

Package ‘metScanR’

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Title Find, Map, and Gather Environmental Data and Metadata

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Description A tool for locating, mapping, and gathering environmental data and metadata, world-wide. Users can search for and filter metadata from ~ 107,000 environmental monitoring stations among 219 countries/territories and 18 networks/platforms via elevation, location, active dates, elements measured (e.g., temperature, precipitation), country, network, and/or known identifier. Future updates to the package will allow the user to obtain datasets from stations within the database.

Depends R (>= 3.3.1)

Imports geosphere, RColorBrewer, plotly, leaflet, ggmap, rjson, sp, grDevices, plyr, RCurl, utils, tools

License GPL-3

Encoding UTF-8

LazyData no

RoxygenNote 6.0.1

URL <https://cflagg.github.io/metScanR/>

NeedsCompilation no

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getCountry	<i>Filter environmental monitoring stations by country</i>
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Description

Return metadata of environmental monitoring stations from specific country(ies)/territory(ies) within the metScanR database.

Usage

```
getCountry(country = NULL, ...)
```

Arguments

country	(character) Country(ies)/territory(ies) to filter environmental stations. Defaults to NULL (entire database will be returned).
...	auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring stations from country(ies)/territory(ies) specified in country

Author(s)

Josh Roberti <jaroberti87@gmail.com>

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#returns metadata from all environmental sites within the database from the United States
getCountry(country="United States")
#returns metadata from all environmental sites within the database from the Italy and Portugal
getCountry(country=c("Italy","Portugal"))
## End(Not run)
```

getDates	<i>Filter environmental monitoring stations by active date(s)</i>
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Description

Return metadata of environmental monitoring stations that were/are active during specified dates.

Usage

```
getDates(startDate = NULL, endDate = NULL, includeUnk = FALSE, ...)
```

Arguments

startDate	(character) "YYY-MM-DD" to filter start dates of environmental stations within the metScanR database. Optional if endDate is initialized. Required if endDate is NULL.
endDate	(character) "YYY-MM-DD" to filter end dates of environmental stations within the metScanR database. Optional if startDate is initialized. Required if startDate is NULL.
includeUnk	(logical) Defaults to FALSE and excludes sites with unknown start dates. Setting to TRUE will include sites with unknown start dates. Sites without known start dates account for ~71 percent of the metScanR database. This is a result of undocumented, government (or network/governing body) metadata. Nearly all stations within the database have a known end date, however. Setting startDate=NULL, initializing endDate, and setting includeUnk=TRUE will more than likely return results than if startDate is also initialized.
...	auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring sites that were/are active between the startDate and/or endDate

Author(s)

Josh Roberti <jaroberti87@gmail.com>
Lee Stanish

References

see reference links above

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#return metadata of sites that were active from at least 1940-01-01 through 1970-04-18
  getDates(startDate="1940-01-01",endDate = "1970-04-18")
#return metadata of sites that were active up through at least 1950-07-08
  getDates(endDate = "1950-07-08")
#return metadata of sites that were active up through at least 1950-07-08
#and have an unknown start date:
  getDates(endDate = "1950-07-08", includeUnk=TRUE)
## End(Not run)
```

getElevation

Filter environmental monitoring stations by elevation

Description

Return metadata of environmental monitoring stations that have a specific elevation.

Usage

```
getElevation(elevThresh = NULL, ...)
```

Arguments

elevThresh	(numeric) defines elevation range to filter metadata. Units are in meters (m). If elevThresh is a single value, the function will return sites within the database that have elevations less than or equal to elevThresh. Alternatively, if elevThresh is a numeric vector of length = 2, the function will assign the first component as a midpoint elevation, and the second component as a threshold (range), e.g., elevThresh=c(100,50) will return sites that have elevations within 100 +/- 50 (m) Above Sea Level. Defaults to NULL (entire database will be returned)
...	auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring stations that have elevations conforming to the criteria specified in elevThresh

Author(s)

Josh Roberti <jaroberti87@gmail.com>

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#return metadata of sites that have elevations between 1500 +/- 500 (m) Above Sea Level
  getElevation(elevThresh=c(1500,500))
#return metadata of sites that have elevations less than or equal to 3500 (m) Above Sea Level
  getElevation(elevThresh=3500)
## End(Not run)
```

getId

Filter environmental monitoring stations by identifier type

Description

Return metadata of environmental monitoring stations that have specific identifier types.

Usage

