Package ‘vapour’

April 11, 2023

Title Access to the ‘Geospatial Data Abstraction Library’ (‘GDAL’)

Version 0.9.5

Description Provides low-level access to ‘GDAL’ functionality.

‘GDAL’ is the ‘Geospatial Data Abstraction Library’ a translator for raster and vector geospatial data formats
that presents a single raster abstract data model and single vector abstract data model to the calling application
for all supported formats <https://gdal.org/>. This package is focussed on providing exactly and only what GDAL does, to enable
developing further tools.

Depends R (>= 3.3.0)

License GPL-3

Encoding UTF-8

LazyData true

LinkingTo Rcpp

Imports jsonlite, nanoarrow, Rcpp, utils

RoxygenNote 7.2.3

Suggests testthat, knitr, markdown, rmarkdown, spelling

SystemRequirements libgdal-dev, GDAL (>= 2.2.3), PROJ (>= 4.8.0)

VignetteBuilder knitr

URL https://github.com/hypertidy/vapour

BugReports https://github.com/hypertidy/vapour/issues

Language en-US

NeedsCompilation yes

Author Michael Sumner [aut, cre] (<https://orcid.org/0000-0002-2471-7511>),
Simon Wotherspoon [ctb] (RasterIO configuration for resampling options),
Mark Padgham [ctb] (helped get started :)),
Edzer Pebesma [ctb] (wrote the field-read handling, adapted here from sf),
Roger Bivand [ctb] (wrote configure.ac, adapted here from rgdal),
Jim Hester [ctb, cph] (wrote CollectorList.h, copied here from fs package),
Timothy Keitt [ctb] (wrote GetPointsInternal copied here from rgdal2 package),
Jeroen Ooms [ctb] (tweaked build process, provided Windows build tools),
Dale Maschette [ctb] (created the hex logo),
Joseph Stachelek [ctb],
Even Rouault [ctb] (primary author of the COG format and its use of the GDALwarp app-library, example code used by the warper function here),
Robert Hijmans [ctb] (code in terra package used as example/inspiration),
Dewey Dunnington [ctb] (wrote the columnar-access mode streaming Arrow support)

Maintainer Michael Sumner <mdsumner@gmail.com>
Repository CRAN
Date/Publication 2023-04-11 14:00:03 UTC

R topics documented:

vapour-package ............................................. 3
gdal_raster_data ........................................ 4
sst_c ......................................................... 6
tas_wkt ....................................................... 7
vapour_create .............................................. 7
vapour_crs_is_lonlat ....................................... 8
vapour_gdal_version ....................................... 9
vapour_geom_name .......................................... 10
vapour_geom_summary ..................................... 11
vapour_layer_extent ....................................... 12
vapour_layer_info ......................................... 13
vapour_layer_names ....................................... 14
vapour_raster_gcp ......................................... 15
vapour_raster_info ....................................... 16
vapour_read_fids .......................................... 19
vapour_read_fields ....................................... 20
vapour_read_geometry ..................................... 21
vapour_read_raster ....................................... 24
vapour_read_raster_block ................................ 25
vapour_read_raster_raw ................................... 26
vapour_report_fields ..................................... 28
vapour_sds_names .......................................... 29
vapour_set_config ......................................... 30
vapour_srs_wkt ........................................... 31
vapour_vrt .................................................. 32
vapour_vsi_list ........................................... 34
vapour_warp_raster ........................................ 35
Description

A lightweight GDAL API package for R.

Details

Provides low-level access to 'GDAL' functionality for R packages. The aim is to minimize the level of interpretation put on the 'GDAL' facilities, to enable direct use of it for a variety of purposes. 'GDAL' is the 'Geospatial Data Abstraction Library' a translator for raster and vector geospatial data formats that presents a single raster abstract data model and single vector abstract data model to the calling application for all supported formats [https://gdal.org/](https://gdal.org/).

Lightweight means we access parts of the GDAL API as near as possible to their native usage. GDAL is not a lightweight library, but provide a very nice abstraction over format details for a very large number of different formats.

Functions for raster and vector sources are included.

- `vapour_all_drivers`: list of all available drivers, with type and features
- `vapour_driver`: report short name of driver that will be used for a data source
- `vapour_gdal_version`: report version of GDAL in use
- `vapour_srs_wkt`: produce WKT projection string from various projection string inputs
- `vapour_vsi_list`: report contents of VSI sources
- `vapour_raster_gcp`: return internal ground control points, if present
- `vapour_raster_info`: structural metadata of a source
- `vapour_read_raster`: read data direct from a window of a raster band source
- `vapour_sds_names`: list individual raster sources in a source containing subdatasets
- `vapour_warp_raster`: read data direct from a raster source into a specific window

- `vapour_driver`: report name of the driver used for a given source
- `vapour_geom_name`: report attribute name of geometry
- `vapour_geom_summary`: report simple properties of each feature geometry
- `vapour_layer_names`: list names of vector layers in a data source
- `vapour_layer_info`: list of data source, driver, layer name/s, fields, feature count, projection
- `vapour_read_extent`: read the extent, or bounding box, of geometries in a layer
- `vapour_read_fields`: read attributes of features in a layer, the columnar data associated with each geometry
- `vapour_read_geometry`: read geometry in binary (blob, WKB) form
As far as possible vapour aims to minimize the level of interpretation provided for the functions, so that developers can choose how things are implemented. Functions return raw lists or vectors rather than data frames or classed types.

**options**

The following options can be set to control global behaviour.

\[
\text{Sys.getenv("vapour.sql.dialect")} \quad \text{the current SQL dialect in use}
\]

**SQL dialect**

The SQL dialect can be set to "" (empty string), "OGRSQL", or "SQLITE".

The empty string indicates that the native dialect will be used, see OGRSQL and SQLITE for GDAL, accessed 2022-11-11 and the GDAL_DMD_SUPPORTED_SQL_DIALECTS development documentation (since GDAL 3.6).

Setting "NATIVE" as an alias for "" is quite recent and has not been tested with vapour, similarly no testing has been done with non OGRSQL-native or SQLITE-native drivers yet.

---

**gdal_raster_data** General raster read and convert

**Description**

The warper is used to convert source/s to an output file or to data in memory.

**Usage**

\[
\text{gdal_raster_data(}
\text{dsn},
\text{target_crs = NULL,}
\text{target_dim = NULL,}
\text{target_ext = NULL,}
\text{target_res = NULL,}
\text{resample = "near",}
\text{bands = 1L,}
\text{band_output_type = NULL,}
\text{)}
\]

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vapour_read_geometry_ia</td>
<td>read geometry by index, arbitrary</td>
</tr>
<tr>
<td>vapour_read_geometry_ii</td>
<td>read geometry by sequential index, i to j</td>
</tr>
<tr>
<td>vapour_read_geometry_text</td>
<td>read geometry in text form, various formats</td>
</tr>
<tr>
<td>vapour_read_names</td>
<td>read the <code>names</code> of features in a layer, the <code>FID</code></td>
</tr>
<tr>
<td>vapour_read_type</td>
<td>read the GDAL types of attributes</td>
</tr>
<tr>
<td>vapour_report_fields</td>
<td>report internal type of each attribute by name</td>
</tr>
</tbody>
</table>
gdal_raster_data

options = character()
)
gdal_raster_dsn(
    dsn,
    target_crs = NULL,
    target_dim = NULL,
    target_ext = NULL,
    target_res = NULL,
    resample = "near",
    bands = NULL,
    band_output_type = NULL,
    options = character(),
    out_dsn = tempfile(fileext = ".tif")
)

gdal_raster_image(
    dsn,
    target_crs = NULL,
    target_dim = NULL,
    target_ext = NULL,
    target_res = NULL,
    resample = "near",
    bands = NULL,
    band_output_type = NULL,
    options = character()
)

