

Package ‘mesonet’

May 8, 2026

Type Package

Title Download and Process Oklahoma Mesonet Data

Version 0.0.2

Date 2025-12-10

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Description A collection of functions to download and process weather data from the Oklahoma Mesonet <<https://mesonet.org>>. Functions are available for downloading station metadata, downloading Mesonet time series (MTS) files, importing MTS files into R, and converting soil temperature change measurements into soil matric potential and volumetric soil moisture.

License GPL-2

Encoding UTF-8

RoxygenNote 7.3.2

Suggests tinytest

Imports methods, stats, units

Depends R (>= 4.2.0)

NeedsCompilation no

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Repository CRAN

Date/Publication 2025-12-11 12:30:02 UTC

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mnet_calc_mp	<i>Calculate soil matric potential for Oklahoma Mesonet data</i>
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Description

Calculate soil matric potential from delta-T soil temperature change data from the Oklahoma Mesonet using the equation from Zhang et al (2019) <doi:10.2136/sssaj2018.12.0481>: $MP = 2083 / (1 + \exp(-3.35 * (T_{ref} - 3.17)))$ where T_{ref} is the measured delta-T data

Usage

```
mnet_calc_mp(data)
```

Arguments

data	a data frame that contains columns for delta-T temperature change data (i.e. TR05, TR25, TR60, TR75)
------	--

Value

a data frame containing new columns with matric potential (kPa) for each column of delta-T temperature change data.

Examples

```
mesonet_data <- data.frame(TR05 = 3.17, TR25 = 2.17, TR60 = 2.0, TR75 = 1.0)
```

```
mnet_calc_mp(mesonet_data)
```

mnet_calc_vwc	<i>Calculate soil volumetric water content for Oklahoma Mesonet data</i>
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Description

Calculate soil volumetric water content from delta-T soil temperature change data from the Oklahoma Mesonet using [mnet_calc_mp](#) to calculate matric potential and [mnet_van_genuchten](#) to calculate the corresponding volumetric water content using parameters provided by [mnet_site_info](#).

Usage

```
mnet_calc_vwc(data, site_info = NULL)
```

Arguments

data	a data frame that contains a column of Mesonet station identifier codes (i.e. STID) and columns for delta-T temperature change data (i.e. TR05, TR25, TR60, TR75)
site_info	a data frame with site and soil information for each Oklahoma Mesonet station as returned by mnet_site_info . If NULL, mnet_site_info will be used to download this information internally

Value

a data frame containing new columns with volumetric water content for each column of delta-T temperature change data.

Examples

```
# Create example dataset
mesonet_data <- data.frame(STID = "ACME", DATE = as.POSIXct("2025-01-01"),
                          TR05 = 3.17, TR25 = 2.17, TR60 = 2.0, TR75 = 1.0)

mnet_calc_vwc(mesonet_data)
```

mnet_concatenate	<i>Concatenate subdaily Oklahoma Mesonet records for multiple dates or stations.</i>
------------------	--

Description

Concatenate subdaily Oklahoma Mesonet records for multiple dates or stations.

Usage

```
mnet_concatenate(
  stid = NULL,
  start_date = NULL,
  end_date = NULL,
  site_info = NULL,
  file_cache = NULL
)
```

Arguments

stid	a character vector of four-digit station identifiers for the Mesonet stations from which to download data
start_date	the first date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
end_date	the final date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
site_info	a data frame with site and soil information for each Oklahoma Mesonet station as returned by mnet_site_info . If NULL, mnet_site_info will be used to download this information internally
file_cache	a character string providing a path to the local Mesonet file cache. If NULL, the function will search for the local file cache and if not found will prompt the user to create one.

Value

A data frame with Oklahoma Mesonet data. See below for a list of variables including column ID, name, unit and description:

ID	Name	Unit	Description
PRES	Station Atmospheric Pressure	kPa	5-minute averaged atmospheric
RAIN	Precipitation	millimeters	Liquid precipitation accumulat
RELH	Relative Humidity	percent	5-minute averaged relative hur

