Package: rpisco (via r-universe)

November 29, 2026

Title Access and Process PISCO High-Resolution Climate Grids for Peru

Version 0.1.0

Description Provides programmatic access, local caching, spatial subsetting, temporal aggregation, anomaly computation, and validation metrics for the Peruvian Interpolated data of SENAMHI's Climatological and hydrological Observations (PISCO) developed by SENAMHI DHI-SEH <https://sites.google.com/view/dhi-seh/pisco>. Supports the complete PISCO products included in its catalog: PISCOp v3.0 precipitation <https://figshare.com/articles/dataset/High-resolution_grids_of_rainfall_for_Peru_-_PISCOp_v3_0_dataset/32411886>, PISCOt v1.2 daily temperature and climatologies, PISCOeo_pm reference evapotranspiration climatology, PISCO_reed v1.0 rainfall erosivity, and PISCO_HyM GR2M and ARNOVIC streamflow with basin and river networks, hosted on Figshare <https://figshare.com/articles/dataset/PISCO_HyM_GR2M_v1_1/14382758> and HydroShare. Includes optimized workflows for basin-scale extraction, seasonal aggregations, and spatial raster and vector processing based on 'terra' and 'sf'.

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URL https://github.com/PaulESantos/rpisco

BugReports https://github.com/PaulESantos/rpisco/issues

Depends R (>= 4.1.0)

Imports cli, ggplot2, grDevices, httr2, sf, stats, terra, tibble, tools

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

LazyData true

VignetteBuilder knitr

Config/testthat/edition 3

Encoding UTF-8

Config/roxygen2/version 8.1.1

NeedsCompilation no

Author Paul Efren Santos Andrade [aut, cre, cph] (ORCID: <https://orcid.org/0000-0002-6635-0375>), Leonardo Gutierrez [dtc] (ORCID: <https://orcid.org/0000-0002-8658-139X>), Waldo Sven Lavado-Casimiro [dtc]

Maintainer Paul Efren Santos Andrade <paulefrens@gmail.com>

Repository https://cran.r-universe.dev

Date/Publication 2026-11-29 19:27:17 UTC

RemoteUrl https://github.com/cran/rpisco

RemoteRef HEAD

RemoteSha 0b3415d8fb551d7bf90d153d5c8f104346646952

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`clima_ejemplo` *Datos climatológicos de prueba para climatodiagramas*

Description

Conjunto de datos de prueba con 12 observaciones mensuales representativas de una estación andina (julio a junio), conteniendo temperatura media mensual y precipitación total mensual para la construcción de climatodiagramas de Walter-Lieth.

Usage

```
clima_ejemplo
```

Format

Un data frame con 12 filas y 3 columnas:

MES Abreviatura del mes de registro (`"Jul"` a `"Jun"`).

TMED Temperatura media mensual en grados Celsius (°C).

PTOT Precipitación total mensual en milímetros (mm).

Source

Elaboración propia con datos climatológicos típicos de la región andina.

See Also

`climatodiagrama`

Examples

```
data(clima_ejemplo)
head(clima_ejemplo)
```

`climatodiagrama` *Climatodiagrama de Walter-Lieth*

Description

Dibuja un climatodiagrama de Walter-Lieth a partir de la temperatura media mensual y la precipitación media mensual de una estación meteorológica. Devuelve un objeto `ggplot2::ggplot()`, por lo que se puede seguir modificando con + (temas, títulos, etc.) y guardar con `ggplot2::ggsave()`.

Usage

```
climatodiagrama(
  datos,
  estacion,
  elevacion,
  anios,
  estilo = c("color", "trama"),
  col_mes = "MES",
  col_temp = "TMED",
  col_prec = "PTOT",
  color_seco = NULL,
  color_humedo = NULL,
  color_perhumedo = NULL,
  color_temp = NULL,
  color_prec = NULL,
  color_fondo = "white",
  alpha_area = 0.85,
```

```
  grosor_linea = 1,
  densidad_trama = 0.07,
  leyenda = TRUE,
  res = 100
)
```