Arguments

dsn data sources, files, urls, db strings, vrt, etc
target_crs projection of the target grid
target_dim dimension of the target grid
target_ext extent of the target grid
target_res resolution of the target grid
resample resampling algorithm used
bands band or bands to include, default is first band only (use NULL or a value less that one to obtain all bands)
band_output_type specify the band type, see vapour_read_raster
options general options passed to gdal warper
out_dsn use with gdal_raster_dsn optionally set the output file name (or one will be generated)

Details

Two functions 'gdal_raster_data' and 'gdal_raster_dsn' act like the gdalwarp command line tool, a convenience third function 'gdal_raster_image()' works especially for image data.
Value

pixel values in a list vector per band, or a list of file paths

Examples

dsn <- system.file("extdata/sst.tif", package = "vapour")
par(mfrow = c(2, 2))
## do nothing, get native
X <- gdal_raster_data(dsn)
## set resolution (or dimension, extent, crs, or combination thereof - GDAL
## will report/resolve incompatible opts)
X1 <- gdal_raster_data(dsn, target_res = 1)
## add a cutline, and cut to it using gdal warp args
cutline <- system.file("extdata/cutline_sst.gpkg", package = "vapour")
X1c <- gdal_raster_data(dsn, target_res = .1, options = c("-cutline",cutline, "-crop_to_cutline"))
## warp whole grid to give res
X2 <- gdal_raster_data(dsn, target_res = 25000, target_crs = "EPSG:32755")
## specify exactly (as per vapour originally)
X3 <- gdal_raster_data(dsn, target_ext = c(-1, 1, -1, 1) * 8e6,
    target_dim = c(512, 678), target_crs = "+proj=stere +lon_0=147 +lat_0=-90")
X4 <- gdal_raster_dsn(dsn, out_dsn = tempfile(fileext = ".tif"))

__sst_c__

SST contours

Description

Southern Ocean GHRSST contours in sf data frame from 2017-07-28, read from

Details

podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L4 GLOB/JPL/MUR/v4.1/2017/209/ 20170728090000-
JPL-L4_GHRSST-SSTfnd-MUR-GLOB-v02.0-fv04.1.nc
See data-raw/sst_c.R for the derivation column sst_c in Celsius.
Also stored in GeoPackage format in system.file("extdata/sst_c.gpkg", package = "vapour")

Examples

f <- system.file("extdata/sst_c.gpkg", package = "vapour")
## create a class-less form of the data in the 'sst_c.gpkg' file with GeoJSON geometry
atts <- vapour_read_fields(f)
dat <- as.data.frame(atts, stringsAsFactors = FALSE)
dat["json"] <- vapour_read_geometry_text(f)
names(dat)
names(sst_c)

---

tas_wkt  

**Example WKT coordinate reference system**

**Description**

A Lambert Azimuthal Equal Area Well-Known-Text string for a region centred on Tasmania.

**Details**

Created from ‘+proj=laea +lon_0=147 +lat_0=-42 +datum=WGS84’. For use in a future warping example.

---

vapour_create  

Create raster file

**Description**

This is in an incomplete interface to raster writing, for exploring.

**Usage**

vapour_create(
  filename,
  driver = "GTiff",
  extent = c(-180, 180, -90, 90),
  dimension = c(2048, 1024),
  projection = "OGC:CRS84",
  n_bands = 1L,
  overwrite = FALSE
)

**Arguments**

- **filename**: filename/path to create
- **driver**: GDAL driver to use (GTiff is default, and recommended)
- **extent**: xmin,xmax,ymin,ymax 4-element vector
- **dimension**: dimension of the output, X * Y
- **projection**: projection of the output, best to use a full WKT but any string accepted
- **n_bands**: number of bands in the output, default is 1
- **overwrite**: not TRUE by default
Details

If GeoTIFF is used (driver = "GTiff", recommended) then the output is tiled 512x512, and has DEFLATE compression, and is sparse when created (no values are initiated, so the file is tiny).

Note that there is no restriction on where you can read or write from, the responsibility is yours. In future we will allow control of output tiling and data type etc.

Value

the file path that was created

Examples

```r
tfile <- tempfile(fileext = ".tif")
if (!file.exists(tfile)) {
  vapour_create(tfile, extent = c(-1, 1, -1, 1) * 1e6,
                dimension = c(128, 128),
                projection = "+proj=laea")
  file.remove(tfile)
}
```

---

vapour_crs_is_lonlat  Is the CRS string representative of angular coordinates

Description

Returns TRUE if this is longitude latitude data. Missing, malformed, zero-length values are disallowed.

Usage

vapour_crs_is_lonlat(crs)

Arguments

- **crs**: character string of length 1

Value

logical value TRUE for lonlat, FALSE otherwise

Examples

```r
vapour_crs_is_lonlat("+proj=laea")
vapour_crs_is_lonlat("+proj=longlat")
vapour_crs_is_lonlat("+init=EPSG:4326")
vapour_crs_is_lonlat("OGC:CRS84")
vapour_crs_is_lonlat("WGS84")
vapour_crs_is_lonlat("NAD27")
vapour_crs_is_lonlat("EPSG:3031")
```
vapour_gdal_version

vapour_gdal_version  GDAL version and drivers.

Description
Return information about the GDAL library in use.

Usage
vapour_gdal_version()
vapour_all_drivers()
vapour_driver(dsource)

Arguments
dsource  data source string (i.e. file name or URL or database connection string)

Details
vapour_gdal_version returns the version of GDAL as a string. This corresponds to the "–version" as described for "GDALVersionInfo". GDAL documentation.

vapour_all_drivers returns the names and capabilities of all available drivers, in a list. This contains:

• driver the driver (short) name
• name the (long) description name
• vector logical vector indicating a vector driver
• raster logical vector indicating a raster driver
• create driver can create (note vapour provides no write capacity)
• copy driver can copy (note vapour provides no write capacity)
• virtual driver has virtual capabilities ('vsi')

vapour_driver() returns the short name of the driver, e.g. 'GPKG' or 'GTiff', to get the long name and other properties use vapour_all_drivers() and match on 'driver'.

Value
please see Details, character vectors or lists of character vectors
vapour_geom_name

Examples

vapour_gdal_version()

drv <- vapour_all_drivers()

f <- system.file("extdata/sst_c.gpkg", package = "vapour")
vapour_driver(f)

as.data.frame(drv)[match(vapour_driver(f), drv$driver), ]

vapour_geom_name Read geometry column name

Description

There might be one or more geometry column names, or it might be an empty string.

Usage

vapour_geom_name(dsource, layer = 0L, sql = "")

Arguments

dsource data source name (path to file, connection string, URL)
layer integer of layer to work with, defaults to the first (0) or the name of the layer
sql if not empty this is executed against the data source (layer will be ignored)

Details

It might be "," , or "geom", or "ogr_geometry" - the last is a default name given when SQL is executed by GDAL but there was no geometry name, and 'SELECT * ' or equivalent was used.

This feature is required by the DBI backend work in RGDALSQL, so that when SELECT * is used we can give a reasonable name to the geometry column which is obtained separately.

Value

character vector of geometry column name/s

Examples

file <- system.file("extdata/tab/list_locality_postcode_meander_valley.tab", package = "vapour")
vapour_geom_name(file) ## empty string
vapour_geom_summary

Summary of available geometry

Description

Read properties of geometry from a source, optionally after SQL execution.