SRAD	Solar Radiation	watts per square meter	5-minute averaged downwelling
STID	Station ID		Station ID
STNM	Station Number		Station Number
TA9M	Air Temperature at 9m	degrees Celsius	5-minute averaged air temperature
TAIR	Air Temperature	degrees Celsius	5-minute averaged air temperature
TB05	Temperature Under Bare Soil at 5cm	degrees Celsius	15-minute averaged temperature
TB10	Temperature Under Bare Soil at 10cm	degrees Celsius	15-minute averaged temperature
TIME	Time	minutes after base time	Minutes after base time (typical)
TR05	Soil Moisture Calibrated Delta-T at 5cm	degrees Celsius	30-minute calibrated change in
TR25	Soil Moisture Calibrated Delta-T at 25cm	degrees Celsius	30-minute calibrated change in
TR60	Soil Moisture Calibrated Delta-T at 60cm	degrees Celsius	30-minute calibrated change in
TR75	Soil Moisture Calibrated Delta-T at 75cm	degrees Celsius	30-minute calibrated change in
TS05	Temperature Under Native Vegetation at 5cm	degrees Celsius	15-minute averaged temperature
TS10	Temperature Under Native Vegetation at 10cm	degrees Celsius	15-minute averaged temperature
TS25	Temperature Under Native Vegetation at 25cm	degrees Celsius	15-minute averaged temperature
TS30	Temperature Under Native Vegetation at 30cm	degrees Celsius	15-minute averaged temperature
TS45	Temperature Under Native Vegetation at 45cm	degrees Celsius	15-minute averaged temperature
TS60	Temperature Under Native Vegetation at 60cm	degrees Celsius	15-minute averaged temperature
VW05	Volumetric soil water Under Native Vegetation at 5cm	cm ³ cm ⁻³	5-minute averaged volumetric
VW25	Volumetric soil water Under Native Vegetation at 25cm	cm ³ cm ⁻³	5-minute averaged volumetric
VW45	Volumetric soil water Under Native Vegetation at 45cm	cm ³ cm ⁻³	5-minute averaged volumetric
WDIR	Wind Direction	degrees	5-minute averaged wind direction
WSDS	Wind Direction Standard Deviation	degrees	Standard deviation of wind direction
WMAX	Maximum Wind Speed	meters per second	Highest 3-second wind speed
WS2M	2m Wind Speed	meters per second	5-minute averaged wind speed
WSPD	Wind Speed	meters per second	5-minute averaged wind speed
WSSD	Wind Speed Standard Deviation	meters per second	Standard deviation of wind speed
WVEC	Wind Vector	meters per second	5-minute averaged wind velocity

Examples

```
mnet_concatenate(stdid = "ACME",
                 start_date = "1994-01-01",
                 end_date = "1994-01-05")
```

mnet_download_mts

Download Mesonet Time Series files

Description

Downloads Mesonet Time Series (MTS) files from the Oklahoma Mesonet for a given set of station identifiers and date range

Usage

```
mnet_download_mts(
  stid,
  start_date = NULL,
  end_date = NULL,
  root_url = mnet_root_url(),
  site_info = NULL,
  file_cache = NULL,
  ask = !silent,
  silent = FALSE
)
```

Arguments

stid	a character vector of four-digit station identifiers for the Mesonet stations from which to download data
start_date	the first date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
end_date	the final date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
root_url	the root url from which to download MTS files (see mnet_root_url)
site_info	a data frame with site and soil information for each Oklahoma Mesonet station as returned by mnet_site_info . If NULL, mnet_site_info will be used to download this information internally
file_cache	a character string providing a path to the local Mesonet file cache. If NULL, the function will search for the local file cache and if not found will prompt the user to create one.
ask	whether or not to ask about creating a local Mesonet file cache
silent	whether to suppress output to terminal (TRUE) or allow output to terminal (FALSE)

Value

invisibly returns a character vector of the URLs for the downloaded files

Examples

```
#'
mnet_download_mts("ACME",
  start_date = "1994-01-01",
  end_date = "1994-01-05")
```

mnet_drop_units	<i>Drop units from all columns of Oklahoma Mesonet data frame</i>
-----------------	---

Description

Drop units from all columns of Oklahoma Mesonet data frame

Usage

```
mnet_drop_units(df)
```

Arguments

df a data frame with units columns

Value

A data frame with identical data, but without units

Examples

```
mesonet_data <- data.frame(  
  DATE = as.POSIXct(757382400, tz = "UTC")) |>  
  within({  
    RELH = units::set_units(31, "percent")  
    TAIR = units::set_units(NA_real_, "Celsius")  
    WSPD = units::set_units(4.6, "m/s")  
    WVEC = units::set_units(4.5, "m/s")  
    WDIR = units::set_units(182, "degrees")  
    RAIN = units::set_units(0, "mm")  
    PRES = units::set_units(97.939, "kPa")  
    SRAD = units::set_units(0, "W/m^2")  
    TA9M = units::set_units(14.1, "Celsius")  
    WS2M = units::set_units(4, "m/s")  
    STID = "ACME"  
  })  
  
mnet_drop_units(mesonet_data)
```

mnet_read_mts

*Read an Oklahoma Mesonet time series file***Description**

Read an Oklahoma Mesonet time series file

Usage

```
mnet_read_mts(file_path)
```

Arguments

`file_path` file path to a single Oklahoma Mesonet time series (MTS) file

Value

A data frame with Oklahoma Mesonet data. See [mnet_variable_definition\(\)](#) or the table below for the ID, variable name, unit and description for each column.

