Package 'ncmeta'

August 27, 2020

Title Straightforward 'NetCDF' Metadata

Version 0.3.0

Description Extract metadata from 'NetCDF' data sources, these can be files, file handles or
servers. This package leverages and extends the lower level functions of the 'RNetCDF' package
providing a consistent set of functions that all return data frames. We introduce named concepts
of 'grid', 'axis' and 'source' which are all meaningful entities without formal definition in the
'NetCDF' library <https://www.unidata.ucar.edu/software/netcdf/>. 'RNetCDF' matches the library
itself with only the named concepts of 'variables', 'dimensions' and 'attributes'.

Depends R (>= 3.3.0)

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

Imports dplyr, rlang, RNetCDF, tibble, stats, tidyr

Suggests testthat, covr

URL <https://github.com/hypertidy/ncmeta>

BugReports <https://github.com/hypertidy/ncmeta/issues>

ByteCompile TRUE

NeedsCompilation no

Author Michael Sumner [aut, cre],
Tomas Remenyi [ctb],
Ben Raymond [ctb],
David Blodgett [ctb]

Maintainer Michael Sumner <mdsumner@gmail.com>

Repository CRAN

Date/Publication 2020-08-27 05:10:15 UTC

R **topics documented:**

---

ncmeta   *ncmeta: straightforward NetCDF metadata*

Description

ncmeta provides a consistent set of tools to obtain metadata from NetCDF. NetCDF is 'Network Common Data Form' https://www.unidata.ucar.edu/software/netcdf/. These functions are generics, allowing methods to be written for various providers so that everything can work from a common basis. All functions return a data frame.

Details

Each function responds to a character file name or data source (i.e. URL) or to a connection of a given class, this is so a source connection may be created a minimal number of times and kept open while a number of entities are queried.

Each "given" entity may be referred to by index (0-based) or name, just as it would be by the NetCDF API and by the two R wrapper providers RNetCDF and ncdf4.

nc_att	find the given attribute of a given variable
nc_atts	find all attributes, of all variables and globals
nc_axes	find all the instances of dimensions
nc_axis	find given instance of a dimension (1-based)
nc_dim	find the given dimension of a source (0-based)
nc_dims	find all the dimensions of a source
nc_grids	find the grids (sets of dimensions) of a source
nc_inq	inquire about a source (i.e. number of dimensions, number of variables, number of global attributes and presen

[nc_meta](#)	find all metadata for a source (runs all other functions)
[nc_sources](#)	tags a record of a source and its "access time"
[nc_var](#)	find a given variable (0-based)
[nc_vars](#)	find the variables of a source

---

nc_att   *NetCDF attributes*

Description

Variable attributes are number 0:(n-1). Global attributes are indexed by -1 or the label "NC_GLOBAL".

Usage

```
nc_att(x, variable, attribute, ...)

## S3 method for class 'NetCDF'
nc_att(x, variable, attribute, ...)

## S3 method for class 'character'
nc_att(x, variable, attribute, ...)
```

Arguments

x	or file handle
variable	name or index (zero based) of variable
attribute	name or index (zero based) of attribute
...	ignored

Details

nc_inq includes the number of global attributes nc_vars includes the number of variable attributes

Value

data frame of attribute with numeric id, character attribute name, character or numeric variable id or name depending on input, and attribute value.

Examples

```
f <- system.file("extdata", "S2008001.L3m_DAY_CHL_chlor_a_9km.nc", package = "ncmeta")
nc_att(f, 0, 0)
```

nc_atts   *NetCDF attributes*

Description

All attributes in the file, globals are treated as if they belong to variable 'NC_GLOBAL'. Attributes for a single variable may be returned by specifying 'variable' - 'NC_GLOBAL' can stand in to return only those attributes.

Usage

```
nc_atts(x, variable = NULL, ...)

## S3 method for class 'NetCDF'
nc_atts(x, variable = NULL, ...)

## S3 method for class 'character'
nc_atts(x, variable = NULL, ...)
```

Arguments

x	filename or handle
variable	optional single name of a variable, or 'NC_GLOBAL'
...	ignored

Value

data frame of attributes

Examples

```
f <- system.file("extdata", "S2008001.L3m_DAY_CHL_chlor_a_9km.nc", package = "ncmeta")
nc_atts(f)
```

nc_axes   *NetCDF axes*

Description

An `axis` is an instance of a dimension.

Usage

```
nc_axes(x, variables = NULL, ...)

## S3 method for class 'character'
nc_axes(x, variables = NULL, ...)

## S3 method for class 'NetCDF'
nc_axes(x, variables = NULL, ...)
```

Arguments

x	NetCDF source
variables	names of vars to query
...	ignored

Details

Each data source has a set of dimensions available for use by variables. Each axis is a 1-dimensional instance.

---

nc_axis	*NetCDF axes*

Description

An `axis` is an instance of a dimension.