Usage

```r
vapour_geom_summary(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)
```

Arguments

- **dsource**: data source name (path to file, connection string, URL)
- **layer**: integer of layer to work with, defaults to the first (0) or the name of the layer
- **sql**: if not empty this is executed against the data source (layer will be ignored)
- **limit_n**: an arbitrary limit to the number of features scanned
- **skip_n**: an arbitrary number of features to skip
- **extent**: apply an arbitrary extent, only when 'sql' used (must be 'ex = c(xmin, xmax, ymin, ymax)' but sp bbox, sf bbox, and raster extent also accepted)

Details

Use `limit_n` to arbitrarily limit the number of features queried.

Value

list containing the following

- **FID**: the feature id value (an integer, usually sequential)
- **valid_geometry**: logical value if a non-empty geometry is available
- **type**: integer value of geometry type from GDAL enumeration
- **xmin, xmax, ymin, ymax**: numeric values of the extent (bounding box) of each geometry
vapour_layer_extent

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
vapour_geom_summary(mvfile, limit_n = 3L)

gsum <- vapour_geom_summary(mvfile)
plot(NA, xlim = range(c(gsum$xmin, gsum$xmax), na.rm = TRUE),
     ylim = range(c(gsum$ymin, gsum$ymax), na.rm = TRUE))
rect(gsum$xmin, gsum$ymin, gsumxmax, gsum$ymax)
rect(gsum$xmin, gsum$ymin, gsum xmax, gsum$ymax)
text(gsum$xmin, gsum$ymin, labels = gsum$FID)
```

---

vapour_layer_extent  Read layer extent

Description

Extent of all features in entire layer, possibly after execution of sql query and input extent filter.

Usage

```r
vapour_layer_extent(dsource, layer = 0L, sql = "", extent = 0, ...)
```

Arguments

- `dsource`: data source name (path to file, connection string, URL)
- `layer`: integer of layer to work with, defaults to the first (0) or the name of the layer
- `sql`: if not empty this is executed against the data source (layer will be ignored)
- `extent`: optional extent (xmin,xmax,ymin,ymax)
- `...`: unused

Value

vector of numeric values xmin,xmax,ymin,ymax

See Also

vapour_read_extent vapour_layer_info

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
## A MapInfo TAB file with polygons
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
vapour_layer_extent(mvfile)
```
vapour_layer_info

Read GDAL layer info

Description
Read GDAL layer information for a vector data source.

Usage
vapour_layer_info(
  dsource,
  layer = 0L,
  sql = "",
  extent = NA,
  count = TRUE,
  ...
)

Arguments
dsource data source name (path to file, connection string, URL)
layer integer of layer to work with, defaults to the first (0) or the name of the layer
sql if not empty this is executed against the data source (layer will be ignored)
extent apply an arbitrary extent, only when 'sql' used (must be 'ex = c(xmin, xmax, ymin, ymax)' but sp bbox, sf bbox, and raster extent also accepted)
count logical to control if count calculated and returned, TRUE by default (set to FALSE to avoid the extra calculation and missing value is the result)
... unused, reserved for future use

Details
Set extent and/or count to FALSE to avoid calculating them if not needed, it might take some time.
The layer information elements are
dsn the data source name
driver the short name of the driver used
layer the name of the layer queried
layer_names the name/s of all available layers (see vapour_layer_names)
fields a named vector of field types (see vapour_report_fields)
count the number of features in this data source (can be turned off to avoid the extra work count)
extent the extent of all features xmin, xmax, ymin, ymax (can be turned off to avoid the extra work extent)
projection a list of character strings, see next
$projection$ is a list of various formats of the projection metadata. Use $projection$ as most authoritative, but we don’t enter into the discussion or limit what might be done with this (that’s up to you). Currently we see c("Proj4", "MCoordSys", "PrettyWkt", "Wkt", "EPSG", "XML") as names of this $projection$ element.

To get the geometry type/s of a layer see vapour_read_type().

Value
list with a list of character vectors of projection metadata, see details

See Also
vapour_geom_name vapour_layer_names vapour_report_fields vapour_read_fields vapour_driver vapour_read_names

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
## A MapInfo TAB file with polygons
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
info <- vapour_layer_info(mvfile)
names(info$projection)

## info depends on the query/spatial-filter
vapour_layer_info(mvfile, extent = c(412000, 420000, 5352612.8, 5425154.3),
                   sql = "SELECT * FROM list_locality_postcode_meander_valley")$count
```

---

vapour_layer_names  Read GDAL layer names

Description
Obtain the names of available layers from a GDAL vector source.

Usage
vapour_layer_names(dsource, ...)

Arguments
dsource data source name (path to file, connection string, URL)
... arguments ignore for deprecated compatibility (no 'sql' argument any longer)
Details

Some vector sources have multiple layers while many have only one. Shapefiles for example have only one, and the single layer gets the file name with no path and no extension. GDAL provides a quirk for shapefiles in that a directory may act as a data source, and any shapefile in that directory acts like a layer of that data source. This is a little like the one-or-many sleight that exists for raster data sources with subdatasets (there’s no way to virtualize single rasters into a data source with multiple subdatasets, oh except by using VRT....)

See vapour_sds_names for more on the multiple topic.

Value

character vector of layer names

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
vapour_layer_names(mvfile)
```

---

vapour_raster_gcp Raster ground control points

Description

Return any ground control points for a raster data set, if they exist.

Usage

```r
vapour_raster_gcp(x, ...)
```

Arguments

- `x` : data source string (i.e. file name or URL or database connection string)
- `...` : ignored currently

Details

Pixel and Line coordinates do not correspond to cells in the underlying raster grid, they refer to the index space of that array in 0, ncols and 0, nrows. They are usually a subsample of the grid and may not align with the grid spacing itself (though they often do in satellite remote sensing products).

The coordinate system of the GCPs is currently not read.
Value

list with

- Pixel the pixel coordinate
- Line the line coordinate
- X the X coordinate of the GCP
- Y the Y coordinate of the GCP
- Z the Z coordinate of the GCP (usually zero)

Examples

```r
## this file has no ground control points
## they are rare, and tend to be in large files
f <- system.file("extdata", "sst.tif", package = "vapour")
vapour_raster_gcp(f)

## a very made-up example with no real use
f1 <- system.file("extdata/gcps", "volcano_gcp.tif", package = "vapour")
vapour_raster_gcp(f1)
```

Description

Return the basic structural metadata of a raster source understood by GDAL. Subdatasets may be specified by number, starting at 1. See `vapour_sds_names` for more.

Usage

```r
vapour_raster_info(x, ..., sds = NULL, min_max = FALSE)
```

Arguments

- `x` data source string (i.e. file name or URL or database connection string)
- `...` currently unused
- `sds` a subdataset number, if necessary
- `min_max` logical, control computing min and max values in source (‘FALSE’ by default)
Details

The structural metadata are

- **extent** the extent of the data, xmin, xmax, ymin, ymax - these are the lower left and upper right corners of pixels
- **geotransform** the affine transform
- **dimension** dimensions x-y, columns*rows
- **minmax** numeric values of the computed min and max from the first band (optional)
- **block** dimensions x-y of internal tiling scheme
- **projection** text version of map projection parameter string
- **bands** number of bands in the dataset
- **projstring** the proj string version of ’projection’
- **nodata_value** not implemented
- **overviews** the number and size of any available overviews
- **filelist** the list of files involved (may be none, and so will be a single NA character value)
- **datatype** the band type name, in GDAL form ’Byte’, ’Int16’, ’Float32’, etc.
- **subdatasets** any subdataset DSNs is present, otherwise NULL
- **corners** corner coordinates of the data, for non-zero skew geotransforms a 2-column matrix with rows upperLeft, lowerLeft, lowerRight, upperRight, and center

Note that the geotransform is a kind of obscure combination of the extent and dimension, I don’t find it useful and modern GDAL is moving away from needing it so much. Extent is more sensible and used in many places in a straightforward way.

