Package ‘era’

March 9, 2022

Type Package
Title Year-Based Time Scales
Version 0.4.0
Description Provides a consistent representation of year-based time scales as a numeric vector with an associated 'era'. There are built-in era definitions for many year numbering systems used in contemporary and historic calendars (e.g. Common Era, Islamic 'Hijri' years); year-based time scales used in archaeology, astronomy, geology, and other palaeosciences (e.g. Before Present, SI-prefixed 'annus'); and support for arbitrary user-defined eras. Years can converted from any one era to another using a generalised transformation function. Methods are also provided for robust casting and coercion between years and other numeric types, type-stable arithmetic with years, and pretty-printing in tables.

Language en-GB
License MIT + file LICENSE
BugReports https://github.com/joeroe/era/issues
Encoding UTF-8
RoxygenNote 7.1.2
Depends R (>= 2.10)
Imports vctrs (>= 0.3.0), methods, rlang, pillar
Suggests tibble, testthat, covr, knitr, rmarkdown, dplyr, spelling, purrr, tidyr, lubridate
VignetteBuilder knitr
Config/testthat/edition 3
NeedsCompilation no
Author Joe Roe [aut, cre] (<https://orcid.org/0000-0002-1011-1244>)
Maintainer Joe Roe <joe@joeroe.io>
Repository CRAN
Date/Publication 2022-03-09 15:30:02 UTC
R topics documented:

- era .................................................. 2
- eras ................................................. 3
- era_parameters .................................... 4
- era_year ........................................... 5
- era_year_parameters .............................. 6
- is_era ............................................... 6
- is_era_year ....................................... 7
- is_yr ............................................... 8
- this_year .......................................... 9
- yr ................................................... 10
- yr_era ............................................. 10
- yr_transform ..................................... 11

Index 13

---

### era

*Create an era object*

**Description**

An `era` object defines the time scale associated with a vector of years (see `yr()`). `era()` returns an `era` object, either by looking up `label` in the standard eras defined in `eras()` or, if more than one argument is given, constructing a new definition with the specified parameters.

**Usage**

```r
era(
  label = character(),
  epoch = NULL,
  name = label,
  unit = era_year("Gregorian"),
  scale = 1,
  direction = -1
)
```

**Arguments**

- `label` Character. If only one argument is given to `era()`, the abbreviated label of a standard era defined in `eras()`. Otherwise, the label to give to the era constructed using the following arguments.
- `epoch` Numeric. Epoch year from which years are counted in Gregorian astronomical years (i.e. there is a "year zero").
- `name` Character. Full name of the era. Defaults to the value of `label`.
- `unit` An `era_year()` object describing the name of the year unit and its average length in solar days. Defaults to a Gregorian year (365.2425 days).
scale Integer. Number of years represented by one unit, e.g. \(1000\) for ka. Default: 1.
direction Are years counted backwards (-1) (the default) or forwards (1) from epoch?

Value
An object of class era.

See Also
Other era definition functions: \texttt{eras()}
Other era helper functions: \texttt{era\_parameters, era\_year\_parameters, era\_year, is\_era\_year()}, \texttt{is\_era(), is\_yr(), this\_year()}

Examples
\[
era("cal BP")
\]
\[
era("T.A.", epoch = -9021, name = "Third Age", direction = 1)
\]

\begin{verbatim}
<table>
<thead>
<tr>
<th>eras</th>
<th>Standard era definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
\end{verbatim}

Description
Definitions of common eras and time scales.
eras() lists all available era definitions. eras(label) looks up a specific era by its unique, abbreviated name (e.g. "cal BP").

Usage
\[
eras(label = NA)
\]

Arguments
\begin{itemize}
\item \texttt{label} (Optional) Abbreviated names(s) of eras to look up.
\end{itemize}

Details
Looking up eras by label uses partial matching.

Value
A table of era definitions. This can be passed to \texttt{era()} to construct an era object.

See Also
Other era definition functions: \texttt{era}
Examples

# List all available eras
eras()

# Look up a specific era by label
eras("cal BP")

# With partial matching
eras("cal")

---

### era_parameters

Get parameters of an era

---

**Description**

Extracts a specific parameter from an era object.

**Usage**

```r
era_label(x)
era_epoch(x)
era_name(x)
era_unit(x)
era_scale(x)
era_direction(x)
```

**Arguments**

- `x` An era object.

