Session: C11 Poster: M138B

The changing cryosphere: Pan-Arctic snow trends (1979-2009)

Glen Liston[†]; Christopher Hiemstra
[†] Colorado State University, USA
Leading author: liston@cira.colostate.edu

Arctic snow presence, absence, properties, and water amount are key components of Earth's changing climate system that incur far-reaching physical and biological ramifications. Due to a number of measurement and modeling obstacles and scaling issues, pan-Arctic snow properties, particularly snow water equivalent depth (SWE), have been difficult to estimate at spatial resolutions required to understand changing Arctic snow covers. However, recent dataset and modeling developments permit relatively high-resolution (10 km horizontal grid; 3 hourly time-step) pan-Arctic snow property estimates for 1979-2009. Using NASA-MERRA atmospheric reanalysis, land cover, and topography data, in conjunction with the MicroMet and SnowModel modeling tools, we created a 30-year, pan-Arctic dataset that includes distributed air temperature, snow precipitation, snow-season timing and length, maximum SWE, average snow density, snow sublimation, and rain-on-snow events. Regional variability is a dominant feature of the modeled snow-property trends. Both positive and negative regional trends are distributed throughout the pan-Arctic domain, featuring, for example, spatially distinct areas of increasing and decreasing SWE or snow season length. In spite of strong regional variability, the data clearly show a general snow decrease throughout the Arctic: maximum winter SWE has decreased, snow cover onset is later, the snow-free date in spring is earlier, and snow cover duration has decreased. The domain-averaged air temperature trend when snow was on the ground was 0.17oC decade-1 with minimum and maximum regional trends of -0.55 and 0.78oC decade-1, respectively. The trends for total number of snow days in a year averaged -2.49 days decade-1 with minimum and maximum regional trends of -17.21 and 7.19 days decade-1, respectively. The average trend for peak SWE in a snow season was -0.17 cm decade-1 with minimum and maximum regional trends of -2.50 and 5.70 cm decade-1, respectively.