On access vapour functions will report on the existence of subdatasets while defaulting to the first subdataset found.

Value

- list with vectors ’geotransform’, ’dimXY’, ’minmax’, ’tilesXY’, ’projection’, ’bands’, ’proj4’, ’nodata_value’, ’overviews’, ’filelist’ see sections in Details for more on each element

Subdatasets

Some sources provide multiple data sets, where a dataset is described by a 2- (or more) dimensional grid whose structure is described by the metadata described above. Note that subdataset is a different concept to band or dimension. Sources that may have multiple data sets are HDF4/HDF5 and NetCDF, and they are loosely analogous to the concept of layer in GDAL vector data. Variables are usually seen as distinct data but in GDAL and related 2D-interpretations this concept is leveraged as a 3rd dimension (and higher). In a GeoTIFF a third dimension might be implicit across bands, i.e. to express time varying data and so each band is not properly a variable. Similarly in NetCDF, the data may be any dimensional but there’s only an implicit link for other variables that exist in that same dimensional space. When using GDAL you are always traversing this confusing realm.

If subdatasets are present but not specified the first is queried. The choice of subdataset is analogous to the way that the raster package behaves, and uses the argument varname. Variables in NetCDF correspond to subdatasets, but a single data set might have multiple variables in different bands or in dimensions, so this guide does not hold across various systems.
The Geo Transform

From https://gdal.org/user/raster_data_model.html.

The affine transform consists of six coefficients returned by GDALDataset::GetGeoTransform() which map pixel/line coordinates into georeferenced space using the following relationship:

\[
\begin{align*}
X_{\text{geo}} &= GT(0) + X_{\text{pixel}} \times GT(1) + Y_{\text{line}} \times GT(2) \\
Y_{\text{geo}} &= GT(3) + X_{\text{pixel}} \times GT(4) + Y_{\text{line}} \times GT(5)
\end{align*}
\]

They are

- **GT0, xmin** the x position of the lower left corner of the lower left pixel
- **GT1, xres** the scale of the x-axis, the width of the pixel in x-units
- **GT2, yskew** y component of the pixel width
- **GT3, ymax** the y position of the upper left corner of the upper left pixel
- **GT4, xskew** x component of the pixel height
- **GT5, yres** the scale of the y-axis, the height of the pixel in negative y-units

Please note that these coefficients are equivalent to the contents of a world file but that the order is not the same and the world file uses cell centre convention rather than edge. https://en.wikipedia.org/wiki/World_file

Usually the skew components are zero, and so only four coefficients are relevant and correspond to the offset and scale used to position the raster - in combination with the number of rows and columns of data they provide the spatial extent and the pixel size in each direction. Very rarely a an actual affine raster will be use with this rotation specified within the transform coefficients.

Calculation of 'minmax' can take a significant amount of time, so it’s not done by default. Use 'minmax = TRUE' to do it. (It does perform well, but may be prohibitive for very large or remote sources.)

Overviews

If there are no overviews this element will simply be a single-element vector of value 0. If there are overviews, the first value will give the number of overviews and their dimensions will be listed as pairs of x,y values.

See Also

vapour_sds_info

Examples

```r
f <- system.file("extdata", "sst.tif", package = "vapour")
vapour_raster_info(f)
```
vapour_read_fids

Read feature names

Description

Obtains the internal ‘Feature ID (FID)’ for a data source.

Usage

vapour_read_fids(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)

vapour_read_names(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)

Arguments

dsource          data source name (path to file, connection string, URL)
layer            integer of layer to work with, defaults to the first (0) or the name of the layer
sql              if not empty this is executed against the data source (layer will be ignored)
limit_n          an arbitrary limit to the number of features scanned
skip_n           an arbitrary number of features to skip
extent           apply an arbitrary extent, only when ‘sql’ used (must be ’ex = c(xmin, xmax, ymin, ymax)’ but sp bbox, sf bbox, and raster extent also accepted)

Details

This may be virtual (created by GDAL for the SQL interface) and may be 0- or 1-based. Some drivers have actual names, and they are persistent and arbitrary. Please use with caution, this function can return the current FIDs, but there’s no guarantee of what it represents for subsequent access.

An earlier version use ‘OGRSQL’ to obtain these names, which was slow for some drivers and also clashed with independent use of the sql argument. vapour_read_names() is an older name, aliased to vapour_read_fids().
vapour_read_fields

Value
character vector of geometry id 'names'

Examples
file <- "list_locality_postcode_meander_valley.tab"
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
range(fids <- vapour_read_names(mvfile))
length(fids)

vapour_read_fields Read feature field data

Description
Read features fields (attributes), optionally after SQL execution.

Usage
vapour_read_fields(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)

vapour_read_attributes(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)

Arguments
dsource data source name (path to file, connection string, URL)
layer integer of layer to work with, defaults to the first (0) or the name of the layer
sql if not empty this is executed against the data source (layer will be ignored)
limit_n an arbitrary limit to the number of features scanned
skip_n an arbitrary number of features to skip
extent apply an arbitrary extent, only when 'sql' used (must be 'ex = c(xmin, xmax, ymin, ymax)' but sp bbox, sf bbox, and raster extent also accepted)
vapour_read_geometry

Details

Internal types are not fully supported, there are straightforward conversions for numeric, integer (32-bit) and string types. Date, Time, DateTime are returned as character, and Integer64 is returned as numeric.

Value

list of vectors one for each field in the source, each will be the same length which will depend on the values of 'skip_n', 'limit_n', 'sql', and the available records in the source. The types will be raw, numeric, integer, character, logical depending on the available mapping to the types in the source for the data there to R's native vectors.

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
att <- vapour_read_fields(mvfile)
str(att)

deep <- "SELECT * FROM list_locality_postcode_meander_valley WHERE FID < 5"
(att <- vapour_read_fields(mvfile, sql = sq))
pfile <- "list_locality_postcode_meander_valley.tab"
dsource <- system.file(file.path("extdata/tab", pfile), package="vapour")
SQL <- "SELECT NAME FROM list_locality_postcode_meander_valley WHERE POSTCODE < 7300"
vapour_read_fields(dsource, sql = SQL)
```

Description

Read GDAL geometry as binary blob, text, or numeric extent.

Usage

```r
vapour_read_geometry_ia(dsource, layer = 0L, sql = "", extent = NA, ia = NULL)

vapour_read_geometry_ij(dsource, layer = 0L, sql = "", extent = NA, ij = NULL)

vapour_read_geometry(
  dsource,
  layer = 0L,
  sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)

