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CLOUD COVER DICTATES SPRING SNOW COVER, BUT SURFACE TEMPERATURE CHANGE IS RELATED TO BOTH

Scott N Williamson *(University of Alberta, Canada)*
David Hik *(Department of Biological Sciences, University of Alberta, Canada)*
John Gamon *(Department of Biological Sciences, University of Alberta, Canada / Department of Earth & Atmospheric Sciences, University of Alberta, Canada)*

snw@ualberta.ca

The relationship between satellite derived infrared surface temperature and downscaled temperature was investigated for various snow cover and cloud cover fractions in the southwest Yukon for the spring months between 2000 and 2008. Initially, we compared the 2008 monthly average temperatures from two independent downscaled temperature products to MODIS Land Surface Temperature (LST) and air temperature at nine metrological stations, situated above tree-line, for the full range of snow cover fractions. We found that both the downscaled products generally agreed with LST for the low elevation, snow-free, vegetation classes. However a systematic cold bias in average LST was found for snow fractions greater than ~40%, and this bias increased in magnitude as snow cover increased (downscaled temperatures are 5-7 °C warmer than average LST for snow fractions of >90%), but is largely independent of the number of measurements of LST within a month. For the areas with large snow cover fractions the maximum LST is typically similar to the air temperatures, but the minimum is colder by 10 °C or more, which causes the cold bias. The use of nine meteorological monitoring stations located between elevations of 1408 – 2690 m, on Barren, Sparsely Vegetated or Permanent Snow and Ice land covers, confirms the cold bias results from incorporating minimum LST. Between 2000 and 2008, 8 day averages of maximum LST and downscaled NARR surface temperature in conjunction with cloud and snow fractions were investigated. We find that during the spring snow melt period, snow cover extent correlates strongly with cloud cover and temperature correlates strongly with both cloud cover and snow cover. This result suggests that an amplification of surface warming within the study area is the result of snow cover decline, which is mediated by cloud cover.