ReadMe - V_air_temperature_snowbed

Eeva Soininen
(eeva.soininen@uit.no)

18.11.2022

1 Protocol

Air temperature is measured at 0 cm above ground using iButtons (Maxim Integrated, San Jose, California, USA) with a loggin interval of 4 hours following the COAT protocol 'protocol_temperature_loggers_air_temperature_varanger'.

1.1 Timing of sampling and changes in that

Temperature loggers are usually deployed the whole year and are downloaded once a year. However, there is some missing data in summer (between a few days and ca 2 month) when the loggers were changed.

1.2 Spatial layout of sampling and changes in that

From 2009 onwards, temperature loggers were deployed in three localities, Vestre Jakobselv, Komagdalen and Ifjordfjellet.

Some sites in Vestre Jakobselv were removed from the study design in 2016 and the locality Ifjordfjellet has been removed in 2017.

More detailed information about which sites were included in the study design and the different setups can be found in the auxialiary file 'V_air_temperature_snowbed_aux.txt'.

2 Description of the dataset

The dataset includes four differnt types of files and all files are saved as ;-separated txt-files:

- One data file per year (`loggerID_YEAR.txt`)
- One meatadata file per year with dates when the loggers were deployed and collected (`V_air_temperature_snowbed_metadata_YEAR.txt`)
- One coordinate file with coordinates of all sites (`V_air_temperature_snowbed_coordinates.txt`)
- One auxiliary file with information about which sites are included in the study design (`V_air_temperature_snowbed_aux.txt`)

2.1 Temperature data files

These files contain temperature values measured every four hours.

Example of the first rows of the data files:

```
  sn_region sn_locality sn_section sc_type_of_sites_ecological     sn_site
1  varanger  komagdalen kjoltindan                     snowbed ko_kj_sn_11
2  varanger  komagdalen kjoltindan                     snowbed ko_kj_sn_11
3  varanger  komagdalen kjoltindan                     snowbed ko_kj_sn_11
  sn_plot     t_date   t_time           t_bintime v_logger_id v_height
1       2 2018-07-11 01:45:01 2018-07-10 22:00:00 ko_kj_sn_11        0
2       2 2018-07-11 05:45:01 2018-07-11 02:00:00 ko_kj_sn_11        0
3       2 2018-07-11 09:45:01 2018-07-11 06:00:00 ko_kj_sn_11        0
  v_temperature v_comment
1        12.580        NA
2        19.097        NA
3        32.095        NA
```

Description of the columns included in the data files:

Column name	Description	Possible values
sn_region	Study region	varanger
sn_locality	Locality (within region)	komagdalen, vestre_jakobselv
sn_section	Section (within locality)	eastordalen, storelva, ruossachokka, kjoltindan, torvhaugdalen, bearalveaijohka
sc_type_of_sites_ecological	Habitat type	snowbed
sn_site	Unique Site ID	e.g. ko_kj_sn_11, ko_kj_sn_15, ko_kj_sn_3, ko_ru_sn_17, ko_ru_sn_3
sn_plot	Plot within site where the logger was deployed	2
t_date	Logging date	yyyy-mm-dd
t_time	Logging time	hh:mm:ss
t_bintime	Consistent logging date and time for all loggers	yyyy-mm-dd hh:mm:ss
v_logger_id	Logger ID	e.g. ko_kj_sn_11, ko_kj_sn_15, ko_kj_sn_3, ko_ru_sn_17, ko_ru_sn_3
v_height	Height in which the logger was deployed (cm) *	[numeric]
v_temperature	measured temperature (°C)	[numeric]
v_comment	Comments	[character]

* Note that this dataset only includes loggers at 0 cm, the variable is included for compatibility with other datasets.

2.2 Metadata files

These annual files contain additional information for each logger, such as height of the logger and dates when the loggers were deployed and collected.

Example of the first rows of metadata files:

```
  sn_region   sn_locality  sn_section sc_type_of_sites_ecological    sn_site
1  varanger ifjordfjellet eastordalen                     snowbed if_ea_sn_1
2  varanger ifjordfjellet eastordalen                     snowbed if_ea_sn_2
3  varanger ifjordfjellet eastordalen                     snowbed if_ea_sn_3
  sn_plot t_year v_logger_id v_height v_date_logger_in v_date_logger_out
1       2   2009  if_ea_sn_1        0       2009-07-04        2009-09-05
2       2   2009  if_ea_sn_2        0       2009-07-04        2009-09-05
3       2   2009  if_ea_sn_3        0       2009-07-04        2009-09-05
  v_date_logger_started v_observer                           v_comment
1                  <NA>       <NA> in: assumed date, out: assumed date
2                  <NA>       <NA> in: assumed date, out: assumed date
3                  <NA>       <NA> in: assumed date, out: assumed date
```