vapour_read_geometry_text(
```
vapour_read_geometry

```r
dsource,
layer = 0L,
sql = "",
textformat = "json",
limit_n = NULL,
skip_n = 0,
extent = NA
)
vapour_read_extent(
  dsource,
  layer = 0L,
sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)
vapour_read_type(
  dsource,
  layer = 0L,
sql = "",
  limit_n = NULL,
  skip_n = 0,
  extent = NA
)
```

**Arguments**

- `dsource`: data source name (path to file, connection string, URL)
- `layer`: integer of layer to work with, defaults to the first (0) or the name of the layer
- `sql`: if not empty this is executed against the data source (layer will be ignored)
- `extent`: apply an arbitrary extent, only when `sql` used (must be `ex = c(xmin, xmax, ymin, ymax)` but sp bbox, sf bbox, and raster extent also accepted)
- `ia`: an arbitrary index, integer vector with values between 0 and one less the number of features, duplicates allowed and arbitrary order is ok
- `ij`: an range index, integer vector of length two with values between 0 and one less the number of features, this range of geometries is returned
- `limit_n`: an arbitrary limit to the number of features scanned
- `skip_n`: an arbitrary number of features to skip
- `textformat`: indicate text output format, available are "json" (default), "gml", "kml", "wkt"

**Details**

`vapour_read_geometry` will read features as binary WKB, `vapour_read_geometry_text` as various text formats (geo-json, wkt, kml, gml),
vapour_read_geometry

vapour_read_extent a numeric extent which is the native bounding box, the four numbers (in this order) xmin, xmax, ymin, ymax. For each function an optional SQL string will be evaluated against the data source before reading.

vapour_read_geometry_ia will read features by arbitrary index, so any integer between 0 and one less than the number of features. These may be duplicated. If 'ia' is greater than the highest index NULL is returned, but if less than 0 the function will error.

vapour_read_geometry_ij will read features by index range, so two numbers to read every feature between those limits inclusively. 'i' and 'j' must be increasing.

vapour_read_type will read the (wkb) type of the geometry as an integer. These are 0 unknown, 1 Point, 2 LineString, 3 Polygon, 4 MultiPoint, 5 MultiLineString, 6 MultiPolygon, 7 GeometryCollection, and the other more exotic types listed in "api/vector_c_api.html" from the GDAL home page (as at October 2020). A missing value 'NA' indicates an empty geometry.

Note that limit_n and skip_n interact with the affect of sql. first the query is executed on the data source, then while looping through available features skip_n features are ignored, and then a feature-count begins and the loop is stopped if limit_n is reached.

Note that extent applies to the 'SpatialFilter' of 'ExecuteSQL': https://gdal.org/user/ogr_sql_dialect.html#executesql.

Value

for vapour_read_geometry(), vapour_read_geometry_ia() and vapour_read_geometry_ij() a raw vector of geometry, for vapour_read_extent() a list of numeric vectors each with 'xmin,xmax,ymin,ymax' respectively for each geometry, for vapour_read_type() a character vector. See Details for more information.

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
## A MapInfo TAB file with polygons
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
## A shapefile with points
pfile <- system.file("extdata/point.shp", package = "vapour")

## raw binary WKB points in a list
ptgeom <- vapour_read_geometry(pfile)
## create a filter query to ensure data read is small
SQL <- "SELECT FID FROM list_locality_postcode_meander_valley WHERE FID < 3"
## polygons in raw binary (WKB)
plgeom <- vapour_read Geometry_text(mvfile, sql = SQL)
## polygons in raw text (GeoJSON)
txtpointjson <- vapour_read Geometry_text(pfile, textformat = "json")

txtpointwkt <- vapour_read Geometry_text(pfile, textformat = "wkt")
```
vapour_read_raster  Raster IO (read)

Description

Read a window of data from a GDAL raster source. The first argument is the source name and the second is a 6-element window of offset, source dimension, and output dimension.

Usage

vapour_read_raster(
  x, 
  band = 1, 
  window, 
  resample = "nearestneighbour", 
  ..., 
  sds = NULL, 
  native = FALSE, 
  set_na = TRUE, 
  band_output_type = "", 
  unscale = TRUE 
)

Arguments

x  data source
band  index of which band to read (1-based)
window  src_offset, src_dim, out_dim
resample  resampling method used (see details)
...  reserved
sds  index of subdataset to read (usually 1)
native  apply the full native window for read, FALSE by default
set_na  specify whether NA values should be set for the NODATA
band_output_type  numeric type of band to apply (else the native type if ",", is mapped to one of 'Byte', 'Int32', or 'Float64'
unscale  default is TRUE so native values will be converted by offset and scale to floating point

Details

The value of window may be input as only 4 elements, in which case the source dimension Will be used as the output dimension.
This is analogous to the rgdal function readGDAL with its arguments offset, region, dim and output, dim. There’s no semantic wrapper for this in vapour, but see https://github.com/hypertidy/lazyraster for one approach.

Resampling options will depend on GDAL version, but currently ‘NearestNeighbour’ (default), ‘Average’, ‘Bilinear’, ‘Cubic’, ‘CubicSpline’, ‘Gauss’, ‘Lanczos’, ‘Mode’ are potentially available. These are compared internally by converting to lower-case. Detailed use of this is barely tried or tested with vapour, but is a standard facility used in GDAL. Easiest way to compare results is with gdal_translate.

There is no write support in vapour.

Currently the window argument is required. If this argument unspecified and native = TRUE then the default window specification will be used, the entire extent at native resolution. If ‘window’ is specified and native = TRUE then the window is used as-is, with a warning (native is ignored).

‘band_output_type’ can be ‘raw’, ‘integer’, ‘double’, or case-insensitive versions of the GDAL types ‘Byte’, ‘UInt16’, ‘Int16’, ‘UInt32’, ‘Int32’, ‘Float32’, or ‘Float64’. These are mapped to one of the supported types ‘Byte’ (‘== raw’), ‘Int32’ (‘== integer’), or ‘Float64’ (‘== double’).

Value

list of numeric vectors (only one for ‘band’)

Examples

f <- system.file("extdata", "sst.tif", package = "vapour")
## a 5*5 window from a 10*10 region
vapour_read_raster(f, window = c(0, 0, 10, 10, 5, 5))
vapour_read_raster(f, window = c(0, 0, 10, 10, 5, 5), resample = "Lanczos")
## find the information first
ri <- vapour_raster_info(f)
str(matrix(vapour_read_raster(f, window = c(0, 0, ri$dimXY, ri$dimXY)), ri$dimXY[1]))
## the method can be used to up-sample as well
str(matrix(vapour_read_raster(f, window = c(0, 0, 10, 10, 15, 25)), 15))
Arguments

dsource file name to read from, or write to
offset position x,y to start writing (0-based, y-top)
dimension window size to read from, or write to
band which band to read (1-based)
band_output_type numeric type of band to apply (else the native type if ") can be one of "Byte",
'Int32', or 'Float64'
unscale default is TRUE so native values will be converted by offset and scale to floating
point

Value

a list with a vector of data from the band read

Examples

f <- system.file("extdata", "sst.tif", package = "vapour")
v <- vapour_read_raster_block(f, c(0L, 0L), dimension = c(2L, 3L), band = 1L)

Description

These wrappers around vapour_read_raster() guarantee single vector output of the nominated
type.

Usage

vapour_read_raster_raw(
x,
band = 1,
window,
resample = "nearestneighbour",
..., 
sds = NULL,
native = FALSE,
set_na = TRUE
vapour_read_raster_raw

)

vapour_read_raster_int(
  x,
  band = 1,
  window,
  resample = "nearestneighbour",
  ..., 
  sds = NULL,
  native = FALSE,
  set_na = TRUE 
)

vapour_read_raster_dbl(
  x,
  band = 1,
  window,
  resample = "nearestneighbour",
  ..., 
  sds = NULL,
  native = FALSE,
  set_na = TRUE 
)

vapour_read_raster_chr(
  x,
  band = 1,
  window,
  resample = "nearestneighbour",
  ..., 
  sds = NULL,
  native = FALSE,
  set_na = TRUE 
)

vapour_read_raster_hex(
  x,
  band = 1,
  window,
  resample = "nearestneighbour",
  ..., 
  sds = NULL,
  native = FALSE,
  set_na = TRUE 
)

Arguments

  x data source
band      index of which band to read (1-based)
window    src_offset, src_dim, out_dim
resample  resampling method used (see details)
...       reserved
sds       index of subdataset to read (usually 1)
native    apply the full native window for read, FALSE by default
set_na    specify whether NA values should be set for the NODATA

Details
* _hex and * _chr are aliases of each other.

