Snow Buoy

Snow Buoys (or snow height beacons) measure relative changes in snow height around the platform by means of 4 ultra-sonic snow depth sensors. Calibrated against the initial snow depths during deployment, these relative changes translate into absolute values. In addition, standard meteorological parameters are recorded, and the MET data along with the GPS position is sent via Iridium at hourly intervals.



Buoy description

Manufacturer:	MetOcean, Halifax, Canada
Manufacturer‘s name:	Snow Beacon
Data provider	JouBeh Technologies, Halifax, Canada
Height of mast	1.75 m, total height: 2.55m, height of sensors: 1.5m
Weight	approx. 30 kg
Deployment type	Installation on sea ice (into 25cm diameter hole)

Technical Details

Measured parameters	Sensor
- Snow depth (m)	4x HRXL-MaxSonar-WR3 (MaxBotix) (accuracy: ±0.001 m)
- 1.5m Air temperature (°C)	YSI 44032 (accuracy ±0.5°C)
- Body temperature (°C)	YSI 44032 (accuracy ±0.5°C)
- Barometric pressure (hPa)	PTB110 (Vaisala) (accuracy: ±1.0 hPa) or equivalent
- GPS position	Jupiter 32xLP (Navman Wireless) (accuracy: ± 3 m)

Measurement interval	Hourly acquisition
Data transmission	Transmits hourly
Data transmitter	Iridium 9602 SBD Transceiver
Power supply	Lithium or alkaline batteries (life time >1 year)

Snow Buoy - Processing

Data processing as performed from the raw data to the data product provided on meereisportal.de.
Status January 2021

All data sets (active and dead) buoys have been reprocessed to ensure the consistent usage of all routines for all data sets. Invalid readings, based on the below described evaluation, data are given as NaN in the ASCII download, but are available from the portal (not online), too. Please get in touch with us.

The data processing consists of the following steps

- Removal of duplicates
- Restriction of data set to valid time period (e.g. exclude test data sets)
- Flagging (and removal) of erroneous values from the raw data (see below)
- Correction for temperature dependency for speed of sound (only needed for the first build of the buoys)
- Data filters (see below)
    - Buoy specific corrections: min/max filters to remove outliers
    - Filter snow depth readings
    - Differences
    - Running mean
- Convert relative changes to real snow depth (apply deployment information)
- Calculate mean snow depth from 4 sonics

Snow Buoy - Filters

The processed Snow Buoy files are filtered for different kinds of erroneous data. In the online files (meereisportal.de) these data are replaced by NAN, for simplicity. However, the original values and an additional flag structure are available from meereisportal.de. Please get in touch with us.

In the original files (*S*_*.mat), the flag structure is based on a binary system, which allows identification on which criteria(s) the individual readings fail. In this case an error value (default =0) is increased by a specific amount. Finally, all data with error values >0 are excluded from the presented data set and set to NaN. These filters are applied for each data field:

Error values for snow height SH
+128: date/time out of reliable range (e.g. before official deployment)
+32: above allowed range (150cm)
+4: running mean: difference is >3cm larger than running mean of 5 readings (snow height differs by >3cm compared to last and next 2h)
+2: gradient criteria: difference of reading is >10cm larger than previous record (max snow accumulation 10cm/h)
+1: buoy specific / manual criteria (see below)

Error values for air temperature AT
+32: temperature <-50C
+1: buoy specific / manual criteria (see below)

Error values for barometric pressure BP
+1: buoy specific / manual criteria (see below)

Specific / manual filter for all sensors
Each buoy has a specific and manual filtering, which is done in post-processing based on the existing time series
Some units were processed with additional filters of outliers (min/max) criteria.

Columns in the filter structure (filter_flag): 1-4 = SH 1-4, 5: SST, 6: BP, 7: BPT, 8: AT, 9: VBAT