Package: PEcAn.data.water (via r-universe)

November 19, 2026

Title PEcAn Functions Used for Querying Water Datasets

Version 0.0.0

Description Functions for querying databases and creating scenarios for models that take water level and flooding parameters as inputs.

Depends R (>= 4.1.0)

Imports dplyr, lubridate, purrr, rlang, sf, tibble, tidyr, VulnToolkit

Suggests knitr, rmarkdown, tidyverse

Remotes github::Smithsonian/VulnToolkit

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LazyData true

LazyDataCompression xz

Encoding UTF-8

VignetteBuilder knitr, rmarkdown

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.3

Config/pak/sysreqs libabsl-dev cmake libgdal-dev gdal-bin libgeos-dev libicu-dev libxml2-dev libssl-dev libproj-dev libsqlite3-dev libudunits2-dev

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Contents

annual_compiled_datums 2
ar6_us_compiled_scenarios 3
findNearestNoaaGauge 4
generateFullTidalScenario 4
long_term_tidal_constituents 6
noaa_us_gauge_info 7

Index **8**

`annual_compiled_datums`

Tidal datum values for 125 NOAA stations

Description

Average annual datums for different types of water levels, recalculated from NOAA tide gauges using the TideHarmonics R package at average annual time steps.

Usage

```
annual_compiled_datums
```

Format

A data frame with 51482 rows and 10 columns:

Datum Datum name, HHA=Higher High Annual, HOT=Highest Observed Tide, MSL=Mean Sea Level, LLA=Lower Low Annual, LOT=Lowest Observed Tide, HHS=Higher High Spring, HH=Higher High Daily, LH=Lower High Daily, HL=Higher Low Daily, LL=Lower Low Daily, LLS=Lower Low Spring

n_obs Number of observations

observed Observed water elevation in meters relative to NAVD88

n_pred Number of predictions

predicted Predicted water elevation in meters relative to NAVD88

risingTime Average rising time of the flood stage (hours)

fallingTime Average falling time of the flood stage (hours)

year Calendar year (YYYY)

station_id Unique numeric station identifier

station_name Unique station name

Source

from https://github.com/Smithsonian/Tidal_Scenarios, compiled by James Holmquist

`ar6_us_compiled_scenarios` *Projected sea level change under climate scenarios from IPCC Assessment Report 6*

Description

Probabilistic and localized relative sea-level rise scenarios produced for NOAA tide gauges for the 6th IPCC Assesment Report by Kopp and Garner (2023). Scenarios were reprocessed by James Holmquist into long-form tables that could be more readily queried.

Usage

```
ar6_us_compiled_scenarios
```

Format

A data frame with 2,278,458 rows and 10 columns:

psmsl_id Unique permanant service for mean sea level identifier

latitude Gauge latitude in decimal degrees WGS84.

longitude Gauge longitude in decimal degrees WGS84.

year Calendar year (YYYY)

quantile Value between 0 and 1 indicating position of the sea-level rise magnitude within the probability space of the scnenario.

sea_level_change_mm Sea level change relative to the baseline period (1986–2005)

noaa_id Unique NOOA numeric station identifier

noaa_name Unique NOAA station name

scenario_name Unique scenario name indicating a Shared Socioeconomic Pathway (ssp) or temperature limitation window (tlim). See source data for additional detail.

confidence Indicates whether forecats are made propegating uncertainty at 'medium' or 'low' confidence

Source

Kopp, R. E., Garner, G. G., Hermans, T. H., Jha, S., Kumar, P., Reedy, A., ... & Smith, C. (2023). The Framework for Assessing Changes To Sea-level (FACTS) v1. 0: a platform for characterizing parametric and structural uncertainty in future global, relative, and extreme sea-level change. Geoscientific Model Development, 16(24), 7461-7489.

Reformatted in https://github.com/Smithsonian/Tidal_Scenarios, by James Holmquist

findNearestNoaaGauge *Find the nearest NOAA gauge to each site*

Description

Finds the nearest long term NOAA gauge to each input site using `sf::st_nearest_feature()`, joins the corresponding gauge attributes to the site table, and calculates the straight-line distance between the site and gauge.

Usage

```
findNearestNoaaGauge(sites, site_lat = "latitude", site_lon = "longitude")
```

Arguments

`sites`	A data frame, tibble, or `sf` object containing site locations.
`site_lat`	Character. Name of the latitude column in `sites`. Default is `"latitude"`.
`site_lon`	Character. Name of the longitude column in `sites`. Default is `"longitude"`.

Details

`sites` may be data frame containing latitude and longitude columns or existing `sf` objects.

Distances are straight-line geographic distances. For coastal and estuarine applications, the nearest gauge by straight-line distance may not necessarily be the most hydrologically connected gauge. This also won't work outside the U.S.

Value

An data.frame object containing the original site attributes and geometry, attributes of the nearest gauge, and distance to the gauge in meters and kilometers.

generateFullTidalScenario *Generate sea-level rise and tidal inundation scenarios*

Description

Queries one or more NOAA tide gauges and generates annual sea-level and tidal inundation scenarios for each gauge.