ID	Name	Unit	Description
PRES	Station Atmospheric Pressure	kPa	5-minute averaged atmospheric pressure
RAIN	Precipitation	millimeters	Liquid precipitation accumulation
RELH	Relative Humidity	percent	5-minute averaged relative humidity
SRAD	Solar Radiation	watts per square meter	5-minute averaged downwelling solar radiation
STID	Station ID		Station ID
STNM	Station Number		Station Number
TA9M	Air Temperature at 9m	degrees Celsius	5-minute averaged air temperature at 9m
TAIR	Air Temperature	degrees Celsius	5-minute averaged air temperature
TB05	Temperature Under Bare Soil at 5cm	degrees Celsius	15-minute averaged temperature at 5cm
TB10	Temperature Under Bare Soil at 10cm	degrees Celsius	15-minute averaged temperature at 10cm
TIME	Time	minutes after base time	Minutes after base time (typical range 0-1440)
TR05	Soil Moisture Calibrated Delta-T at 5cm	degrees Celsius	30-minute calibrated change in soil moisture at 5cm
TR25	Soil Moisture Calibrated Delta-T at 25cm	degrees Celsius	30-minute calibrated change in soil moisture at 25cm
TR60	Soil Moisture Calibrated Delta-T at 60cm	degrees Celsius	30-minute calibrated change in soil moisture at 60cm
TR75	Soil Moisture Calibrated Delta-T at 75cm	degrees Celsius	30-minute calibrated change in soil moisture at 75cm
TS05	Temperature Under Native Vegetation at 5cm	degrees Celsius	15-minute averaged temperature at 5cm
TS10	Temperature Under Native Vegetation at 10cm	degrees Celsius	15-minute averaged temperature at 10cm
TS25	Temperature Under Native Vegetation at 25cm	degrees Celsius	15-minute averaged temperature at 25cm
TS30	Temperature Under Native Vegetation at 30cm	degrees Celsius	15-minute averaged temperature at 30cm
TS45	Temperature Under Native Vegetation at 45cm	degrees Celsius	15-minute averaged temperature at 45cm
TS60	Temperature Under Native Vegetation at 60cm	degrees Celsius	15-minute averaged temperature at 60cm
VW05	Volumetric soil water Under Native Vegetation at 5cm	cm ³ cm ⁻³	5-minute averaged volumetric soil water at 5cm
VW25	Volumetric soil water Under Native Vegetation at 25cm	cm ³ cm ⁻³	5-minute averaged volumetric soil water at 25cm
VW45	Volumetric soil water Under Native Vegetation at 45cm	cm ³ cm ⁻³	5-minute averaged volumetric soil water at 45cm
WDIR	Wind Direction	degrees	5-minute averaged wind direction
WDSD	Wind Direction Standard Deviation	degrees	Standard deviation of wind direction

WMAX	Maximum Wind Speed	meters per second	Highest 3-second wind speed
WS2M	2m Wind Speed	meters per second	5-minute averaged wind speed
WSPD	Wind Speed	meters per second	5-minute averaged wind speed
WSSD	Wind Speed Standard Deviation	meters per second	Standard deviation of wind speed
WVEC	Wind Vector	meters per second	5-minute averaged wind velocity

Examples

```
# Create example file cache
local_cache <- mnet_test_cache(mts_files = TRUE)

example_file <- file.path(local_cache, "mts/1994/01/01/19940101acme.mts")

# Read data from example file
mnet_read_mts(example_file)

# Clean up example file cache
unlink(local_cache, recursive = TRUE)
```

`mnet_requisition_list` *Calculate a requisition list for Oklahoma Mesonet MTS files*

Description

Calculate a requisition list of Mesonet Time Series (MTS) files from the Oklahoma Mesonet for given stations and dates

Usage

```
mnet_requisition_list(
  stid = NULL,
  start_date = NULL,
  end_date = NULL,
  site_info = NULL,
  file_cache = NULL,
  ask = TRUE
)
```

Arguments

`stid` a character vector of four-digit station identifiers for the Mesonet stations from which to download data