**Details**

The available parameters are:

- **label** – unique, abbreviated label of the era, e.g. "cal BP"
- **epoch** – year of origin of the era, e.g. 1950 for Before Present
- **name** – full name of the era, e.g. "calendar years Before Present"
- **unit** – unit of years used, an `era_year()` object
- **scale** – multiple of years used, e.g. 1000 for ka/kiloannum
- **direction** – whether years are counted "backwards" or "forwards" from the epoch #
era_year

Value

Value of the parameter.

See Also

Other era helper functions: era_year_parameters, era_year, era, is-era_year(), is-era(), is_yr(), this_year()

Examples

x <- era("cal BP")
era_name(x)

<table>
<thead>
<tr>
<th>era_year</th>
<th>Year units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description

era_year objects describe the unit used for a year as its length in days. This value is used in an era definition (era()) to enable conversions between eras that use different units (with yr_transform()).

Usage

era_year(label = character(), days = 365.2425)

Arguments

label Character. Name of the year unit.
days Numeric. Average length of the year in solar days. Defaults to a Gregorian year (365.2425 days).

Value

S3 vector of class era_year.

See Also

Other era helper functions: era_parameters, era_year_parameters, era, is-era_year(), is-era(), is_yr(), this_year()

Examples

era_year("Julian", 365.25)
era_year_parameters

Get the parameters of an era_year object.

Description

Extracts a specific parameter from a year unit object constructed by era_year().

Usage

era_year_label(x)

era_year_days(x)

Arguments

x

An object of class era_year.

Value

Value of the parameter.

See Also

Other era helper functions: era_parameters, era_year, era, is_era_year(), is_era(), is_yr(), this_year()

Examples

julian <- era_year("Julian", 365.25)
era_year_label(julian)
era_year_days(julian)

is_era

Validation functions for era objects

Description

Tests whether an object is an era definition (an era object). is_era() tests whether the object inherits from the S3 class era_yr. is_valid_era() performs additional checks to determine whether the object is well-formed (see details). validate_era() throws an informative error message for invalid yrs.
is_era_year

Usage

is_era(x)

validate_era(x)

is_valid_era(x)

Arguments

x          Object to test.

Details

Valid era objects:

- Must have all parameters set and not NA
- Must have a character label parameter
- Must have a numeric epoch parameter
- Must have a character name parameter
- Must have a character unit parameter that is one of the defined units
- Must have a positive, integer scale parameter
- Must have a direction parameter that is -1 (backwards) or 1 (forwards)

Value

is_era() and is_valid_era() return TRUE or FALSE. validate_era() returns x invisibly, and is used for its side-effect of throwing an informative error for invalid objects.

See Also

Other era helper functions: era_parameters, era_year_parameters, era_year, era, is_era_year(), is_yr(), this_year()

--------------------------------------------------------------------------------

is_era_year          Validation functions for era_year objects

Description

Tests whether an object is of class era_year (constructed by era_year()).

Usage

is_era_year(x)

Arguments

x          Object to test.
**Value**

TRUE or FALSE.

**See Also**

Other era helper functions: `era_parameters`, `era_year_parameters`, `era_year`, `era`, `is_era()`, `is_yr()`, `this_year()`

**Examples**

```r
is_era_year(era_year("Julian", 365.25))
```

---

**is_yr**

Validation functions for yr objects

**Description**

Tests whether an object is a vector of years with an era (a yr object). `is_yr()` tests whether the object inherits from the S3 class `era_yr`. `is_valid_yr()` performs additional checks to determine whether the object is well-formed (see details). `validate_yr()` throws an informative error message for invalid yrs.

**Usage**

```r
is_yr(x)
validate_yr(x)
is_valid_yr(x)
```

**Arguments**

- `x` Object to test.

**Details**

Valid yr objects:

- Must contain numeric data (NAs are allowed)
- Must have the `era` attribute set and not NA
- Must not have more than one era
- Must have an `era` attribute that is a valid era object (see `validate_era()`)

**Value**

`is_yr()` and `is_valid_yr()` return TRUE or FALSE. `validate_yr()` returns `x` invisibly, and is used for its side-effect of throwing an informative error for invalid objects.
this_year

See Also

Other era helper functions: era_parameters, era_year_parameters, era_year, era, is_era_year(), is_era(), this_year()

Examples

```r
x <- yr(5000:5050, era("cal BP"))
is_yr(x)
is_valid_yr(x)
validate_yr(x)
```

<table>
<thead>
<tr>
<th>this_year</th>
<th>Current year</th>
</tr>
</thead>
</table>

Description

Returns the current year as a year vector, in the era system specified by `era`.

