---TITLE: Winter Precipitation, Sublimation, and Snow-Depth in the Pan-Arctic: Critical Processes and a Half Century of Change

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The data are from Barrow, Alaska (71°18′1″N 156°44′9″W)

1.1 General Information

We operated two towers near Barrow, Alaska from March to May, 2005 and again from October to June, 2006. Of the two towers we operated during the study period, one was an eddy correlation tower with a sonic anemometer and krypton hygrometer. In addition, high frequency humidity data (20 Hz) was collected at two heights on the eddy correlation tower. The other tower was a small (3-m) gradient tower with four levels of wind and temperature. We call them respectively the Eddy correlation Tower (EC-tower), and the Gradient Tower (G-tower). The G- and EC towers were visited about once a month in the winter (described below).

1.1.1 Meteorological tower specifics

G-tower: Anemometers and air temperature sensors were installed at 4 different heights (see Table **1**). The sampling frequency was 5 min after which 10 min averages were made and stored on a Campbell Scientific CR10 datalogger. A sonic sounder and a particle counter were also installed to continuously record snow depth and blowing snow events but occasionally the latter instrument was buried in the snow. This also occurred occasionally with the lowest wind and air sensor, resulting in inconsistent measurements at that level. A quality control of the data was performed using several consistency checks, and erroneous data due to instrument malfunction was removed.
Notes:

- The sonic sounder should not be trusted fully. This instrument was used as an indicator of drifting snow.

EC-tower: Relative humidity and air temperature sensors were mounted at two different heights. In addition at approximately the height of the upper humidity sensor a krypton hygrometer, CSAT3, and a fine-wire thermocouple were installed. Eddy correlation data were collected at an interval of 20 Hz and stored on a Campbell Scientific CR5000 datalogger. The data was post-processed using software developed by Dean Vickers at Oregon State University. It included statistical analysis for quality control. In the humid conditions near Barrow the krypton hygrometer had a tendency to ice up, and on occasion became coated with marine salts causing inconsistencies in the water flux measurements. The water vapor signal from the krypton was subjected to special quality control (QC) algorithms. Because of this approximately 30% of the records were discarded due to apparent instrument malfunction. In order to compensate for this loss of data, a non-conventional approach was used: we logged the humidity sensors at 20 Hz. Our intent was to see if the HMP's could be used in addition to the krypton hygrometer to provide the vapor flux variance.
Notes:

- 20 Hz data is available upon request (contact Glen Liston)

Table 1 List of Instruments at Barrow by tower.

Tower	Instrument	Model	Parameters	Height, m
Gradient	Anemometer	RM Young 05103	wind_speed_low	0.45
	Anemometer	RM Young 05103	wind_speed_mid	1.7
	Anemometer	RM Young 05103	wind_speed_hi	2.8
	Anemometer	RM Young 05103	wind_speed_top	3.9
	Air temperature	Model 107 Campbell Scientific	air_temperature_low	0.45
	Air temperature	Model 107 Campbell Scientific	air_temperature_mid	1.7
	Air temperature	Model 107 Campbell Scientific	air_temperature_hi	2.8
	Air temperature	Model 107 Campbell Scientific	air_temperature_top	3.9
	Air pressure	CS105 Vaisala PTB101B	air_pressure	1.2
	Sonic sounder	Campbell Scientific SR50	snow_depth	2.39
	Particle counter	by John Pomeroy	particles	0.24
Eddy Correlation	3-D sonic anemometer	CSAT3 Campbell Scientific	sonic_temperature	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	wind_speed_west_CSAT	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	wind_speed_south_CSAT	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	vertical_wind_velocity_variance_CSAT	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	along_wind_velocity_variance_CSAT	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	cross_wind_velocity_variance_CSAT	2.22
	3-D sonic anemometer	CSAT3 Campbell Scientific	friction_velocity_CSAT	2.22
	Specific Humidity from HMP	HMP45C Vaisala	specific_humidity_HMP	2.64
	Relative Humidity	HMP45C Vaisala	relative_humidity_0.5m	0.52

	Relative Humidity	HMP45C Vaisala	relative_humidity_3m	2.64
	3-D sonic anemometer	CSAT3 Campbell Scientific	buoyancy_flux_CSAT	2.22
	Moisture flux from krypton hygrometer	KH20 Campbell Scientific	moisture_flux_krypton	2.1