Description of the columns included in the metadata files:

Column name	Description	Possible values
sn_region	Study region	varanger
sn_locality	Locality (within region)	ifjordfjellet, komagdalen, vestre_jakobselv
sn_section	Section (within locality)	eastordalen, storelva, ruossachokka, kjoltindan, torvhaugdalen, bearalveaijohka
sc_type_of_sites_ecological	Habitat type	snowbed
sn_site	Unique Site ID	e.g. if_ea_sn_1, if_ea_sn_5, if_ea_sn_10, if_ea_sn_20, if_st_sn_4
sn_plot	Plot within site where the logger was deployed	2
t_year	Year in which loggers were changed	e.g. 2005
v_logger_id	Logger ID	e.g. if_ea_sn_1, if_ea_sn_5, if_ea_sn_10, if_ea_sn_20, if_st_sn_4
v_height	Height in which the logger was deployed (cm)	[numeric]
v_date_logger_in	Date when the logger was collected	yyyy-mm-dd
v_date_logger_out	Date when the logger was deployed	yyyy-mm-dd
v_date_logger_started	Date when the logger was started	yyyy-mm-dd

v_observer	Initials of observer	e.g. es (Eeva Soininen)
v_comment	Comments	[character]

2.3 Coordinate file

This file contains the coordinates of all sites included in the study desgin. Coordinates are given in decimal degrees and UTM 33 (WGS 84).

Example of the first rows of coordinate files:

```
     sn_site     e_dd     n_dd  e_utm33 n_utm33
1 if_ea_sn_1 27.35208 70.42404 959119.7 7860013
2 if_ea_sn_2 27.35316 70.42437 959151.9 7860058
3 if_ea_sn_3 27.35785 70.42369 959339.5 7860019
```

2.4 Auxiliary file

This file contains further information about the dataset such as old site names (for example used in raw data files before 2019) and the years when sites were first included in the study design and when sites were excluded from the study design.

Example of the first rows of auxiliary-files:

```
  sn_region   sn_locality  sn_section    sn_site sn_site_old year_first
1  varanger ifjordfjellet eastordalen if_ea_sn_1        ia01       2009
2  varanger ifjordfjellet eastordalen if_ea_sn_2        ia02       2009
3  varanger ifjordfjellet eastordalen if_ea_sn_3        ia03       2009
  year_last v_comment
1      2017        NA
2      2017        NA
3      2017        NA
```

3 Data cleaning and formatting

From 2009 to 2018, rawdata has been cleaned and days when the loggers were not not deployed were removed by Eivind Flittie Kleiven and Hanna Boehner. All pre-cleaned files were formatted meeting the requirements of the COAT dataportal by Hanna Boehner.

From 2019 onwards, raw metdata (entered in an excel-template) and temperature data (downloaded from the temperature loggers) are cleaned and formatted using the scripts
`01_clean_metadata_temperature_data_snowbeds_COAT.R` and
`02_clean_cut_temperature_data_snowbeds_COAT.R` .

1. Metadata: The scripts checks all variables for correct spelling and correct formatting. Errors will be corrected in the script and the data will be reformatted according to the requirements of the COAT data portal. The file will be saved as a ;-spearated txt-file and uploaded to to COAT data portal. In particular, the script checks for:

- **sn_site:** Correct spelling of all variables.
- **t_date:** Correct format (yyyy-mm-dd), dates in other formats are reformatted.
- **v_logger_id:** Missing observations. Are all loggers included in the metadata?
- **v_observer:** Correct format (initials and lowercase letters), observer is reformatted e.g. if full names were used.
- **v_comment:** Correct spelling and format (lowercase letters and english). Comments are edited or translated if necessary.

All corrections that lead to differences between rawdata and cleaned data are double-checked in the fieldbooks and a comment is added.

2. Temperature data: The script removes the days when the logger was not deployed in the field , reformats the data according to the requirements of the COAT data portal and saves the data as ;-separated txt-tiles which can be uploaded to the COAT data portal. In particular, the script includes the following steps:

- Checking if the logger was started before it was deployed in the field and was stopped after it was collected.
- Removing days when the logger was not deployed (based on t_date_logger_in and t_date_logger_out in the metadata).
- Reformatting the columns t_date and t_time and adding t_bintime.
- Checking the recorded temperature values. Sometimes the logger jumps to extreme values (above +40 °C and below - 40 °c), these will be set to NA.
- Adding all other necessary columns such as spatial variables and loggerID.