PROMICE
Programme for Monitoring of the Greenland Ice Sheet

Readme: PROMICE automatic weather station data

Data available at http://www.promice.dk. Contact: info@promice.dk.

Terms of use

If the data are presented or used to support results of any kind, please inform a member of the PROMICE team at GEUS, and:

- Include the acknowledgement: "*Data from the Programme for Monitoring of the Greenland Ice Sheet (PROMICE) were provided by the Geological Survey of Denmark and Greenland (GEUS) at http://www.promice.dk.*" If KAN weather station data are also used, please use the acknowledgement: "*Data from the Programme for Monitoring of the Greenland Ice Sheet (PROMICE) and the Greenland Analogue Project (GAP) were provided by the Geological Survey of Denmark and Greenland (GEUS) at http://www.promice.dk.*"
- Include a reference to a peer-reviewed GEUS paper presenting PROMICE weather station data.

If the data are crucial to the main conclusions of a manuscript or presentation of any kind, please include a member of the PROMICE team at GEUS in the author list.

Variables in hourly, daily and/or monthly data files

For details on calculated/corrected variables we refer to the following paper and references therein: Van As, D. (2011) Warming, glacier melt and surface energy budget from weather station observations in the Melville Bay region of northwest Greenland. Journal of Glaciology, 57 (202), 208-220, doi:10.3189/002214311796405898.

Year	-
MonthOfYear	-
DayOfMonth	-
HourOfDay(UTC)	Time stamp of hourly averages given for following hour.
DayOfYear	-
DayOfCentury	-
AirPressure(hPa)	Barometric pressure in logger enclosure.
AirTemperature(C)	Primary air temperature. Measurement height is approximately HeightSensorBoom – 0.1 m, or 2.6 m over bare ice surfaces.

AirTemperatureHygroClip(C)	Secondary air temperature. Measurement height is approximately HeightSensorBoom – 0.1 m, or 2.6 m over bare ice surfaces.
RelativeHumidity(%)	Relative humidity wrt water/ice above/below freezing. Measurement height is approximately HeightSensorBoom – 10 cm, or 2.6 m over bare ice surfaces.
SpecificHumidity(g/kg)	Calculated from RelativeHumidity.
WindSpeed(m/s)	Measurement height is approximately HeightSensorBoom + 0.4 m, or 3.1 m over bare ice surfaces.
WindDirection(d)	Measurement height is approximately HeightSensorBoom + 0.4 m, or 3.1 m over bare ice surfaces.
SensibleHeatFlux(W/m2)	Calculated using gradients of wind speed, and temperature between the surface and measurement height. Aerodynamic surface roughness for momentum is set to 0.001 m.
LatentHeatFlux(W/m2)	Calculated using gradients of wind speed and humidity between the surface and measurement height. Aerodynamic surface roughness for momentum is set to 0.001 m.
ShortwaveRadiationDown(W/m2)	Measurement height is approximately HeightSensorBoom + 0.1 m, or 2.8 m over bare ice surfaces.
ShortwaveRadiationDown_Cor(W/m2)	Tilt-corrected values calculated from ShortwaveRadiationDown.
ShortwaveRadiationUp(W/m2)	Measurement height is approximately HeightSensorBoom + 0.1 m, or 2.8 m over bare ice surfaces.
ShortwaveRadiationUp_Cor(W/m2)	Tilt-corrected values calculated from ShortwaveRadiationUp.
Albedo_theta<70d	Surface albedo calculated from ShortwaveRadiationDown_Cor and ShortwaveRadiationUp_Cor using values obtained for solar zenith angles below 70°.
LongwaveRadiationDown(W/m2)	Measurement height is approximately HeightSensorBoom + 0.1 m, or 2.8 m over bare ice surfaces.
LongwaveRadiationUp(W/m2)	Measurement height is approximately HeightSensorBoom + 0.1 m, or 2.8 m over bare ice surfaces.
CloudCover	Estimated from LongwaveRadiationDown and AirTemperature.
SurfaceTemperature(C)	Calculated from LongwaveRadiationUp and LongwaveRadiationDown. Surface longwave emissivity is set to 0.97.
HeightSensorBoom(m)	Measured at approximately 0.1 m below the sensor boom. The sensitivity of sonic ranger readings to air temperature is removed.
HeightStakes(m)	Measured on a boom connecting aluminum stakes drilled into ice/firn. The sensitivity of sonic ranger readings to air temperature is removed.
DepthPressureTransducer(m)	Typically drilled >10 m into ice, reduces as ablation occurs.
DepthPressureTransducer_Cor(m)	Air pressure contributions eliminated from DepthPressureTransducer.
AblationPressureTransducer(mm)	Daily ablation estimate from pressure transducer. Only in daily file.