Value
atomic vector of the nominated type raw, int, dbl, or character (hex)

Examples
f <- system.file("extdata", "sst.tif", package = "vapour")
vapour_read_raster_int(f, window = c(0, 0, 5, 4))
vapour_read_raster_raw(f, window = c(0, 0, 5, 4))
vapour_read_raster_chr(f, window = c(0, 0, 5, 4))
plot(vapour_read_raster_dbl(f, native = TRUE), pch = ".", ylim = c(273, 300))
vapour_sds_names

Details
Use this to compare the interpreted versions converted into R types by vapour_read_fields.
This and vapour_read_fields() are aliased to older versions named 'vapour_report_attributes()' and 'vapour_read_attributes()', but "field" is a clearer and more sensible name (in our opinion).
These are defined for the enum OGRFieldType in GDAL itself. https://gdal.org/doxygen/ogr__core_8h.html#a787194bea637faf12d61643124a7c9fc

Value
named character vector of the GDAL types for each field

Examples

```r
file <- "list_locality_postcode_meander_valley.tab"
mvfile <- system.file(file.path("extdata/tab", file), package="vapour")
vapour_report_fields(mvfile)
## modified by sql argument
vapour_report_fields(mvfile,
  sql = "SELECT POSTCODE, NAME FROM list_locality_postcode_meander_valley")
```

---

vapour_sds_names

GDAL raster subdatasets (variables)

Description
A subdataset is a collection abstraction for a number of variables within a single GDAL source. If there's only one variable the datasource and the variable have the same data source string. If there is more than one the subdatasets have the form DRIVER:"datasourcename":varname. Each subdataset name can stand in place of a data source name that has only one variable, so we always treat a source as a subdataset, even if there’s only one.

Usage
vapour_sds_names(x)

Arguments
x a data source string, filename, database connection string, or other URL

Details
Returns a character vector of `subdatasets`. In the case of a normal data source, with no subdatasets the value is simply the datasource'.

If the raw SDS names contain spaces these are replaced by ‘%20’ escape strings. A specific example is "WCS:https://elevation.nationalmap.gov:443" with request "aregis/services/3DEPElevation/ImageServer/WCSServer?version=2.0.1&coverage=DEP3Elevation_Hillshade Gray". This function will return ".DEP3Elevation_Hillshade%20Gray". See wiki post for more details.
vapour_set_config

Value

class character vector of subdataset names, or just the source itself if no SDS are present

Examples

```r
f <- system.file("extdata/gdal", "sds.nc", package = "vapour")
## protect from error with netcdf problems
result <- try(vapour_sds_names(f), silent = TRUE)
if (!inherits(result, "try-error")) {
  print(result)
}
vapour_sds_names(system.file("extdata", "sst.tif", package = "vapour"))
```

vapour_set_config \hspace{1cm} Set and query GDAL configuration options

Description

These functions can get and set configuration options for GDAL, for fine control over specific GDAL behaviours.

Usage

```r
vapour_set_config(option, value)
vapour_get_config(option)
```

Arguments

```r
option \hspace{1cm} GDAL config name (see Details), character string
value \hspace{1cm} value for config option, character string
```

Details

Configuration options may also be set as environment variables.

See GDAL config options for details on available options.

Value

class character string for vapour_get_config, integer 1 for successful vapour_set_config()
Examples

```r
## Not run:
(orig <- vapour_get_config("GDAL_CACHEMAX"))
vapour_set_config("GDAL_CACHEMAX", "64")
vapour_get_config("GDAL_CACHEMAX")
vapour_set_config("GDAL_CACHEMAX", orig)

## End(Not run)
```

vapour_srs_wkt

### PROJ4 string to WKT

#### Description
Convert a projstring to Well Known Text.

#### Usage

```r
vapour_srs_wkt(crs)
```

#### Arguments

- `crs` projection string, see Details.

#### Details

The function is vectorized because why not, but probably only ever will be used on single element vectors of character strings.

Note that no sanitizing is done on inputs, we literally just `OGRSpatialReference.SetFromUserInput(crs)` and give the output as WKT. If it's an error in GDAL it's an error in R.

Common inputs are WKT variants, 'AUTH:CODE's e.g. 'EPSG:3031', the 'OGC:CRS84' for long,lat WGS84, 'ESRI:code' and other authority variants, and datum names such as 'WGS84','NAD27' recognized by PROJ itself.

See help for 'SetFromUserInput' in 'OGRSpatialReference', and 'proj_create_crs_to_crs'.

```r
c.proj_create_crs_to_crs
c.proj_create
SetFromUserInput
```

#### Value

WKT2 projection string

#### Examples

```r
vapour_srs_wkt("+proj=laea +datum=WGS84")
```
Description

Simple VRT creation of a GDAL virtual raster. The data source string is **augmented** by input of other optional arguments. That means it **overrides** their values provided by the source data, or stands in place of this information if it is missing.

Usage

```r
vapour_vrt(
  x,
  extent = NULL,
  projection = NULL,
  sds = 1L,
  bands = NULL,
  geolocation = NULL,
  ...,  
  relative_to_vrt = FALSE,
  nomd = FALSE,
  overview = -1L
)
```

Arguments

- `x` - data source name, filepath, url, database connection string, or VRT text
- `extent` - (optional) numeric extent, xmin,xmax,ymin,ymax
- `projection` - (optional) character string, projection string ("auth:code", proj4, or WKT, or anything understood by PROJ, see Details)
- `sds` - which subdataset to select from a source with more than one
- `bands` - (optional) which band/s to include from the source
- `geolocation` - vector of 2 dsn to longitude, latitude geolocation array sources
- `...` - ignored
- `relative_to_vrt` - default FALSE, if TRUE input strings that identify as files on the system are left as-is (by default they are made absolute at the R level)
- `nomd` - if TRUE the Metadata tag is removed from the resulting VRT (it can be quite substantial)
- `overview` - pick an integer overview from the source (0L is highest resolution, default -1L does nothing)
Details

Create a GDAL data source string (to be used like a filename) with various helpers. VRT stands for 'ViRTual’. A VRT string then acts as a representative of a data source for further use (to read or warp it).

An input string will be converted to a single subdataset, use 'sds’ argument to select.

If 'extent’, 'projection’ is provided this is applied to override the source’s extent and/or projection. (These might be invalid, or missing, so we facilitate correcting this).

If 'bands’ is provided this is used to select a set of bands (numbered from 1), which might be repeated, or in any order and contain repetitions.

vapour_vrt() is vectorized, it will return multiple VRT strings for multiple inputs in a "length > 1" character vector. These are all independent, this is different to the function vapour_warp_raster() where multiple inputs are merged (possibly by sequential overlapping).

Value

VRT character string (for use by GDAL-capable tools, i.e. reading raster)

Rationale

For a raster, the basic essentials we can specify or modify for a source are

1. the source, 2) the extent, 3) the projection 4) what subdataset (these are variables from NetCDF and the like that contain multiple datasets) and 5) which band/s to provided. For extent and projection we are simply providing or correcting complete information about how to interpret the georeferencing, with subdatasets and bands this is more like a query of which ones we want. If we only wanted band 5, then the output data would have one band only (and we we read it we need band = 1).

We don’t provide ability override the dimension, but that is possible as well. More features may come with a 'VRTBuilder’ interface.

Projections

Common inputs for projection are WKT variants, "AUTH:CODE”s e.g. "EPSG:3031", the "OGC:CRS84” for long.lat WGS84, "ESRI:code” and other authority variants, and datum names such as 'WGS84’,'NAD27’ recognized by PROJ itself.

See the following links to GDAL and PROJ documentation:

PROJ documentation: c.proj_create_crs_to_crs
PROJ documentation: c.proj_create
GDAL documentation: SetFromUserInput

Examples

tif <- system.file("extdata", "sst.tif", package = "vapour")
vapour_vrt(tif)

vapour_vrt(tif, bands = c(1, 1))
vapour_vsi_list  Read GDAL virtual source contents

Description

Obtain the names of available items in a virtual file source.