Usage

```r
this_year(era = "CE")
```

Arguments

`era` An era object or label understood by `era()`. Defaults to the Common Era (`era("CE")`).

Value

A `yr` vector with the current year.

See Also

Other era helper functions: era_parameters, era_year_parameters, era_year, era, is_era_year(), is_era(), is_yr()

Examples

```r
# This year in the Common Era
this_year()

# This year in the Holocene Epoch
this_year("HE")
```
yr

Create a vector of years with era

Description

A yr object represents years with an associated calendar era or time scale.

Usage

yr(x = numeric(), era = character())

Arguments

x
A numeric vector of years.

era
The calendar era used by x. Either:

- A string matching one of the standard era labels defined in eras()
- An era object constructed with era()

Value

A yr (era_yr) object.

See Also

Other years with era functions: yr_era(), yr_transform()

Examples

# The R Age
yr(1993:2020, "CE")

# A bad movie
yr(10000, "BC")

yr_era

Get or set the era of a vector of years

Description

Functions for extracting or assigning the era of a vector of years. This function does not alter the underlying values of x. Use yr_transform() to convert the values of a yr vector to a new era.
**yr_transform**

**Usage**

\[ \text{yr\_era(x)} \]

\[ \text{yr\_set\_era(x, era)} \]

\[ \text{yr\_era(x) \leftarrow value} \]

**Arguments**

- **x** A vector of years.
- **value, era** An era object (see `era()` to be assigned to `x`.

**Value**

- `yr\_era(x)` returns the existing era associated with `x`.
- `yr\_set\_era(x, era)` and `yr\_era(x) \leftarrow era` return `x` with the new era assigned. If `x` is not already a yr vector, it will attempt to coerce it into one.

**See Also**

- Other years with era functions: `yr\_transform()`, `yr()`

**Examples**

```r
x <- 5000:5050
yr\_era(x) \leftarrow era("cal BP")
yr\_era(x)
```

---

**yr_transform**  
*Convert years from one era to another*

**Description**

Transform a vector of years from one era to another.

**Usage**

\[ \text{yr\_transform(x, era = yr\_era(x), precision = NA)} \]

**Arguments**

- **x** yr object. A vector of years with an era, see `yr()`.
- **era** era object describing the target era, see `era()`.
- **precision** Desired precision of the transformation, i.e. the transformed values are rounded to the nearest precision. If NA (the default), no rounding is performed and the exact transformed value is returned.
yr_transform

Details

Transformation between eras uses the scale, epoch, direction and unit parameters of the era definition. NA values for any of these parameters in the source or destination era will cause an error. This is most often encountered when either are measured in 'radiocarbon years', which cannot be related to a calendar time scale without calibration or un-calibration.

The transformation function is exact and treats years as a real number scale. This means that transformations between eras with different year units (e.g. Gregorian to Julian) and/or epochs not aligned to 1 January in the Gregorian calendar (e.g. Common Era to Islamic calendars) will likely return non-integer values. The precision argument provides a convenient way to round the result if you do not need this level of precision. It is also useful for working around the ambiguous definition of 'present' in various geological time-scales.

Value

A yr object in the era specified by era.

See Also

Other years with era functions: yr_era(), yr()

Examples

x <- yr(10010:10001, "cal BP")
yr_transform(x, era("BCE"))

yr_transform(x, era("ka"), precision = 1)
# Index

**era definition functions**
- era, 2
- eras, 3
**era helper functions**
- era, 2
  - era_parameters, 4
  - era_year, 5
  - era_year_parameters, 6
  - is_era, 6
  - is_era_year, 7
  - is_yr, 8
  - this_year, 9
**years with era functions**
- yr, 10
  - yr_era, 10
  - yr_transform, 11

- era, 2, 3, 5–9
- era(), 3, 5, 9–11
- era_direction (era_parameters), 4
- era_epoch (era_parameters), 4
- era_label (era_parameters), 4
- era_name (era_parameters), 4
- era_parameters, 3, 4, 5–9
- era_scale (era_parameters), 4
- era_unit (era_parameters), 4
- era_year, 3, 5, 5, 6–9
- era_year(), 2, 4, 6, 7
- era_year_days (era_year_parameters), 6
- era_year_label (era_year_parameters), 6
- era_year_parameters, 3, 5, 6, 7–9
- eras, 3, 3
- eras(), 2, 10

- is_era, 3, 5, 6, 8, 9
- is_era_year, 3, 5–7, 7, 9
- is_valid_era (is_era), 6
- is_valid_yr (is_yr), 8
- is_yr, 3, 5–8, 8, 9