IceTemperature1-8(C)	Subsurface temperature installed at 1, 2, 3, 4, 5, 6, 7 and 10 m depth at ablation-area sites. Note that the thermistor strings in the ablation area will melt out. For sensor depths at accumulation area sites, please contact us.
TiltToEast(d)	Station tilt towards the east. Station may have rotated.
TiltToNorth(d)	Station tilt towards the north. Station may have rotated.
TimeGPS(hhmmssUTC)	GPS time stamp.
LatitudeGPS(degN)	Daily and monthly averages are calculated only using HorDilOfPrecGPS values smaller than 1.
LongitudeGPS(degW)	Daily and monthly averages are calculated only using HorDilOfPrecGPS values smaller than 1.
ElevationGPS(m)	Daily and monthly averages are calculated only using HorDilOfPrecGPS values smaller than 1.
HorDilOfPrecGPS	GPS horizontal dilution of precision (HDOP) value.
LoggerTemperature(C)	Temperature measured by the data logger in the enclosure at 1-1.5 m above the bare ice surface.
FanCurrent(mA)	Current drawn for ventilation of the temperature and humidity assembly. Normal values exceed 100 mA.
FanOK(%)	Percentage of time with sufficient ventilation of the temperature and humidity assembly. Only in monthly file.
BatteryVoltage(V)	Voltage of the four 28 Ah batteries. Ventilation of the temperature and humidity assembly, and GPS positioning, stop below 11.5 V.

Sensor list

Instrument type	Manufacturer	Model
Barometer	Setra	CS100-Setra model 278
Thermometer, aspirated	Rotronic in Rotronic assembly	MP100H-4-1-03-00-10DIN
Hygro-/thermometer, aspirated	Rotronic in Rotronic assembly	HygroClip S3
Wind monitor	R.M. Young	05103-5
Radiometer	Kipp & Zonen	CNR1 or CNR4
Sonic ranger (2)	Campbell Scientific	SR50A
Pressure transducer	Ørum & Jensen in GEUS assembly	NT1400 or NT1700
Thermistor string	GEUS	
Inclinometer	HL Planar in GEUS assembly	NS-25/E2
GPS antenna	Trimble	SAF5270-G

Measurement/transmission intervals

The AWSs measure all variables (except those by GPS) every 10 minutes, and transmit hourly averages during summer (days 100-300) and daily averages during winter. (NB: This may change starting summer 2018.)
Parameters of low variability (height, tilt, etc.) are transmitted every 6 hours in summer, and daily (at midnight)

in winter. In the processing, values are calculated from raw logger data. Data gaps are filled making use of transmitted data, where available. GPS measurements are taken and transmitted every 6 hours / day in summer / winter.

Averages
- Daily averages are calculated from hourly averages if >20 values are available.
- Monthly averages are calculated from daily averages if >24 values are available.

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- Unrealistic spikes have been removed from the data by setting upper and lower limits.
- The most recent values in the data files are calculated from transmitted data and will be updated after the next station visit, improving data quality and coverage.
- Automatic weather stations can topple in strong winds or get covered by winter-accumulated snow, in which cases data quality for most measured variables will be reduced. Erroneous data recorded after/during these events are always identified by the automatic processing routine, but will be clearly identifiable for the data user.
- During maintenance visits (in spring or summer) the stations may be moved/leveled. Variables such as height of depth will undergo an easily recognizable shift.

Changes in version 2 (v2)
- Shortwave radiation values no longer corrected if it requires albedo extrapolation towards the end of the time series.
- Tilt values only given when actually measured.

Changes in version 3 (v3)
- Lower temperature limits set to -80 C, previously -60 C.
- Relative humidity values exceeding 100% now set to 100%.
- Column RelativeHumidity_wrtWater removed.
- Column SpecificHumidity included.
- Wind speed values of 0 m/s no longer replaced by -999.
- Wind speed no longer replaced by -999 for wind directions outside the 1-360 degree range.
- Estimates of the sensible and latent heat fluxes included.
- Pressure transducer depth limit set to 30 m, previously 50 m.
- Daily ablation now calculated after smoothing over 5 hourly values to reduce noise by random measurement error.
- Tilt values now smoothed over 7 values to reduce noise by random measurement error.
- Longwave emissivity of snow and ice changed from 1 to 0.97.
- Surface temperature values exceeding 0 °C now set to 0 °C.
- Latitude and longitude outputted in decimal degrees instead of degrees and decimal minutes.
- Hourly-average raw logger data shifted by one hour (minor bug fix).