`start_date` the first date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month

end_date	the final date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
site_info	a data frame with site and soil information for each Oklahoma Mesonet station as returned by mnet_site_info . If NULL, mnet_site_info will be used to download this information internally
file_cache	a character string providing a path to the local Mesonet file cache. If NULL, the function will search for the local file cache and if not found will prompt the user to create one.
ask	whether or not to ask about creating a local Mesonet file cache

Value

a data frame containing paths for the MTS files required for the requested stations and dates

Examples

```
mnet_requisition_list("ACME",
                      start_date = "1994-01-01",
                      end_date = "1994-01-05")
```

mnet_retrieve	<i>Retrieve Oklahoma Mesonet subdaily data</i>
---------------	--

Description

Retrieves data from the Oklahoma Mesonet for a given set of station identifiers and date range

Usage

```
mnet_retrieve(
  stid,
  start_date = NULL,
  end_date = NULL,
  root_url = mnet_root_url(),
  site_info = NULL,
  file_cache = NULL,
  ask = !silent,
  silent = FALSE
)
```

Arguments

stid	a character vector of four-digit station identifiers for the Mesonet stations from which to download data
start_date	the first date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
end_date	the final date for which to download data specified in Central Standard Time (i.e. "America/Costa_Rica") zone as a Date or POSIXt object or a string with the format YYYY-MM-DD, where YYYY is the four-digit year, MM is the two-digit numeric month and DD is the two-digit day of month
root_url	the root url from which to download MTS files (see mnet_root_url)
site_info	a data frame with site and soil information for each Oklahoma Mesonet station as returned by mnet_site_info . If NULL, mnet_site_info will be used to download this information internally
file_cache	a character string providing a path to the local Mesonet file cache. If NULL, the function will search for the local file cache and if not found will prompt the user to create one.
ask	whether or not to ask about creating a local Mesonet file cache
silent	whether to suppress output to terminal (TRUE) or allow output to terminal (FALSE)

Value

A data frame with Oklahoma Mesonet data. See below for a list of variables including column ID, name, unit and description:

ID	Name	Unit	Description
PRES	Station Atmospheric Pressure	kPa	5-minute averaged atmospheric pressure
RAIN	Precipitation	millimeters	Liquid precipitation accumulation
RELH	Relative Humidity	percent	5-minute averaged relative humidity
SRAD	Solar Radiation	watts per square meter	5-minute averaged downwelling solar radiation
STID	Station ID		Station ID
STNM	Station Number		Station Number
TA9M	Air Temperature at 9m	degrees Celsius	5-minute averaged air temperature at 9m
TAIR	Air Temperature	degrees Celsius	5-minute averaged air temperature
TB05	Temperature Under Bare Soil at 5cm	degrees Celsius	15-minute averaged temperature at 5cm
TB10	Temperature Under Bare Soil at 10cm	degrees Celsius	15-minute averaged temperature at 10cm
TIME	Time	minutes after base time	Minutes after base time (typical base time is 0600)
TR05	Soil Moisture Calibrated Delta-T at 5cm	degrees Celsius	30-minute calibrated change in soil temperature at 5cm
TR25	Soil Moisture Calibrated Delta-T at 25cm	degrees Celsius	30-minute calibrated change in soil temperature at 25cm
TR60	Soil Moisture Calibrated Delta-T at 60cm	degrees Celsius	30-minute calibrated change in soil temperature at 60cm
TR75	Soil Moisture Calibrated Delta-T at 75cm	degrees Celsius	30-minute calibrated change in soil temperature at 75cm
TS05	Temperature Under Native Vegetation at 5cm	degrees Celsius	15-minute averaged temperature at 5cm
TS10	Temperature Under Native Vegetation at 10cm	degrees Celsius	15-minute averaged temperature at 10cm
TS25	Temperature Under Native Vegetation at 25cm	degrees Celsius	15-minute averaged temperature at 25cm

TS30	Temperature Under Native Vegetation at 30cm	degrees Celsius	15-minute averaged temperature
TS45	Temperature Under Native Vegetation at 45cm	degrees Celsius	15-minute averaged temperature
TS60	Temperature Under Native Vegetation at 60cm	degrees Celsius	15-minute averaged temperature
VW05	Volumetric soil water Under Native Vegetation at 5cm	cm ³ cm ⁻³	5-minute averaged volumetric
VW25	Volumetric soil water Under Native Vegetation at 25cm	cm ³ cm ⁻³	5-minute averaged volumetric
VW45	Volumetric soil water Under Native Vegetation at 45cm	cm ³ cm ⁻³	5-minute averaged volumetric
WDIR	Wind Direction	degrees	5-minute averaged wind direction
WSD	Wind Direction Standard Deviation	degrees	Standard deviation of wind direction
WMAX	Maximum Wind Speed	meters per second	Highest 3-second wind speed
WS2M	2m Wind Speed	meters per second	5-minute averaged wind speed
WSPD	Wind Speed	meters per second	5-minute averaged wind speed
WSSD	Wind Speed Standard Deviation	meters per second	Standard deviation of wind speed
WVEC	Wind Vector	meters per second	5-minute averaged wind velocity

