Package ‘earhtide’

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Type Package

Title Parallel Implementation of 'ETERNA 3.40' for Prediction and Analysis of Earth Tides

Version 0.1.2

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Description This is a port of 'Fortran ETERNA 3.4' <http://igets.u-strasbg.fr/soft_and_tool.php> by H.G. Wenzel for calculating synthetic Earth tides using the
Hartmann and Wenzel (1994) <doi:10.1029/95GL03324> or

BugReports https://github.com/jkennel/earhtide/issues

URL https://github.com/jkennel/earhtide

License GPL-3

Depends R (>= 3.4.0)

Imports Rcpp (>= 1.0.0), R6 (>= 2.3.0), RcppThread

LinkingTo Rcpp (>= 1.0.0), RcppThread, RcppEigen

Suggests testthat (>= 2.1.0), knitr, rmarkdown, covr

RoxygenNote 7.2.3

VignetteBuilder knitr

Encoding UTF-8

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R topics documented:

- earthtide-package .................................................. 2
- calc_earthtide ..................................................... 3
- Earthtide .......................................................... 5
- eterna_wavegroups .................................................. 7
- get_iers ............................................................ 7
- get_main_frequency ................................................. 8

Index  9

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earthtide-package

earthtide: R port of the earth tide processing package ETERNA (by Hans-Georg Wenzel) including the Kudryavtsev wave catalog.

Description

The goal of this package is to generate synthetic earth tides for use in the R programming language and in particular environmental models. Code was parallelized and refactored to minimize duplication, and to allow for future improvements.

Details

You can learn about the earthtide package in the vignettes: `browseVignettes(package = "earthtide")`

Author(s)

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References


See Also

Useful links:
- https://github.com/jkennel/earthtide
- Report bugs at https://github.com/jkennel/earthtide/issues
Description

This is a wrapper to the Earthtide R6 class for the prediction of Earth tides. This function is provided for users who would prefer a more typical R function.

Usage

```r
calc_earthtide(
  utc,
  do_predict = TRUE,
  method = "gravity",
  latitude = 0,
  longitude = 0,
  elevation = 0,
  azimuth = 0,
  gravity = 0,
  earth_radius = 6378136.3,
  earth_eccen = 0.0066943979514,
  cutoff = 1e-06,
  wave_groups = NULL,
  catalog = "ksm04",
  eop = NULL,
  return_matrix = FALSE,
  scale = TRUE,
  n_thread = 1,
  ...
)
```

Arguments

- `utc` The date-time in UTC (POSIXct vector).
- `do_predict` Run in predict or analyze mode.
- `method` One or more of "gravity", "tidal_potential", "tidal_tilt", "vertical_displacement", "horizontal_displacement", "n_s_displacement", "e_w_displacement", "vertical_strain", "areal_strain", "volume_strain", "horizontal_strain", or "ocean_tides", "pole_tide", or "lod_tide". The pole tide and lod_tide are used in predict mode even if do_predict is FALSE. More than one value can only be used if do_predict == TRUE.
- `latitude` The station latitude (numeric) defaults to 0.
- `longitude` The station longitude (numeric) defaults to 0.
- `elevation` The station elevation (m) (numeric) defaults to 0.
- `azimuth` Earth azimuth (numeric) defaults to 0.
calc_earthtide

gravity  Gravity at the station (m/s^2) (numeric) 0 to estimate gravity from elevation and latitude.
earth_radius  Radius of earth (m) (numeric) defaults to 6378136.3
earth_eccen  Eccentricity of earth (numeric) defaults to 6.69439795140e-3
cutoff  Cutoff amplitude for constituents (numeric) defaults to 1e-6.
wave_groups  Two column data.frame having start and end of frequency groups (data.frame). This data.frame must have two columns with the names 'start', and 'end' signifying the start and end of the wave groupings. An optional third column 'multiplier' can be provided to scale the particular wave group. If column names do not match, the inferred column positions are start, end, multiplier.
catalog  Use the "hw95s" catalog or "ksm04" catalog (character).
eop  User defined Earth Orientation Parameter (EOP) data.frame with the following columns: datetime, ddt, ut1_utc, lod, x, y, dx, dy
return_matrix  Return a matrix of tidal values instead of data.frame. The datetime column will not be present in this case (logical).
scale  Scale results when do_predict is FALSE
n_thread  Number of threads to use for parallel processing (integer).

Value
data.frame or matrix of tidal results

Examples

tms <- as.POSIXct("1990-01-01", tz = "UTC") + c(0, 3600)
wave_groups <- data.frame(start = 0, end = 8, multiplier = 1.5)
et <- calc_earthtide(
  utc = tms,
  do_predict = TRUE,
  method = c("tidal_potential", "lod_tide", "pole_tide"),
  latitude = 52.3868,
  longitude = 9.7144,
  elevation = 110,
  gravity = 9.8127,
  cutoff = 1.0e-5,
  catalog = "ksm04",
  wave_groups = wave_groups,
  n_thread = 1
)
Earthtide  

Earthtide class

Description

Class to generate synthetic earthtide signals.