```
getId(id = NULL, ...)
```

Arguments

id (character) identifier(s) of interest. Defaults to NULL. Metadata are available for stations with any of the identifiers listed below. Note that a single station can have multiple, associated identifiers. See reference links for further information.

GHCND: Global Historical Climatology Network - Daily

<https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/global-historical-climatology-network-ghcn>

GHCNMLT: Global Historical Climatology Network - Monthly Land Temperature v4 (GHCNM-LT)

<https://www.ncdc.noaa.gov/ghcnm/>

WBAN: Weather Bureau Army Navy

http://rredc.nrel.gov/solar//old_data/nsrdb/1961-1990/hourly/1990/WBAN1s.html

FAA: Federal Aviation Administration

<https://www.faa.gov/>

ICAO: International Civil Aviation Organization
<http://www.icao.int/Pages/default.aspx>

NCDCSTNID: National Climatic Data Center
<https://www.ncdc.noaa.gov/homr/>

COOP: Cooperative Observer Network
<https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/cooperative-observer-network-coop>

WMO: World Meteorological Organization
https://www.wmo.int/pages/index_en.html

NWSLI: National Weather Service Location Identifier
<https://www.weather.gov/arh/stationlist>

TRANS: *miscellaneous IDs that do not fall into National Centers for Environmental Information(NCEI) support
<https://www.ncei.noaa.gov/>

NEON: National Ecological Observatory Network
<http://www.neonscience.org/science-design/field-sites>

NRCS: Natural Resources Conservation Service
https://www.wcc.nrcs.usda.gov/web_service/NRCS_Station_Networks.pdf

... auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring stations having identifier types specified in id

Author(s)

Josh Roberti <jaroberti87@gmail.com>

References

see reference links above

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#return a list of sites that have an WBAN identifier
getId(id="WBAN")
#return a list of sites that have either an FAA, ICAO, or NWSLI identifier
getId(id=c("FAA","ICAO","NWSLI"))
## End(Not run)
```

getNearby

Filter environmental monitoring stations by POI

Description

Return metadata of environmental monitoring stations nearby a specific environmental station or near a a Latitude/Longitude pair.

Usage

```
getNearby(siteID = NULL, lat = 40.0149, lon = -105.2705, radius = 50,
...)
```

Arguments

siteID	(character) "idType:id" NULL if initializing lat & lon. Required if lat & lon are set to NULL.
lat	(numeric) Latitude of Point of interest (POI). Defaults to 40.0149, i.e., latitude of Boulder, CO, USA
lon	(numeric) Longitude of POI. Defaults to -105.2705, i.e., longitude of Boulder, CO, USA
radius	(numeric) Search radius outward from POI for finding environmental monitoring stations. Defined in kilometers (km) and defaults to 50.
...	auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring stations located within radius from the user-entered siteID or Lat/Lon POI.

Author(s)

Josh Roberti <jaroberti87@gmail.com>

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#returns metadata from all sites within 50 km of NEON site 'CPER'
  getNearby(siteID="NEON:CPER", radius=50)
#return metadata of sites within 10 km of Lat=41.7821 & Lon = -71.4204 (Cranston, RI, USA)
  getNearby(lat=41.7821, lon = -71.4204, radius=10)
## End(Not run)
```

getNetwork

Filter environmental monitoring stations by network

Description

Return metadata of environmental monitoring stations from networks/platforms within the metScanR database.

Usage