Examples

```
mnet_retrieve(stid = "ACME",
              start_date = "1994-01-02",
              end_date = "1994-01-03")
```

mnet_root_url	<i>Root url for Oklahoma Mesonet Time Series files</i>
---------------	--

Description

Root url for Oklahoma Mesonet Time Series files

Usage

```
mnet_root_url(data_source = "mesonet")
```

Arguments

`data_source` the data source for which to provide the url: "mesonet" for the Oklahoma Mesonet, "fcars" for the USDA ARS station network in the Fort Cobb watershed, or "ars" for the USDA ARS station network in the Little Washita watershed

Value

a character string with the root URL for the desired Mesonet data source

Examples

```
mnet_root_url()

mnet_root_url("fcars")
```

mnet_site_info	<i>Download Mesonet site and soil information for all Mesonet sites</i>
----------------	---

Description

Downloads a table of Mesonet site and soil information from the Oklahoma Mesonet website.

Usage

```
mnet_site_info(
  url = "https://api.mesonet.org/index.php/export/station_location_soil_information",
  file_cache = NULL,
  clear_cache = FALSE
)
```

Arguments

url	the url to the page on the Oklahoma Mesonet website where site and soil information are stored
file_cache	a character string providing a path to the local Mesonet file cache. If NULL, the function will search for the local file cache and if not found will prompt the user to create one.
clear_cache	whether to clear cached copy of site and soil information and re-download

Details

Variable descriptions for Mesonet site and soil information.

Variable	Description
stnm	Station Number
stid	Station Identifier
name	Station Name
city	Nearest Incorporated Town
rang	Range From Town To Station
cdir	Compass Direction From Town To Station
cnty	County
nlat	North Latitude
elon	East Longitude
elev	Elevation In Meters
cdiv	Oklahoma Climate Division

clas	Station Class
wcr05	5 cm Residual Water Content (cm ³ /cm ³)
wcs05	5 cm Saturated Water Content (cm ³ /cm ³)
a05	5 cm Alpha Constant (1/kPa)
n05	5 cm N Constant (dimensionless)
bulk5	5 cm Soil Bulk Density (g/cm ³)
grav5	5 cm Soil Percentage Gravel
sand5	5 cm Soil Percentage Sand
silt5	5 cm Soil Percentage Silt
clay5	5 cm Soil Percentage Clay
text5	5 cm Soil Texture Class
wcr25	25 cm Residual Water Content (cm ³ /cm ³)
wcs25	25 cm Saturated Water Content (cm ³ /cm ³)
a25	25 cm Alpha Constant
n25	25 cm N Constant
bulk25	25 cm Soil Bulk Density
grav25	25 cm Soil Percentage Gravel
sand25	25 cm Soil Percentage Sand
silt25	25 cm Soil Percentage Silt
clay25	25 cm Soil Percentage Clay
text25	25 cm Soil Texture Class
wcr60	60 cm Residual Water Content (cm ³ /cm ³)
wcs60	60 cm Saturated Water Content (cm ³ /cm ³)
a60	60 cm Alpha Constant
n60	60 cm N Constant
bulk60	60 cm Soil Bulk Density
grab60	60 cm Soil Percentage Gravel
sand60	60 cm Soil Percentage Sand
silt60	60 cm Soil Percentage Silt
clay60	60 cm Soil Percentage Clay
text60	60 cm Soil Texture Class
wcr75	75 cm Residual Water Content (cm ³ /cm ³)
wcs75	75 cm Saturated Water Content (cm ³ /cm ³)
a75	75 cm Alpha Constant
n75	75 cm N Constant
bulk75	75 cm Soil Bulk Density
grav75	75 cm Soil Percentage Gravel
sand75	75 cm Soil Percentage Sand
silt75	75 cm Soil Percentage Silt
clay75	75 cm Soil Percentage Clay
text75	75 cm Soil Texture Class
datc	Date Commissioned
datd	Date De-Commissioned

Value

a data frame containing site and soil information. See Details for definition of variable descriptions.