Usage

```
nc_axis(x, i)

## S3 method for class 'character'
nc_axis(x, i)

## S3 method for class 'NetCDF'
nc_axis(x, i)
```

Arguments

x	NetCDF source
i	index of axis (1-based, 0 is "empty")

Details

Each data source has a set of dimensions available for use by variables. Each axis is a 1-dimensional instance.

---

nc_coord_var   *Get Coordinate Variables for Given Variable*

Description

In NetCDF, variables are defined along dimensions and are said to have "coordinate variables" that define the (typically spatio-temporal) positions of the data's cells.

Usage

```
nc_coord_var(x, variable = NULL, ...)

## S3 method for class 'character'
nc_coord_var(x, variable = NULL, ...)

## S3 method for class 'NetCDF'
nc_coord_var(x, variable = NULL, ...)
```

Arguments

x	NetCDF source
variable	variable name of interest. If not included, all variables will be returned.
...	ignored

Details

This function attempts to identify the X, Y, Z, and T coordinate variables for each data variable in the provided NetCDF source. The NetCDF-CF attribute conventions are used to make this determination.

All variables that can be related to a spatio-temporal axis, including coordinate variables are returned. For coordinate variables, a "bounds" column is included in the response indicating which variable contains bounds information.

See <http://cfconventions.org/cf-conventions/v1.6.0/cf-conventions.html#coordinate-system> for more.

Value

tibble with "variable", "X", "Y", "Z", "T", and "bounds" columns that reference variables by name.

Examples

```
f <- system.file("extdata", "S2008001.L3m_DAY_CHL_chlor_a_9km.nc", package = "ncmeta")
nc_coord_var(f, "chlor_a")

f <- system.file("extdata", "guam.nc", package = "ncmeta")
nc_coord_var(f)
```

---

nc_dim	*NetCDF variables Obtain information about a single dimension by index.*

Description

NetCDF variables Obtain information about a single dimension by index.

Usage

```
nc_dim(x, i, ...)

## S3 method for class 'character'
nc_dim(x, i, ...)

## S3 method for class 'NetCDF'
nc_dim(x, i, ...)

## S3 method for class 'ncdf4'
nc_dim(x, i, ...)
```

Arguments

x	filename or handle
i	index of dimension (zero based)
...	ignored

See Also

nc_vars to obtain information about all dimensions, nc_inq for an overview of the file

---

nc_dims	*NetCDF dimension*

Description

Get information about the dimensions in a NetCDF source.

Usage

```
nc_dims(x, ...)

## S3 method for class 'character'
nc_dims(x, ...)

## S3 method for class 'NetCDF'
nc_dims(x, ...)

## S3 method for class 'ncdf4'
nc_dims(x, ...)
```

Arguments

x	file address or handle
...	ignored

---

nc_gm_to_prj	*Get projection from NetCDF-CF Grid Mapping*

Description

Takes NetCDF-CF grid mapping attributes and returns a proj4 string.

Usage

```
nc_gm_to_prj(x)

## S3 method for class 'data.frame'
nc_gm_to_prj(x)

## S3 method for class 'list'
nc_gm_to_prj(x)
```

Arguments

x	list or data.frame of attributes of the grid mapping variable as returned by ncdf or ncdf4's get attributes functions or ncmeta's nc_grid_mapping_atts.

Details

The WGS84 datum is used as a default if one os not provided in the grid mapping.

If only a semi_major axis is provided, a sperical earth is assumed.

Value

A proj4 string.

References

1. <https://en.wikibooks.org/wiki/PROJ.4>
2. <https://trac.osgeo.org/gdal/wiki/NetCDF_ProjectionTestingStatus>
3. <http://cfconventions.org/cf-conventions/cf-conventions.html#appendix-grid-mappings>

Examples

```
crs <- list(grid_mapping_name="latitude_longitude",
            longitude_of_prime_meridian = 0,
            semi_major_axis = 6378137,
            inverse_flattening = 298)
nc_gm_to_prj(crs)
```

---

nc_grids   *NetCDF grids*

Description

A `grid` is a discretized space, defined by a set of dimensions. These are the spaces used by one or more variables in a source. Traditional summaries are organized by variable, but when organized by space or grid we can treat multiple variables together using standard database techniques.

Usage

```
nc_grids(x, ...)

## S3 method for class 'character'
nc_grids(x, ...)

## S3 method for class 'NetCDF'
nc_grids(x, ...)

## S3 method for class 'tidync'
nc_grids(x, ...)
```

Arguments

x	NetCDF source
...	ignored

Details

Each data source has a set of dimensions available for use by variables. Each grid is an n-dimensional space available for use by 0, 1 or more variables. A grid only really exists if variable is defined for it, and 'grid' is an implicit entity not an explicit part of the NetCDF API definition. The Unidata pages refer to "shape", which is more or less what we mean by "grid".