```
getNetwork(network = NULL, ...)
```

Arguments

network (character) Network(s)/platform(s) to filter environmental monitoring stations. Defaults to NULL (entire database will be returned). Metadata are available for stations in the networks below. An individual station may be part of multiple networks. See reference links for further information.

AL USRCRN: United States Regional Climate Reference Network - Alabama
<https://gis.ncdc.noaa.gov/geoportal/catalog/search/resource/details.page?id=gov.noaa.ncdc:C01117>

ASOS: Automated Surface Observing System
<https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/automated-surface-observing-system-asos>

AWOS: Automated Weather Observing System
<https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/automated-weather-observing-system-awos>

BOR: Bureau of Reclamation

<https://www.wcc.nrcs.usda.gov/wsf/wsf-reservoir.html>

COCORAHS: Community Collaborative Rain, Hail & Snow Network

<https://www.cocorahs.org/>

COOP: Cooperative Observer Network

<https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/cooperative-observer-network-coop>

MPRC: Manual Precipitation Network

MSNT: Non-Telemetered Snow Telemetry Network

NEON: National Ecological Observatory Network

<http://www.neonscience.org/>

OTHER: Telemetered Natural Resource Conservation Service (NRCS) Stations that do not meet criteria for SNOTEL, SNOLITE, SCAN, or NRCS Experimental hydromet

SCAN: Soil Climate Analysis Network

https://www.wcc.nrcs.usda.gov/about/mon_scan.html

SNOW: Snow Course and Aerial Marker Network

https://www.wcc.nrcs.usda.gov/about/mon_manual.html

SNTL: Snow Telemetry Network

https://www.wcc.nrcs.usda.gov/about/mon_automate.html

SNTLT: Snow Telemetry Network, Limited Sensors

https://www.wcc.nrcs.usda.gov/about/mon_automate.html

UKN: *unknown* (unidentified network)

UPPERAIR: Upper Air network

<http://www.ua.nws.noaa.gov/>

USCRN: United States Climate Reference Network

<https://www.ncdc.noaa.gov/crn/>

USGS: Streamflow Network (United States Geological Survey)

<https://water.usgs.gov/nsip/>

USRCRN: United States Regional Climate Reference Network

<https://www.ncdc.noaa.gov/crn/>

... auto-populates when called from siteFinder() wrapper

Value

A list comprising metadata of environmental monitoring sites from network(s)/platform(s) specified in network

Author(s)

Josh Roberti <jaroberti87@gmail.com>
Derek Smith

References

see reference links above

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:  
#returns metadata from all SCAN sites within the database  
getNetwork(network="SCAN")  
#returns metadata from ASOS, COOP, USCRN, and NEON sites within the database  
getNetwork(network=c("ASOS", "COOP", "USCRN", "NEON"))  
## End(Not run)
```

getVar

Filter environmental monitoring stations by reported elements

Description

Return metadata of environmental monitoring stations that collect specific element-level (environmental variables, e.g., air temperature) metadata.

Usage

```
getVar(vars = NULL, ...)
```

Arguments

`vars` (character) Elements(s)/variables(s) of interest. Defaults to NULL (entire database will be returned). The user can search for general, environmental terms, such as 'temperature,' or 'wind,' and the function will return environmental stations that collect the specified elements. Keep in mind that the database contains ~107,000 stations, worldwide. Searching for a general term such as 'temperature' will return many stations. The user is advised to search for more granular terms, e.g., using subTerms such as 'air temperature,' or 'soil temperature,' if they wish to narrow their results.

... auto-populates when called from `siteFinder()` wrapper

Value

A list comprising environmental monitoring sites that observe or collect the element(s)/variable(s) specified in `vars`

Author(s)

Josh Roberti <jaroberti87@gmail.com>

See Also

[siteFinder](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#return a list of sites that collect humidity data
getVars(vars="humidity")
#return a list of sites that collect soil temperature and/or wind data
getVars(vars=c("soil temperature", "wind"))
## End(Not run)
```

mapSiteFinder

Map environmental monitoring stations

Description

A plotting tool to map environmental monitoring stations from the metScanR database. NOTE: This function requires internet connection!

Usage

```
mapSiteFinder(x)
```

Arguments

x (list) Metadata of environmental monitoring stations from the metScanR package.

Value

A map of environmental monitoring stations

Author(s)

Josh Roberti <jaroberti87@gmail.com>
Lee Stanish
Cody Flagg
Sam Weintraub
Derek Smith

See Also

[getNearby](#) [getElevation](#) [getDates](#) [getNetwork](#) [getVars](#) [getCountry](#) [getId](#) [siteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:  
#map environmental monitoring stations located in Italy  
  mapSiteFinder(getCountry(country="Italy"))  
#map environmental monitoring stations within 50 km of Boulder, CO, USA  
  mapSiteFinder(getNearby(lat=40.0149,lon=-105.2705,radius=50))  
## End(Not run)
```

metScanR_DB

Worldwide, Environmental Monitoring Station metadata

Description

Metadata from ~107,000 environmental monitoring stations among 219 countries/territories and 18 environmental networks. Metadata are gathered from a growing number of sources and the database is continually updated to reflect the increase of information.

Usage

```
metScanR_DB
```

Format

(list) Metadata from ~107,000 environmental monitoring stations, worldwide. The metadata for each site include:

namez (character) Name of environmental monitoring site as defined by governing network

identifiers (data.frame) Station identifiers of environmental monitoring site as defined by associated networks

platform (character) Station platform (type). A single station may be a specific platform but it might be associated with many networks / identifiers.

elements (data.frame) Elements (environmental phenomena) measured, along with associated start and end dates

location (data.frame) Spatial location information (latitude, longitude, country, elevation) of environmental monitoring site

metScanR_terms

Environmental metadata terms used within metScanR_DB

Description

Environmental metadata terms (e.g., air temperature, wind speed, etc.) and data product identifiers used by the environmental monitoring networks within the metScanR_DB. Terms are gathered from a growing number of sources and the terms database is continually updated to reflect the increase of information.