Examples

```
mnet_site_info()
```

mnet_summarize	<i>Produce a daily summary of Oklahoma Mesonet subdaily data</i>
----------------	--

Description

Produce a daily summary of Oklahoma Mesonet subdaily data

Usage

```
mnet_summarize(
  sub_daily,
  tz = "Etc/GMT+6",
  interval = "1 day",
  include_qc_variables = FALSE
)
```

Arguments

sub_daily	a data frame with subdaily measurements from the Oklahoma Mesonet such as that produced by mnet_read_mts() .
tz	a length-one character vector specifying which time zone to use for daily summary. Use base::OlsonNames() to obtain a listing of valid available time zones.
interval	the interval over which to summarize data. May be defined as a difftime object (see base::difftime()) or a character value compatible with units::as_units() . Tested intervals include "1 day" (the default), "30 min", and "1 hour", although other intervals may work (e.g. "3 hours").
include_qc_variables	a length-one logical vector specifying whether or not to include quality control variables (e.g. number of errant observations) in the output

Value

A data frame with daily summaries of Oklahoma Mesonet data. See [mnet_variable_definition\(\)](#) or the table below for the ID, variable name, unit and description for each column.

ID	Variable Name	Unit
2AVG	Average Wind Speed at 2m	meters per second

2BAD	Number of Errant 2m Wind Speed Observations	number of 5-minute observations
2DEV	Standard Deviation of Wind Speed at 2m	meters per second
2MAX	Maximum 2m Wind Speed	meters per second
2MIN	Minimum 2m Wind Speed	meters per second
9AVG	Average Air Temperature at 9m	degrees Celsius
9BAD	Number of Errant 9m Air Temperature Observations	number of 5-minute observations
ABAD	Number of Errant Solar Radiation Observations	number of 5-minute observations
AMAX	Maximum Solar Radiation	Watts per square meter
AMAXO	Maximum Solar Radiation Observation Number	5-minute observation number
ATOT	Total Solar Radiation	mega Joules per square meter
B5AV	Average Temperature Under Bare Soil at 5cm	degrees Celsius
B5BD	Number of Errant Temperature Under Bare Soil at 5cm Observations	number of 15-minute observations
B5MN	Minimum Temperature Under Bare Soil at 5cm	degrees Celsius
B5MNO	Minimum Temperature Under Bare Soil at 5cm Observation Number	15-minute observation number
B5MX	Maximum Temperature Bare Soil at 5cm	degrees Celsius
B5MXO	Maximum Temperature Under Bare Soil at 5cm Observation Number	15-minute observation number
BAVG	Average Temperature Under Bare Soil at 10cm	degrees Celsius
BBAD	Number of Errant Temperature Under Bare Soil at 10cm Observations	number of 15-minute observations
BMAX	Maximum Temperature Bare Soil at 10cm	degrees Celsius
BMAXO	Maximum Temperature Under Bare Soil at 10cm Observation Number	15-minute observation number
BMIN	Minimum Temperature Under Native Vegetation at 10cm	degrees Celsius
BMINO	Minimum Temperature Under Bare Soil at 10cm Observation Number	15-minute observation number
CDEG	Cooling Degree Days	degrees Celsius
DATE	Date of summary in Central Standard Time	
DAVG	Average Dewpoint Temperature	degrees Celsius
DBAD	Number of Errant Dewpoint Temperature Observations	number of 5-minute observations
DMAX	Maximum Dewpoint Temperature	degrees Celsius
DMAXO	Maximum Daily Dewpoint Temperature Observation Number	5-minute observation number
DMIN	Minimum Dewpoint Temperature	degrees Celsius
DMINO	Minimum Daily Dewpoint Temperature Observation Number	5-minute observation number
HAVG	Average Humidity	percent
HBAD	Number of Errant Humidity Observations	number of 5-minute observations
HDEG	Heating Degree Days	degrees Celsius
HMAX	Maximum Humidity	percent
HMAXO	Maximum Daily Humidity Observation Number	5-minute observation number
HMIN	Minimum Humidity	percent
HMINO	Minimum Daily Humidity Observation Number	5-minute observation number
HTBAD	Number of Errant Heat Index Observations	number of 5-minute observations
HTMX	Maximum Heat Index Temperature	degrees Celsius
HTMXO	Maximum Daily Heat Index Observation Number	5-minute observation number
IBAD	Number of Errant Wind Direction Observations	number of 5-minute observations
MSLP	Mean Sea Level Pressure	inches of mercury
PAVG	Average Station Pressure	inches of mercury
PBAD	Number of Errant Station Pressure Observations	number of 5-minute observations
PDFQ	Primary Wind Direction Frequency	percentage
PDIR	Primary Wind Direction	16-point cardinal direction
PMAX	Maximum Station Pressure	inches of mercury
PMAXO	Maximum Daily Station Pressure Observation Number	5-minute observation number

