ReadMe - V_soil_moisture_intensive_quadrats_experimental

Eeva Soininen
(eeva.soininen@uit.no)

15.11.2022

1 Protocol

Soil moisture is measured using TMS-4 data loggers (TOMST, Prague, Czech Republic) with a logging interval of 15 minutes following the COAT protocol 'protocol_soil_moisture_temperature_loggers_varanger'.

1.1 Timing of sampling and changes in that

Temperature loggers are usually deployed the whole year and are downloaded once a year.

1.2 Spatial layout of sampling and changes in that

The loggers were deployed in 2021 at the intensive quadrats at Vestre Jakobselv inside the all herbivore exclosures. Only quadrats where exclosure experiment is conducted are included in the dataset.

More detailed information about which sites were included in the study design can be found in the auxiliary file 'V_soil_moisture_intensive_quadrats_experimental_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 (`V_soil_moisture_intensive_quadrats_experimental_YEAR.txt`)
- One meatadata file per year with dates when the loggers were deployed and collected (`V_soil_moisture_temperature_intensive_quadrats_experimental_metadata_YEAR.txt`)
- One coordinate file with coordinates of all sites (`V_soil_moisture_temperature_intensive_quadrats_experimental_coordinates.txt`)
- One auxiliary file with information about which sites are included in the study design (`V_soil_moisture_temperature_intensive_quadrats_experimental_aux.txt`)

2.1 Soil moisture data files

These files contain raw soil moisture values measured every 15 minutes. The raw values can be converted to volumetric soil moisture content. However, there is no calibration for the soil types included in this dataset available. The calibrations provided by the manufacturer TOMST don't cover the whole range of this dataset and can not be applied.

Example of the first rows of the data files:

```
  sn_region      sn_locality      sn_section    sn_site
1  varanger vestre_jakobselv bearalveaijohka vj_be_hn_a
2  varanger vestre_jakobselv bearalveaijohka vj_be_hn_a
3  varanger vestre_jakobselv bearalveaijohka vj_be_hn_a
  sc_type_of_sites_ecological       sc_plot_treatment     t_date   t_time
1                  heath_near all_herbivore_exclosure 2021-08-07 00:00:00
2                  heath_near all_herbivore_exclosure 2021-08-07 00:15:00
3                  heath_near all_herbivore_exclosure 2021-08-07 00:30:00
                       v_logger_id v_soil_moisture v_comment
1 vj_be_hn_a_all_herbivore_exclosure            1674        NA
2 vj_be_hn_a_all_herbivore_exclosure            1675        NA
3 vj_be_hn_a_all_herbivore_exclosure            1676        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)	vestre_jakobselv
sn_section	Section (within locality)	bearalveaijohka, torvhaugdalen
sn_site	Unique Site ID	e.g. vj_be_hn_a, vj_to_m_a
sc_type_of_sites_ecological	Habitat type	heath_near, meadow
sc_plot_treatment	Plot treatment within site where the logger was deployed	all_herbivore_exclosure
t_date	Logging date	yyyy-mm-dd
t_time	Logging time	hh:mm:ss
v_logger_id	Logger ID	e.g. vj_be_hn_a_all_herbivore_exclosure, vj_to_m_a_all_herbivore_exclosure
v_soil_moisture	Soil moisture raw values	[numeric]
v_comment	Comments	[character]

2.2 Metadata files

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

Example of the first rows of metadata files:

```
  sn_region      sn_locality      sn_section sc_type_of_sites_ecological
1  varanger vestre_jakobselv bearalveaijohka                  heath_near
2  varanger vestre_jakobselv bearalveaijohka                  heath_near
3  varanger vestre_jakobselv bearalveaijohka                  heath_near
      sn_site       sc_plot_treatment t_year
1  vj_be_hn_a all_herbivore_exclosure   2021
2  vj_be_hn_b all_herbivore_exclosure   2021
3 vj_be_hn_c2 all_herbivore_exclosure   2021
                          v_logger_id v_serial_number v_date_logger_in
1  vj_be_hn_a_all_herbivore_exclosure        94213416             <NA>
2  vj_be_hn_b_all_herbivore_exclosure        94213418             <NA>
3 vj_be_hn_c2_all_herbivore_exclosure        94213425             <NA>
  v_date_logger_out v_observer v_comment
1        2021-08-06        aem      <NA>
2        2021-08-05        aem      <NA>
3        2021-08-05        kha      <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)	vestre_jakobselv
sn_section	Section (within locality)	bearalveaijohka, torvhaugdalen
sc_type_of_sites_ecological	Habitat type	heath_near, meadow
sn_site	Unique Site ID	e.g. vj_be_hn_a, vj_to_m_b
sc_plot_treatment	Plot treatment within site where the logger was deployed	
t_year	Year in which loggers were downloaded	e.g. 2005
v_logger_id	Logger ID	e.g. vj_be_hn_a_all_herbivore_exclosure, vj_to_m_b_all_herbivore_exclosure
v_serial_number	Serial number of the logger	e.g. 94213416, 94213424
v_date_logger_in	Date when the logger was collected/downloaded	yyyy-mm-dd
v_date_logger_out	Date when the logger was deployed/downloaded	yyyy-mm-dd
v_observer	Date when the logger was started	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 design. 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 vj_to_hn_c 29.08530 70.30827 1025566 7861453
2 vj_to_hn_d 29.11366 70.30286 1026747 7861110
3 vj_be_hn_a 28.95137 70.28681 1021193 7857958
```

2.4 Auxiliary file

This file contains further information about the dataset such as the years when sites were first included in the study design and when sites were excluded from the study design as well as site specific information about soil type and vegetation.

Example of the first rows of auxiliary-files:

```
  sn_region      sn_locality      sn_section sc_type_of_sites_ecological
1  varanger vestre_jakobselv bearalveaijohka                  heath_near
2  varanger vestre_jakobselv bearalveaijohka                  heath_near
3  varanger vestre_jakobselv bearalveaijohka                  heath_near
      sn_site       sc_plot_treatment year_first year_last     t_date t_time
1  vj_be_hn_a all_herbivore_exclosure       2021        NA 06/08/2021  15:50
2  vj_be_hn_b all_herbivore_exclosure       2021        NA 05/08/2021  16:00
3 vj_be_hn_c2 all_herbivore_exclosure       2021        NA 05/08/2021   <NA>
  v_serial_number v_vegetation_height_cm v_moss_depth_cm
1        94213416                      7             1.0
2        94213418                     15             0.5
3        94213425                      5             1.0
  v_organic_layer_depth_cm v_sand_percent v_silt_percent v_clay_percent
1                        5             NA             NA             NA
2                       NA             NA             NA             NA
3                        4              5             90              5
                            v_comment_soil_type v_soil_type_calibration
1              mainly silt, some sand and gravel               silt_loam
2 mainly organic soil, fine material (sand, clay)                   peat
3                                          <NA>               silt_loam
                   v_certainty_soil_type_calibration v_observer v_comment
1                                   relative certain        aem      <NA>
2 uncertain if peat is appropriate for other organic soils        aem      <NA>
3                                   relative certain        kha      <NA>
```

3 Data cleaning and formatting

Raw metdata (entered in an excel-template) and data downloaded from the loggers are cleaned and formatted using the scripts `01_clean_and_reformat_metadata.R` and `02_process_data_tomst_loggers.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 ;-separated 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:

- 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.
- Checking the recorded temperature values.
- Adding all other necessary columns such as spatial variables and loggerID.