ReadMe - V_air_temperature_meadow

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18.11.2022

1 Protocol

Air temperature is measured 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 2005 onwards, temperature loggers were deployed in two localities, Vestre Jakobselv and Komagdalen. In Komagdalen, a new section ('sandfjorddalen') has been included since 2010.

A third locality, Ifjordfjellet, has been included from 2009 to 2017.

From 2005 to 2011, temperature loggers were deployed in the first and the last site of each section. From 2011 onwards, temperature loggers were deployed in all sites.

The loggers were deployed in 3 different setups:
2005-2010: Two loggers in 100 cm height at the thicket edge of each site. These loggers are named siteID_th1_100 and siteID_th2_100.
2010-2011: Two loggers at the thicket edge of each site. One logger was deployed at ground level and one in 30 cm height. These loggers are named siteID_th (ground level) and site_ID_th30 (30 cm height).
2011 onwards: Two loggers at ground level in each site. One logger is deployed at the thicket edge and one at the meadow edge (see protocol). These loggers are named siteID_th (thicket edge) and siteID_me (meadow edge).

If loggers were moved during winter and were not collected at the correct position, they are named siteID_na. If both loggers were found at the wrong position, they are named siteID_na1 and siteID_na2.

Note: the names thicket and meadow edge refer to the postion of the logger within the sampling quadrat, sites in the section 'sandfjorddalen', iesjohka' and 'giksjohka' do not have thicket habitats.

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_meadow_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_meadow_metadata_YEAR.txt`)
- One coordinate file with coordinates of all sites (`V_air_temperature_meadow_coordinates.txt`)
- One auxiliary file with information about which sites are included in the study design (`V_air_temperature_meadow_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 komagdalen_midtre                      meadow ko_km_m_a
2  varanger  komagdalen komagdalen_midtre                      meadow ko_km_m_a
3  varanger  komagdalen komagdalen_midtre                      meadow ko_km_m_a
  sn_plot     t_date   t_time           t_bintime  v_logger_id v_height
1       1 2018-07-29 00:21:01 2018-07-28 22:00:00 ko_km_m_a_th        0
2       1 2018-07-29 04:21:01 2018-07-29 02:00:00 ko_km_m_a_th        0
3       1 2018-07-29 08:21:01 2018-07-29 06:00:00 ko_km_m_a_th        0
  v_temperature v_comment
1        14.596        NA
2        11.088        NA
3        15.598        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)	komagdalen_midtre, komagdalen_ovre, bearalveaijohka, torvhaugdalen, jakobselv, eastordalen, giksjohka, iesjohka, storelva, sandfjorddalen
sc_type_of_sites_ecological	Habitat type	meadow
sn_site	Unique Site ID	e.g. ko_km_m_a, ko_km_m_e, ko_ko_m_e, vj_be_m_d, vj_to_m_c
sn_plot	Corner of the sampling quadrat in which the logger was placed	1, 6
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_km_m_a_th, ko_km_m_c_th, ko_ko_m_a_me, ko_sa_m_a_th, ko_sa_m_c_th
v_height	Height in which the logger was deployed (cm)	0, 30, 100
v_temperature	measured temperature (°C)	[numeric]
v_comment	Comments	[character]

2.2 Metadata files

These files contain additional inforamtion 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  komagdalen komagdalen_midtre                      meadow ko_km_m_a
2  varanger  komagdalen komagdalen_midtre                      meadow ko_km_m_e
3  varanger  komagdalen   komagdalen_ovre                      meadow ko_ko_m_a
  sn_plot t_year      v_logger_id v_height v_date_logger_in v_date_logger_out
1       1   2005 ko_km_m_a_th_100      100             <NA>        2005-08-27
2       1   2005 ko_km_m_e_th_100      100             <NA>        2005-07-12
3       1   2005 ko_ko_m_a_th_100      100             <NA>        2005-08-27
  v_date_logger_started v_observer v_comment
1                  <NA>       <NA>      <NA>
2                  <NA>       <NA>      <NA>
3                  <NA>       <NA>      <NA>
```

Description of the columns included in the metadata files:

Column name	Description	Possible values
sn_region	Study region	varanger
sn_locality	Locality (within region)	komagdalen, vestre_jakobselv, ifjordfjellet
sn_section	Section (within locality)	komagdalen_midtre, komagdalen_ovre, bearalveaijohka, torvhaugdalen, jakobselv, eastordalen, giksjohka, iesjohka, storelva, sandfjorddalen
sc_type_of_sites_ecological	Habitat type	meadow

sn_site	Unique Site ID	e.g. ko_km_m_a, vj_be_m_e, if_ea_m_e, if_ea_m_c, if_st_m_b
sn_plot	Corner of the sampling quadrat in which the logger was placed	1, NA, 6
t_year	Year in which loggers were changed	e.g. 2005
v_logger_id	Logger ID	e.g. ko_km_m_a_th_100, vj_be_m_e_th_100, if_ea_m_a_th2_100, ko_ko_m_e_th2_100, vj_to_m_d_th2_100
v_height	Height in which the logger was deployed (cm)	0, 30, 100
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_m_a 27.36179 70.40552 959895.0 7858059
2 if_ea_m_b 27.34104 70.42183 958764.2 7859688
3 if_ea_m_c 27.34996 70.42336 959057.2 7859923
```

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. It also includes in which sites were included in which of the different setups (see section 1.2).

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_m_a        ae1k       2009
2  varanger ifjordfjellet eastordalen if_ea_m_b        ae2k       2011
```

```
3  varanger ifjordfjellet eastordalen if_ea_m_c        ae3k       2011
  year_last v_comment v_setup_2005_2010 v_setup_2010_2011 v_setup_2011
1      2017        NA                 1                 1            1
2      2017        NA                 0                 0            1
3      2017        NA                 0                 0            1
```

3 Data cleaning and formatting

From 2005 to 2008, rawdata has been cleaned by Vegard Trasti. From 2009 to 2018, rawdata has been cleaned and days when the loggers were not not deployed were removed by 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_meadows_COAT.R` and
`02_clean_cut_temperature_data_meadows_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.