Usage

vapour_vsi_list(dsource, ...)

Arguments

dsource data source name (path to file, connection string, URL) with virtual prefix, see Details

... ignored

Details

The dsource must begin with a valid form of the special vsiPREFIX, for details see GDAL Virtual File Systems.

Note that the listing is not recursive, and so cannot be used for automation. One would use this function interactively to determine a useable /vsiPREFIX/dsource data source string.

Value

character vector listing of items

Examples

pointzipfile <- system.file("extdata/vsi/point_shp.zip", package = "vapour")
vapour_vsi_list(sprintf("/vsizip/%s", pointzipfile))

# Not run:
# example from https://github.com/hypertidy/vapour/issues/55
#file <- "http://radmap_v3_2015_filtered_dose/radmap_v3_2015_filtered_dose.ers.zip"
#url <- "http://dapds00.nci.org.au/thredds/fileServer/rr2/national_geophysical_compilations"
#u <- sprintf("/vsizip/vsicurl/%s", file.path(url, file))
#vapour_vsi_list(u)
#1 "radmap_v3_2015_filtered_dose" "radmap_v3_2015_filtered_dose.ers"
#3 "radmap_v3_2015_filtered_dose.isi" "radmap_v3_2015_filtered_dose.txt"
#gdalinfo /vsitar/home/ubuntu/LT05_L1GS_027026_20060116_20160911_01_T2.tar.gz
#vapour_vsi_list("/vsitar/home/ubuntu/LT05_L1GS_027026_20060116_20160911_01_T2.tar.gz")
#1 "LT05_L1TP_027026_20061218_20160911_01_T1_ANG.txt"
#1 "LT05_L1TP_027026_20061218_20160911_01_T1_B1.TIF"
#1 "LT05_L1TP_027026_20061218_20160911_01_T1_B2.TIF"
#1 "LT05_L1TP_027026_20061218_20160911_01_T1_B3.TIF"
#...
vapour_warp_raster  

Raster warper (reprojection)

## Description

Read a window of data from a GDAL raster source through a warp specification. The warp specification is provided by 'extent', 'dimension', and 'projection' properties of the transformed output.

## Usage

```r
vapour_warp_raster(
  x,
  bands = NULL,
  extent = NULL,
  dimension = NULL,
  projection = "",
  set_na = TRUE,
  source_projection = NULL,
  source_extent = 0,
  resample = "near",
  silent = TRUE,
  ...
)
```

## Arguments

- **x**: vector of data source names (file name or URL or database connection string)
- **bands**: index of band/s to read (1-based), may be new order or replicated, or NULL (all bands used, the default)
- **extent**: extent of the target warped raster 'c(xmin, xmax, ymin, ymax)'
- **dimension**: dimensions in pixels of the warped raster (x, y)
- **projection**: projection of warped raster (in Well-Known-Text, or any projection string accepted by GDAL)
- **set_na**: NOT IMPLEMENTED logical, should 'NODATA' values be set to NA
source_projection
optional, override or augment the projection of the source (in Well-Known-Text, or any projection string accepted by GDAL)

source_extent
extent of the source raster, used to override/augment incorrect source metadata

resample
resampling method used (see details in vapour_read_raster)

silent
TRUE by default, set to FALSE to report messages

band_output_type
numeric type of band to apply (else the native type if '') can be one of 'Byte', 'Int32', or 'Float64' but see details in vapour_read_raster()

warp_options
character vector of options, as in gdalwarp -wo - see Details

transformation_options
character vector of options, as in gdalwarp -to see Details

open_options
character vector of options, as in gdalwarp -oo - see Details

options
character vectors of options as per the gdalwarp command line

nomd
if TRUE the Metadata tag is removed from the resulting VRT (it can be quite substantial)

overview
pick an integer overview from the source (0L is highest resolution, default -1L does nothing)

Details

Any bands may be read, including repeats.

This function is not memory safe, the source is left on disk but the output raster is all computed in memory so please be careful with very large values for 'dimension'. 1000 * 1000 * 8 for 1000 columns, 1000 rows and floating point double type will be 8Mb.

There’s control over the output type, and is auto-detected from the source (raw/Byte, integer/Int32, numeric/Float64) or can be set with 'band_output_type'.

'projection' refers to any projection string for a CRS understood by GDAL. This includes the full Well-Known-Text specification of a coordinate reference system, PROJ strings, "AUTH:CODE" types, and others. See vapour_srs_wkt() for conversion from PROJ.4 string to WKT, and vapour_raster_info() and vapour_layer_info() for various formats available from a data source. Any string accepted by GDAL may be used for 'projection' or 'source_projection', including EPSG strings, PROJ4 strings, and file names. Note that this argument was named 'wkt' up until version 0.8.0.

'extent' is the four-figure xmin,xmax,ymin,ymax outer corners of corner pixels

'dimension' is the pixel dimensions of the output, x (ncol) then y (nrow).

Options for missing data are not yet handled, just returned as-is. Note that there may be regions of "zero data" in a warped output, separate from propagated missing "NODATA" values in the source.

Argument 'source_projection' may be used to assign the projection of the source, 'source_extent' to assign the extent of the source. Sometimes both are required. Note, this is now better done by creating 'VRT', see vapour_vrt() for assigning the source projection, extent, and some other options.
If multiple sources are specified via `x` and either `source_projection` or `source_extent` are provided, these are applied to every source even if they have valid values already. If this is not sensible please use VRT to wrap the multiple sources first.

Wild combinations of `source_extent` and/or `extent` may be used for arbitrary flip orientations, scale and offset. For expert usage only. Old versions allowed transform input for target and source but this is now disabled (maybe we’ll write a new wrapper for that).

**Value**

list of vectors (only 1 for `band`) of numeric values, in raster order

**Options**

The various options are convenience arguments for 'warp options -wo', transformation options -to', 'open options -oo', and 'options' for any other arguments in gdalwarp. There are no 'creation options -co' or 'dataset output options -doo', because these are not supported by the MEM driver.

All 'warp_options' are paired with a '-wo' declaration and similarly for '-to', and '-oo', this is purely a convenience, since 'options' itself can be used for these as well but we recommend using the individual arguments. An example for warp options is `warp_options = c("SAMPLE_GRID=YES", "SAMPLE_STEPS=30")` and one for general arguments might be 'options = c("-ovr", "AUTO", "-nomd", "-cutline", "/path/to/cut.gpkg", "-crop_to_cutline")'. If they would be separated by spaces on the command line then include as separate elements in the options character vector.

See GDALWarpOptions for '-wo'.

See GDAL transformation options for '-to'.

See GDALWARP command line app for further details.

Note we already apply the following gdalwarp arguments based on input R arguments to this function.

- **-of** MEM is hardcoded, but may be extended in future
- **-t_srs** set via 'projection'
- **-s_srs** set via 'source_projection'
- **-te** set via 'extent'
- **-ts** set via 'dimension'
- **-r** set via 'resample'
- **-ot** set via 'band_output_type'
- **-te_srs** not supported
- **-a_ullr** (not a gdalwarp argument, but we do analog) set via 'source_extent' use `vapour_vrt()` instead

In future all 'source_*' arguments may be deprecated in favour of augmentation by 'vapour_vrt()'.

Common inputs for projection are WKT variants, 'AUTH:CODE's e.g. 'EPSG:3031', the 'OGC:CRS84' for lon,lat WGS84, 'ESRI:code' and other authority variants, and datum names such as 'WGS84','NAD27' recognized by PROJ itself.