PMIN	Minimum Station Pressure	inches of mercury
PMINO	Minimum Daily Station Pressure Observation Number	5-minute observation number
R05BD	Number of Errant Soil Moisture Calibrated Delta-T at 5cm Observations	number of 30-minute observations
R25BD	Number of Errant Soil Moisture Calibrated Delta-T at 25cm Observations	number of 30-minute observations
R60BD	Number of Errant Soil Moisture Calibrated Delta-T at 60cm Observations	number of 30-minute observations
R75BD	Number of Errant Soil Moisture Calibrated Delta-T at 75cm Observations	number of 30-minute observations
RAIN	Rain	inches
RBAD	Number of Errant 5-minute Rain Observations	number of 5-minute observations
RMAX	Maximum 5-minute Rainfall Rate	inches per hour
RNUM	Number of 5-minute Rainy Periods	number of 5-minute observations
S25AV	Average Temperature Under Native Vegetation at 25cm	degrees Celsius
S25BD	Number of Errant Temperature Under Native Vegetation at 25cm Observations	number of 15-minute observations
S25MN	Minimum Temperature Under Native Vegetation at 25cm	degrees Celsius
S25MX	Maximum Temperature Under Native Vegetation at 25cm	degrees Celsius
S25NO	Minimum Temperature Under Native Vegetation at 25cm Observation Number	15-minute observation number
S25XO	Maximum Temperature Under Native Vegetation at 25cm Observation Number	15-minute observation number
S3AV	Average Temperature Under Native Vegetation at 30cm	degrees Celsius
S3BD	Number of Errant Temperature Under Native Vegetation at 30cm Observations	number of 15-minute observations
S3MN	Minimum Temperature Under Native Vegetation at 30cm	degrees Celsius
S3MNO	Minimum Temperature Under Native Vegetation at 30cm Observation Number	15-minute observation number
S3MX	Maximum Temperature Under Native Vegetation at 30cm	degrees Celsius
S3MXO	Maximum Temperature Under Native Vegetation at 30cm Observation Number	15-minute observation number
S5AV	Average Temperature Under Native Vegetation at 5cm	degrees Celsius
S5BD	Number of Errant Temperature Under Native Vegetation at 5cm Observations	number of 15-minute observations
S5MN	Minimum Temperature Under Native Vegetation at 5cm	degrees Celsius
S5MNO	Minimum Temperature Under Native Vegetation at 5cm Observation Number	15-minute observation number
S5MX	Maximum Temperature Under Native Vegetation at 5cm	degrees Celsius
S5MXO	Maximum Temperature Under Native Vegetation at 5cm Observation Number	15-minute observation number
S60AV	Average Temperature Under Native Vegetation at 60cm	degrees Celsius
S60BD	Number of Errant Temperature Under Native Vegetation at 60cm Observations	number of 15-minute observations
S60MN	Minimum Temperature Under Native Vegetation at 60cm	degrees Celsius
S60MX	Maximum Temperature Under Native Vegetation at 60cm	degrees Celsius
S60NO	Minimum Temperature Under Native Vegetation at 60cm Observation Number	15-minute observation number
S60XO	Maximum Temperature Under Native Vegetation at 60cm Observation Number	15-minute observation number
SAVG	Average Temperature Under Native Vegetation at 10cm	degrees Celsius
SBAD	Number of Errant Temperature Under Native Vegetation at 10cm Observations	number of 15-minute observations
SDFQ	Secondary Wind Direction Frequency	percentage
SDIR	Secondary Wind Direction	16-point cardinal direction
SMAX	Maximum Temperature Under Native Vegetation at 10cm	degrees Celsius
SMAXO	Maximum Temperature Under Native Vegetation at 10cm Observation Number	15-minute observation number
SMIN	Minimum Temperature Under Native Vegetation at 10cm	degrees Celsius
SMINO	Minimum Temperature Under Native Vegetation at 10cm Observation Number	15-minute observation number
STID	Station ID	
TAVG	Average Air Temperature	degrees Celsius
TBAD	Number of Errant 1.5m Air Temperature Observations	number of 5-minute observations
TMAX	Maximum Daily Air Temperature	degrees Celsius
TMAXO	Maximum Daily Air Temperature Observation Number	5-minute observation number
TMIN	Minimum Daily Air Temperature	degrees Celsius

