Geophysical Research Abstracts
Vol. 17, EGU2015-2654, 2015
EGU General Assembly 2015

Arctic Light Snow Observations: Missing Precipitation

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The objective of this work is to describe measurement conditions for light snow that is important for meteorological and hydrometeorological applications. Snow microphysical properties play a crucial role for developing better nowcasting/forecasting techniques, and to validate numerical weather prediction (NWP) simulations and assess climate change. Observations collected during the Fog Remote Sensing and Modeling (FRAM) and Satellite Applications for Arctic Weather and SAR (Search And Rescue) Operations (SAAWSO) projects that took place over the cold climatic regions of Canada, including Yellowknife, St. John's, and Goose Bay, respectively, were studied to assess missing snow effect on weather and climate change simulations. The Ground Cloud Imaging Probe (GCIP) together with other microphysical precipitation sensors (e.g. fog device, distrometer) can be used to better understand fog deposition, freezing drizzle, light rain, and light snow spectral characteristics and shape. Light snow particle size range based on GCIP measurements is between 7.5 and 940 μm, and provides particle size spectra over 60 channels at 15 μm intervals, as well as particle shape. The GCIP measurements together with hydrometeor measurements obtained from a distrometer called laser precipitation monitor (LPM) were used in an integrated approach for snow precipitation analysis because of the measurements uncertainties in the particle sizes less than 500 μm. The results suggest that missing light snow depth measurement as less than 1 mm/d can affect the energy budget of Arctic environments over a 6 month time period up to -2 to -5 W/m2 if snow sublimates. These values can be comparable with other feedbacks in climate simulations such as aerosol effects. In this study, GCIP used for light snow measurements and ice fog will be discussed and challenges related to measurement of light snow precipitation microphysics will be emphasized.