Usage

metScanR_terms

Format

(data frame) Environmental terms and data product identifiers from environmental monitoring networks, worldwide

siteFinder *Filter environmental monitoring stations (wrapper)*

Description

A wrapper function comprising all filtering functions within the metScanR package. The metScanR database contains metadata from roughly 107,000 stations among ~200 countries/territories and ~18 networks/platforms, worldwide. This function returns metadata for a subset of those stations, based on the criteria specified by a user.

Usage

```
siteFinder(country = NULL, siteID = NULL, lat = 39.833333,
           lon = -98.583333, radius = 50, network = NULL, vars = "temperature",
           id = NULL, startDate = NULL, endDate = "2006-01-27",
           includeUnk = TRUE, elevThresh = NULL, ...)
```

Arguments

country	(character) Country(ies)/territory(ies) to filter environmental stations. Defaults to NULL (entire database will be returned).
siteID	(character) "idType:id" NULL if initializing lat & lon. Required if lat & lon are set to NULL.
lat	(numeric) Latitude of Point of interest (POI). Defaults to 40.0149, i.e., latitude of Boulder, CO, USA
lon	(numeric) Longitude of Point of interest (POI). Defaults to -105.2705, i.e., longitude of Boulder, CO, USA
radius	(numeric) Search radius outward from POI for finding environmental monitoring stations. Defined in kilometers (km) and defaults to 50.
network	(character) Network(s)/platform(s) to filter environmental monitoring stations. Defaults to NULL. Metadata are available for stations in the networks below. An individual station may be part of multiple networks. See reference links for further information.
vars	(character) Elements(s)/variables(s) of interest. Defaults to NULL. The user can search for general, environmental terms, such as 'temperature,' or 'wind,' and the function will return environmental stations that collect the specified elements. Keep in mind that the database contains ~107,000 stations, worldwide. Searching for a general term such as 'temperature' will return many stations. The user is advised to search for more granular terms, e.g., using subTerms such as 'air temperature,' or 'soil temperature,' if they wish to narrow their results.

id	(character) identifier(s) of interest. Defaults to NULL. Metadata are available for stations with any of the identifiers listed below. Note that a single station can have multiple, associated identifiers. See reference links for further information.
startDate	(character) "YYY-MM-DD" to filter start dates of environmental stations within the metScanR database. Optional if endDate is initialized. Required if endDate is NULL.
endDate	(character) "YYY-MM-DD" to filter end dates of environmental stations within the metScanR database. Optional if startDate is initialized. Required if startDate is NULL.
includeUnk	(logical) Defaults to FALSE and excludes sites with unknown start dates. Setting to TRUE will include sites with unknown start dates. Sites without known start dates account for ~71 percent of the metScanR database. This is a result of undocumented, government (or network/governing body) metadata. Nearly all stations within the database have a known end date, however. Setting startDate=NULL, initializing endDate, and setting includeUnk=TRUE will more than likely return results than if startDate is also initialized.
elevThresh	(numeric) defines elevation range to filter metadata. Units are in meters (m). If elevThresh is a single value, the function will return sites within the database that have elevations less than or equal to elevThresh. Alternatively, if elevThresh is a numeric vector of length = 2, the function will assign the first component as a midpoint elevation, and the second component as a threshold (range), e.g., elevThresh=c(100,50) will return sites that have elevations within 100 +/- 50 (m) Above Sea Level.
...	Deprecated terms from previous version of function.

Value

A list comprising metadata of environmental monitoring stations from country(ies)/territory(ies) specified in country

Author(s)

Josh Roberti <jaroberti87@gmail.com>
 Cody Flagg
 Lee Stanish
 Sam Weintraub
 Derek Smith

See Also

[getNearby](#) [getElevation](#) [getDates](#) [getNetwork](#) [getVars](#) [getCountry](#) [getId](#) [mapSiteFinder](#) [metScanR_DB](#)

Examples

```
## Not run:
#Return metadata of sites within 50 km of NEON's HARV active from 1965-10-20 to 1986-09-02
```

```
siteFinder(siteID="NEON:HARV",startDate="1965-10-20",
endDate="1986-09-02",radius=50)

#Return metadata of SCAN, SNTL, and ASOS sites active from at least 2000-01-05 onward
siteFinder(network=c("SCAN","SNTL","ASOS"),startDate="2000-01-05")

#Return metadata of sites in Brazil with elevations of 1500 +/- 250 (m) Above Sea Level
siteFinder(elevThresh=c(1500,250),country="Brazil")
## End(Not run)
```


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