Usage

```
generateFullTidalScenario(
  station_id = 9410660,
  run_hindcast = TRUE,
  run_forecast = TRUE,
  hindcast_start = 1928,
  forecast_start = 2026,
  forecast_end = 2100,
  scenario = c("ssp126", "ssp245"),
  confidence_level = "medium",
  target_quantile = c(0.25, 0.5, 0.75),
  include_lt_tidal_const = TRUE,
  datum_start_year = 1980,
  datum_end_year = 2025
)
```

Arguments

`station_id`	Vector of NOAA station identifiers.
`run_hindcast`	Logical. Generate historical sea-level data.
`run_forecast`	Logical. Generate forecast sea-level scenarios.
`hindcast_start`	First year of hindcast.
`forecast_start`	First year of forecast.
`forecast_end`	Final forecast year.
`scenario`	Character vector of AR6 scenarios.
`confidence_level`	Character vector of confidence levels.
`target_quantile`	Numeric vector of target quantiles.
`include_lt_tidal_const`	Include long-term tidal constituents.
`datum_start_year`	First year used to calculate tidal datums.
`datum_end_year`	Last year used to calculate tidal datums.

Value

A list containing:

- scenario_curves: Combined scenario table for all gauges.
- tidal_datums_summarized: Combined tidal datum table for all gauges.

`long_term_tidal_constituents` *Long term tidal constituents for NOAA tide gauges*

Description

Harmonic constituents of long term tidal amplitude changes for NOAA tide gauges. 4.4 and 18.6 year cycles in tidal amplitude change are accounted for following formulas presented in Peng et al. (2018). Formulas are modified to fit harmonic constituents to different tidal flood and ebb types matching `annual_compiled_datums`.

Usage

```
long_term_tidal_constituents
```

Format

A data frame with 1000 rows and 17 columns:

station_id Unique numeric NOAA station identifier

station_name Unique NOAA station name

start_date Calendar start date for observation (YYYYMMDD)

end_date Calendar end date for observation (YYYYMMDD)

tide Type of tide: HHA=Higher High Annual, HOT=Highest Observed Tide, MSL=Mean Sea Level, LLA=Lower Low Annual, LOT=Lowest Observed Tide, HHS=Higher High Spring, HH=Higher High Daily, LH=Lower High Daily, HL=Higher Low Daily, LL=Lower Low Daily, LLS=Lower Low Spring

mean_amp Mean tidal amplitude for model 1 (4.4 and 18.6 year cycles accounted for)

amp18 18.6 year cycle amplitude of amplitude for model 1 (4.4 and 18.6 year cycles accounted for)

phase18 18.6 year cycle phase for model 1 (4.4 and 18.6 year cycles accounted for)

amp44 4.4 year cycle amplitude for model 1

phase44 4.4 year cycle phase for model 1

rse Residual standard error for model 1 (4.4 and 18.6 year cycles accounted for)

r2 R-squared value for model 1 (4.4 and 18.6 year cycles accounted for)

mean_ampb Mean tidal amplitude for model 2 (18.6 year cycle accounted for)

amp18b 18.6 year cycle amplitude of amplitude for model 2 (18.6 year cycle accounted for)

phase18b 18.6 year cycle phase for model 2 (18.6 year cycle accounted for)

rseb Residual standard error for model 2 (18.6 year cycle accounted for)

r2b R-squared value for model 2 (18.6 year cycle accounted for)

Source

Peng, D., Hill, E. M., Meltzner, A. J., & Switzer, A. D. (2019). Tide gauge records show that the 18.61-year nodal tidal cycle can change high water levels by up to 30 cm. Journal of Geophysical Research: Oceans, 124(1), 736-749.

Recalculated in https://github.com/Smithsonian/Tidal_Scenarios, by James Holmquist

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`noaa_us_gauge_info` *Locations, IDs, and available date ranges for 126 NOAA tidal stations*

Description

Publically available NOAA tide gauge positional and temporal information organized into a single table.

Usage

```
noaa_us_gauge_info
```

Format

A data frame with 89 rows and 8 columns:

noaa_id Unique numeric NOAA station identifier

startDate Calendar start date for observation record (YYYYMMDD)

endDate Calendar end date for observation record (YYYYMMDD)

noaa_name Unique NOAA station name

latitude Gauge latitude in decimal degrees WGS84

longitude Gauge longitude in decimal degrees WGS84

state State- or territory-level two letter abbreviation

has_NAVD88 Specifies whether NAVD88 datum is present.

Source

Queried from NOAA servers and organized in https://github.com/Smithsonian/Tidal_Scenarios, by James Holmquist

Index

∗ **datasets**
annual_compiled_datums, 2
ar6_us_compiled_scenarios, 3
long_term_tidal_constituents, 6
noaa_us_gauge_info, 7

annual_compiled_datums, 2
ar6_us_compiled_scenarios, 3

findNearestNoaaGauge, 4

generateFullTidalScenario, 4

long_term_tidal_constituents, 6

noaa_us_gauge_info, 7