TMINO	Minimum Daily Air Temperature Observation Number	5-minute observation number
TR05	Soil Moisture Calibrated Delta-T at 5cm	degrees Celsius
TR25	Soil Moisture Calibrated Delta-T at 25cm	degrees Celsius
TR60	Soil Moisture Calibrated Delta-T at 60cm	degrees Celsius
TR75	Soil Moisture Calibrated Delta-T at 75cm	degrees Celsius
VDEF	Average Daily Vapor Deficit	millibars
WBAD	Number of Errant Wind Speed Observations	number of 5-minute observations
WCBAD	Number of Errant Wind Chill Observations	number of 5-minute observations
WCMN	Minimum Wind Chill Index Temperature	degrees Celsius
WCMNO	Minimum Daily Wind Chill Observation Number	5-minute observation number
WDEV	Standard Deviation of Wind Speed at 10m	meters per second
WMAX	Maximum Wind Gust	meters per second
WMAXO	Maximum Wind Gust Observation Number	5-minute observation number
WSMN	Minimum Wind Speed	meters per second
WSMNO	Minimum Wind Speed Observation Number	5-minute observation number
WSMX	Maximum Wind Speed	meters per second
WSMXO	Maximum Wind Speed Observation Number	5-minute observation number
WSPD	Average Wind Speed	meters per second

Examples

```
# Retrieve some data to summarize:
mesonet_data <- mnet_retrieve(stid = "ACME",
                             start_date = "1994-01-02",
                             end_date = "1994-01-03")

# Interval is 1 day by default:
mnet_summarize(mesonet_data)

# Summarize to hourly:
mnet_summarize(mesonet_data,
              interval = "1 hour")
```

mnet_test_cache

Create example local mesonet file cache

Description

Create an example local mesonet file cache for running tests and examples

Usage

```
mnet_test_cache(
  file_cache,
  site_info = FALSE,
  mts_files = FALSE,
  rds_files = FALSE
)
```

Arguments

<code>file_cache</code>	an optional character string that provides a path to the directory to use for the local mesonet file cache. If missing, a new directory will be created within the temporary directory for the current session.
<code>site_info</code>	a logical value indicating whether to create an example version of the <code>site_info.csv</code> file in the local file cache
<code>mts_files</code>	a logical value indicating whether to create example versions of Mesonet Time Series (MTS) files in the local file cache
<code>rds_files</code>	a logical value indicating whether to create example versions of processed Mesonet data in the form of R data serialized (RDS) files in the local file cache

Value

Invisibly returns the full path to the test file cache

Examples

```
# Create test cache directory and write site info file
test_cache <- mnet_test_cache(site_info = TRUE)

# Create test cache directory and write MTS and RDS files
test_cache <- mnet_test_cache(mts_files = TRUE,
                             rds_files = TRUE)

# Remove test cache directory
unlink(test_cache, recursive = TRUE)
```

`mnet_van_genuchten` *Calculate volumetric soil water content with van Genuchten curve*

Description

Calculate volumetric soil water content using the van Genuchten curve

Usage

```
mnet_van_genuchten(MP, WCr, WCs, a, n)
```

Arguments

MP	a vector of matric potential at which to calculate volumetric soil water content
WCr	residual water content for dry soil
WCs	saturated water content for wet soil
a	the alpha parameter for the van Genuchten equation related to the inverse of the air entry suction
n	the n parameter for the van Genuchten equation related to the pore-size distribution

Value

a vector of volumetric soil water content values

Examples

```
mnet_van_genuchten(-100, 0.034, 0.41, 0.273, 1.39)
```

```
mnet_variable_definition
```

Find Mesonet variable definition

Description

Provide definition of a requested set of Mesonet variables including (by default) the standard variable identifier (ID), name, unit, and description.

Usage

```
mnet_variable_definition(
  id,
  columns = c("ID", "Variable Name", "Unit", "Description")
)
```

Arguments

id	a string or regular expression to use for retrieving definitions of Mesonet variables
columns	a character vector of columns to include in the output. Possible values include any combination of "ID", "Variable Name", "Unit" or "Description"

Value

a data frame with Mesonet variable definitions filtered by the id argument

Examples

```
mnet_variable_definition("RAIN")
```

```
mnet_variable_definition("^2")
```

```
mnet_variable_definition("^2",  
                          columns = c("ID", "Variable Name", "Unit"))
```

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