albedo values to each of the three fractions. The resulting areal transmissivity and albedo are between those expected for pure snow and pure shrub surfaces and a function of both Plant Area Index and shrub canopy gap structure.