Format

An R6Class generator object

Usage

et <- Earthtide$new(
etc = as.POSIXct("2017-01-01", tz = "UTC") + 0:(24 * 7) * 3600,
latitude = 52.3868,
longitude = 9.7144,
catalog = "ksm04",
wave_groups = data.frame(start = 0.0, end = 6.0))
et$predict(method = "gravity", n_thread = 1)
et$analyze(method = "gravity", n_thread = 1)
et$lod_tide()
et$pole_tide()
et$tide()
et$print()

Arguments

Earthtide$new

et: An Earthtide object.
etc: The date-time in UTC (POSIXct vector).
latitude: The station latitude (WGS84) (degree) (numeric) defaults to 0.0
longitude: The station longitude (WGS84) (degree) (numeric) defaults to 0.0
elevation: The station ellipsoidal height (WGS84) (m) (numeric) defaults to 0.0
azimuth: Earth azimuth (numeric) defaults to 0 (degrees)
gravity: Gravity at the station (m/s^2) (numeric) 0 to estimate gravity from elevation and latitude.
earth_radius: Radius of earth (m) (numeric) defaults to 6378136.3
earth_eccen: Eccentricity of earth (numeric) defaults to 6.69437975140e-3
cutoff: Cutoff amplitude for constituents (numeric) defaults to 1e-6
wave_groups: Two column data.frame having start and end of frequency groups (data.frame).
    This data.frame must have two columns with the names 'start', and 'end' signifying the start
    and end of the wave groupings. An optional third column 'multiplier' can be provided to scale
    the particular wave group. If column names do no match, the inferred column positions are
    start, end, multiplier.
catalog:  Use the "hw95s" catalog or "ksm04" catalog (character).

eop:  User defined Earth Orientation Parameter (EOP) data.frame with the following columns:
   datetime, ddt, ut1_utc, lod, x, y, dx, dy

...:  Currently not used.

Earthtide$predict, Earthtide$analyze

method:  For predict and analyze. One of "gravity", "tidal_potential", "tidal_tilt", "vertical_displacement",
   "horizontal_displacement", "n_s_displacement", "e_w_displacement", "vertical_strain", "areal_strain",
   "volume_strain", "horizontal_strain" or "ocean_tides".

return_matrix:  For predict and analyze. Return a matrix of tidal values instead of data.frame.
   The datetime column will not be present in this case (logical).

n_thread:  For predict and analyze. Number of threads to use for parallel processing.

Details
$new(utc, latitude, longitude, elevation, azimuth, gravity,
   earth_radius, earth_eccen, cutoff, wave_groups, catalog, ...)
create a new Earthtide object and initialize catalog, station and times.

$predict(method, astro_argument, return_matrix) generate a combined synthetic Earth tide.
$analyze(method, astro_argument, return_matrix, scale) generate components of the Earth tide for analysis.
$lod_tide() generate components of the LOD (Length Of Day) tide.
$pole_tide() generate components of the pole tide.
$tide() get the tide data.frame.
$print() print the Earthtide object.

References


Examples
et <- Earthtide$new(
   utc = as.POSIXct("2017-01-01", tz = "UTC") + 0:(24 * 7) * 3600,
   latitude = 52.3868,
   longitude = 9.7144,
   catalog = "ksm04",
   wave_groups = data.frame(start = 0.0, end = 6.0)
)
eterna_wavegroups

et$predict(method = "gravity")

plot(gravity ~ datetime, et$tide(), type = "l")

eterna_wavegroups

Hartmann and Wenzel (1995) (ETERNA 3.4) wavegroups

Description

This data.frame contains wavegroups for different data time spans. The wavegroups should be subset prior to use and the 'time' column provides guidelines based on your input time span.

Usage

eterna_wavegroups

Format

A data.frame The columns are:

- name: wave group name
- start: lowest frequency of the wave group
- end: highest frequency of the wave group
- time: applicable to data of what length

Examples

utils::data(eterna_wavegroups)

get_iers

get_iers

Description

get_iers returns a data.frame of earth orientation parameters from (1962-present). This function requires an active internet connection. Bulletins A and B are combined giving precedence to B. Approximately (~ 7 MB) of data are downloaded. This function is brittle and may fail when data sources change.

Usage

get_iers(a_path = NULL, b_path = NULL, daily_path = NULL, tai_utc_path = NULL)
get_main_frequency

Arguments

- a_path: ftp or http path to download IERS bulletin A
- b_path: ftp or http path to download IERS bulletin B
- daily_path: ftp or http path to download IERS daily data
- tai_utc_path: ftp or http path to tai-utc data

Value

data.frame of earth orientation parameters with the following columns: datetime, ddt, ut1_utc, lod, x, y, dx, dy.

Examples

## Not run:
eop <- get_iers()
## End(Not run)

---

describe get_main_frequency

Description

Get the frequency of the wave with the maximum amplitude in a range.

Usage

get_main_frequency(start, end)

Arguments

- start: the starting frequency in cycles per day (numeric)
- end: the ending frequency in cycles per day (numeric)

Value

the main frequency between start and end
Index

* datasets
  * eterna_wavegroups, 7
  * PACKAGE (earthtide-package), 2

calc_earthtide, 3

Earthtide, 5
Earthtide-class (Earthtide), 5
earthtide-package, 2
eterna_wavegroups, 7

get_iers, 7
get_main_frequency, 8

R6Class, 5