---

nc_grid_mapping_atts   *Get Grid Mapping*

Description

Get the grid mapping from a NetCDF file

Usage

```
nc_grid_mapping_atts(x, data_variable = NULL)

## S3 method for class 'character'
nc_grid_mapping_atts(x, data_variable = NULL)

## S3 method for class 'NetCDF'
nc_grid_mapping_atts(x, data_variable = NULL)

## S3 method for class 'data.frame'
nc_grid_mapping_atts(x, data_variable = NULL)
```

Arguments

x	open NetCDF object, character file path or url to be opened with RNetCDF::open.nc, or data.frame as returned from ncmeta::nc_atts
data_variable	character variable of interest

Value

tibble containing attributes that make up the file's grid_mapping. A data_variable column is included to indicate which data variable the grid mapping belongs to.

Examples

```
nc_grid_mapping_atts(system.file("extdata/daymet_sample.nc", package = "ncmeta"))
```

---

nc_inq   *File info*

Description

Get information about a NetCDF data source, may be a file path, or a RNetCDF file handle, or an OpenDAP/Thredds server address.

Usage

```
nc_inq(x, ...)

## S3 method for class 'NetCDF'
nc_inq(x, ...)

## S3 method for class 'character'
nc_inq(x, ...)
```

Arguments

x	filename or handle
...	ignored

Examples

```
## Not run:
 f <- raadfiles:::cmip5_files()$fullname[1]
 nc_inq(f)
 nc_var(f, 0)
 nc_dim(f, 0)

## End(Not run)

f <- system.file("extdata", "S2008001.L3m_DAY_CHL_chlor_a_9km.nc", package = "ncmeta")
nc_inq(f)
nc_var(f, 0)
nc_dim(f, 0)

nc_vars(f)
nc_dims(f)

## Not run:
## thredds (see rerddap)
u <- "https://upwell.pfeg.noaa.gov/erddap/tabledap/FRDCPSTrawlLHHaulCatch"
nc_inq(u)
# A tibble: 1 x 5
#ndims nvars ngatts unlimdimid
#<dbl> <dbl> <dbl>      <lgl>
# 1     2    18     37        NA
# ... with 1 more variables: filename <chr>

## End(Not run)
```

---

nc_meta   *Top level NetCDF metadata.*

Description

This function exists to maintain the open connection while all dimension, variable, and attribute metadata is extracted.

Usage

```
nc_meta(x, ...)

## S3 method for class 'NetCDF'
nc_meta(x, ...)

## S3 method for class 'character'
nc_meta(x, ...)
```

Arguments

x   data source address, file name or handle

...   ignored

Details

This function is pretty ambitious, and will send nearly any string to the underlying NetCDF library other than "", which immediately generates an error. This should be robust, but might present fairly obscure error messages from the underlying library.

Examples

```
f <- system.file("extdata", "S2008001.L3m_DAY_CHL_chlor_a_9km.nc", package = "ncmeta")
nc_meta(f)

## Not run:
u <- "https://upwell.pfeg.noaa.gov/erddap/tabledap/FRDCPSTrawlLHHaulCatch"
nc_meta(u)

## End(Not run)
```

---

nc_prj_to_gridmapping   *Get NetCDF-CF grid mapping from projection*

Description

Takes a proj4 string and returns a NetCDF-CF projection as a named list of attributes.

Usage

```
nc_prj_to_gridmapping(prj)
```

Arguments

prj   character PROJ string as used in raster, sf, sp, proj4, and rgdal packages.

Value

A named list containing attributes required for that grid_mapping.

References

1. <https://en.wikibooks.org/wiki/PROJ.4>

2. <https://trac.osgeo.org/gdal/wiki/NetCDF_ProjectionTestingStatus>

3. <http://cfconventions.org/cf-conventions/cf-conventions.html#appendix-grid-mappings>

Examples

```
prj <- "+proj=longlat +datum=NAD27 +no_defs"
nc_prj_to_gridmapping(prj)
p1 <- "+proj=aea +lat_1=29.5 +lat_2=45.5 +lat_0=23 +lon_0=-96"
p2 <- "+x_0=0 +y_0=0 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs"
prj2 <- sprintf("%s %s", p1, p2)
nc_prj_to_gridmapping(prj2)

nc_prj_to_gridmapping("+proj=longlat +a=6378137 +f=0.00335281066474748 +pm=0 +no_defs")
```

---

nc_sources   *NetCDF sources*

Description

A record of file, URL, or any data source with NetCDF.

Usage

```
nc_sources(x, ...)

## S3 method for class 'character'
nc_sources(x, ...)
```

Arguments

x   data source string

...   ignored

---

nc_var *NetCDF variable*

Description

Return a data frame about the variable at index i.

Usage

```
nc_var(x, i)

## S3 method for class 'character'
nc_var(x, i)

## S3 method for class 'NetCDF'
nc_var(x, i)
```

Arguments

x	file name or handle
i	variable index (zero based)

Value

data frame of variable information

See Also

nc_vars to obtain information about all variables, nc_inq for an overview of the file

---

nc_vars *NetCDF variables*

Description

Generate a table of all variables.

Usage

```
nc_vars(x, ...)

## S3 method for class 'character'
nc_vars(x, ...)

## S3 method for class 'NetCDF'
nc_vars(x, ...)
```

Arguments

x	filename or handle
. . .	ignored currently

Value

data frame of variable information

Index