See help for 'SetFromUserInput' in 'OGRSpatialReference', and 'proj_create_crs_to_crs'.
vapour_warp_raster_raw

c.proj_create_crs_to_crs
c.proj_create
SetFromUserInput

See Also
vapour_read_raster vapour_read_raster_raw vapour_read_raster_int vapour_read_raster_dbl vapour_read_raster_chr
vapour_read_raster_hex

Examples
b <- 4e5
f <- system.file("extdata", "sst.tif", package = "vapour")
prj <- "+proj=aeqd +lon_0=147 +lat_0=-42"
vals <- vapour_warp_raster(f, extent = c(-b, b, -b, b),
  dimension = c(186, 298),
  bands = 1,
  projection = vapour_srs_wkt(prj),
  warp_options = c("SAMPLE_GRID=YES"))

image(list(x = seq(-b, b, length.out = 187),
  y = seq(-b, b, length.out = 298),
  z = matrix(unlist(vals, use.names = FALSE), 186[,298:1]),
  asp = 1)

vapour_warp_raster_raw

type safe(r) raster warp

Description
These wrappers around vapour_warp_raster() guarantee single vector output of the nominated type.

Usage
vapour_warp_raster_raw(
  x,
  bands = NULL,
  extent = NULL,
  dimension = NULL,
  projection = "",
  set_na = TRUE,
  source_projection = NULL,
  source_extent = 0,
  resample = "near",
  silent = TRUE,
  ...,
  warp_options = "",
)
vapour_warp_raster_raw

transformation_options = "", 
open_options = "", 
options = ""
)

vapour_warp_raster_int(

x,
bands = NULL,
extent = NULL,
dimension = NULL,
projection = "", 
set_na = TRUE,
source_projection = NULL,
source_extent = 0,
resample = "near",
silent = TRUE,
...

warp_options = "", 
transformation_options = "", 
open_options = "", 
options = ""
)

vapour_warp_raster_dbl(

x,
bands = NULL,
extent = NULL,
dimension = NULL,
projection = "", 
set_na = TRUE,
source_projection = NULL,
source_extent = 0,
resample = "near",
silent = TRUE,
...

warp_options = "", 
transformation_options = "", 
open_options = "", 
options = ""
)

vapour_warp_raster_chr(

x,
bands = NULL,
extent = NULL,
dimension = NULL,
projection = "", 
set_na = TRUE,
source_projection = NULL,
source_extent = 0,
resample = "near",
silent = TRUE,
...
,...
, warp_options = "",
transformation_options = "",
open_options = "",
options = ""
)

vapour_warp_raster_hex(
  x,
bands = NULL,
extent = NULL,
dimension = NULL,
projection = "",
set_na = TRUE,
source_projection = NULL,
source_extent = 0,
resample = "near",
silent = TRUE,
...
,...
, warp_options = "",
transformation_options = "",
open_options = "",
options = ""
)

Arguments

x vector of data source names (file name or URL or database connection string)
bands index of band/s to read (1-based), may be new order or replicated, or NULL (all
bands used, the default)
extent extent of the target warped raster 'c(xmin, xmax, ymin, ymax)'
dimension dimensions in pixels of the warped raster (x, y)
projection projection of warped raster (in Well-Known-Text, or any projection string ac-
cepted by GDAL)
set_na NOT IMPLEMENTED logical, should 'NODATA' values be set to NA
source_projection optional, override or augment the projection of the source (in Well-Known-Text,
or any projection string accepted by GDAL)
source_extent extent of the source raster, used to override/augment incorrect source metadata
resample resampling method used (see details in vapour_read_raster)
silent TRUE by default, set to FALSE to report messages
...
unused
warp_options character vector of options, as in gdalwarp -wo - see Details
transformation_options character vector of options, as in gdalwarp -to see Details
open_options character vector of options, as in gdalwarp -oo - see Details
options character vectors of options as per the gdalwarp command line

Details
_hex and _chr are aliases of each other.

Value
atomic vector of the nominated type raw, int, dbl, or character (hex)

Examples
b <- 4e5
f <- system.file("extdata", "sst.tif", package = "vapour")
prj <- "+proj=aeqd +lon_0=147 +lat_0=-42"
bytes <- vapour_warp_raster_raw(f, extent = c(-b, b, -b, b),
dimension = c(18, 2),
bands = 1,
projection = prj)
  # not useful given source type floating point, but works
str(bytes)

vapour_write_raster_block
Write data to a block in an existing file.

Description
Be careful! The write function doesn’t create a file, you have to use an existing one. Don’t write to a file you don’t want to update by mistake.

Usage
vapour_write_raster_block(
  dsource,  
data,  
offset,  
dimension,  
band = 1L,  
overwrite = FALSE  )
Arguments

dsource    data source name
data       data vector, length should match prod(dimension) or length 1 allowed
offset     offset to start
dimension  dimension to write
band       which band to write to (1-based)
overwrite  set to FALSE as a safety valve to not overwrite an existing file

Value

a logical value indicating success (or failure) of the write

Examples

f <- system.file("extdata", "sst.tif", package = "vapour")
v <- vapour_read_raster_block(f, c(0L, 0L), dimension = c(2L, 3L), band = 1L)
file.copy(f, tf <- tempfile(fileext = ".tif"))
try(vapour_write_raster_block(tf, data = v[[1]], offset = c(0L, 0L),
                              dimension = c(2L, 3L), band = 1L))
if (file.exists(tf)) file.remove(tf)
Index

gdal_raster_data, 4
gdal_raster_dsn, 5
gdal_raster_dsn (gdal_raster_data), 4
gdal_raster_image (gdal_raster_data), 4
sst_c, 6
tas_wkt, 7
vapour (vapour-package), 3
vapour-package, 3
vapour_all_drivers, 3
vapour_all_drivers
   (vapour_gdal_version), 9
vapour_create, 7
vapour_crs_is_lonlat, 8
vapour_driver, 3
vapour_driver (vapour_gdal_version), 9
vapour_gdal_version, 3, 9
vapour_geom_name, 3, 10
vapour_geom_summary, 3, 11
vapour_get_config (vapour_set_config), 30
vapour_layer_extent, 12
vapour_layer_info, 3, 13
vapour_layer_info(), 36
vapour_layer_names, 3, 13, 14
vapour_raster_gcp, 3, 15
vapour_raster_info, 3, 16
vapour_raster_info(), 36
vapour_read_attributes
   (vapour_read_fields), 20
vapour_read_extent, 3
vapour_read_extent
   (vapour_read_geometry), 21
vapour_read_extent(), 23
vapour_read_fids, 19
vapour_read_fids(), 19
vapour_read_fields, 3, 20
vapour_read_fields(), 29
vapour_read_raster(), 26
vapour_read_raster_blk
   (vapour_read_raster_raw), 26
vapour_read_raster_db
   (vapour_read_raster_raw), 26
vapour_read_raster_hex
   (vapour_read_raster_raw), 26
vapour_read_raster_int
   (vapour_read_raster_raw), 26
vapour_read_raster_raw, 26
vapour_read_type, 4
vapour_read_type
   (vapour_read_geometry), 21
vapour_read_type(), 14, 23
vapour_report_attributes
   (vapour_report_fields), 28
vapour_report_fields, 4, 13, 28
vapour_sds_names, 3, 15, 16, 29
vapour_set_config, 30
vapour_srs_wkt, 3, 31
vapour_srs_wkt(), 36
vapour_vrt, 32
vapour_vrt(), 36, 37
vapour_vsi_list, 3, 34
vapour_warp_raster, 3, 35
vapour_warp_raster(), 38
vapour_warp_raster_chr
    (vapour_warp_raster_raw), 38
vapour_warp_raster dbl
    (vapour_warp_raster_raw), 38
vapour_warp_raster_hex
    (vapour_warp_raster_raw), 38
vapour_warp_raster_int
    (vapour_warp_raster_raw), 38
vapour_warp_raster_raw, 38
vapour_write_raster_block, 41