Arguments

`datos`	Data frame o tibble con 12 filas y las columnas del mes, la temperatura media mensual (°C) y la precipitación media mensual (mm).
`estacion`	Nombre de la estación meteorológica (texto).
`elevacion`	Elevación de la estación en m s. n. m.
`anios`	Años de registro. Un valor (`"6"`) si la temperatura y la precipitación tienen el mismo periodo de registro, o dos valores separados por un guion (`"5-6"`): el primero para la temperatura y el segundo para la precipitación.
`estilo`	Estilo de las áreas: `"color"` (por defecto) o `"trama"` (rayas y puntos en blanco y negro). Ver *Details*.
`col_mes`, `col_temp`, `col_prec`	Nombres de las columnas de `datos` con el mes, la temperatura media y la precipitación total. Por defecto `"MES"`, `"TMED"` y `"PTOT"`.
`color_seco`, `color_humedo`, `color_perhumedo`	Colores de los periodos seco, húmedo y perhúmedo. En `estilo = "trama"` son los colores de las rayas (seco), los puntos (húmedo) y el relleno sólido (perhúmedo).
`color_temp`, `color_prec`	Colores de las curvas de temperatura y de precipitación. También se usan para los títulos de los ejes.
`color_fondo`	Color de fondo del panel. Por defecto `"white"`.
`alpha_area`	Transparencia (0 a 1) del relleno de las áreas. Solo se aplica a `estilo = "color"`. Por defecto `0.85`.
`grosor_linea`	Grosor de las curvas de temperatura y precipitación. Por defecto `1`.
`densidad_trama`	Separación horizontal entre rayas y puntos, en unidades de mes: un valor menor da una trama más densa. Solo se aplica a `estilo = "trama"`. Por defecto `0.07`.
`leyenda`	Si es `TRUE` (por defecto) se muestra la leyenda (o el texto explicativo en `estilo = "trama"`).
`res`	Número de puntos usados para interpolar cada tramo entre meses. Valores más altos dan un cruce más preciso entre las curvas. Por defecto `100`.

Details

Convención de Walter-Lieth. La temperatura y la precipitación se representan con una relación de 1 °C = 2 mm. Cuando la curva de precipitación queda por debajo de la de temperatura el periodo es **seco** (la precipitación no compensa la evapotranspiración); cuando queda por encima, el periodo es **húmedo**. Por encima de 100 mm la escala de precipitación se comprime 10 veces y esa zona se considera **perhúmeda**.

Estilos.

- `estilo = "color"`: las zonas se rellenan con color y se añade una leyenda.
- `estilo = "trama"`: estilo clásico en blanco y negro. El periodo seco se dibuja con rayas verticales, el húmedo con puntos y el perhúmedo con relleno sólido. Los segmentos se dibujan con `geom_segment()`, así que no se necesitan paquetes adicionales. La leyenda se muestra como texto al pie del gráfico.

Colores. Todos los argumentos `color_*` aceptan nombres de color de R (p. ej. `"firebrick"`) o códigos hexadecimales (p. ej. `"#E8B04A"`). Si se dejan en `NULL` se usan los colores por defecto del estilo elegido. En `estilo = "trama"`, `color_seco` y `color_humedo` son los colores de las rayas y de los puntos.

Datos de entrada. `datos` debe tener exactamente 12 filas (un mes por fila, en el orden en que se quieran mostrar; tradicionalmente de julio a junio en el hemisferio sur). Los nombres de las columnas pueden cambiarse con `col_mes`, `col_temp` y `col_prec`.

Value

Un objeto `ggplot2::ggplot()`.

References

Walter, H. y Lieth, H. (1960). *Klimadiagramm-Weltatlas*. VEB Gustav Fischer Verlag, Jena.

See Also

clima_ejemplo para un conjunto de datos de prueba.

Examples

```
# Estilo con colores (por defecto)
climatodiagrama(clima_ejemplo,
                estacion = "Estación de ejemplo", elevacion = 2000,
                anios = "6")

# Estilo clásico de rayas y puntos en blanco y negro
climatodiagrama(clima_ejemplo,
                estacion = "Estación de ejemplo", elevacion = 2000,
                anios = "6", estilo = "trama")

# Trama con colores propios
climatodiagrama(clima_ejemplo,
                estacion = "Estación de ejemplo", elevacion = 2000,
                anios = "6", estilo = "trama",
                color_seco = "#B2182B", color_humedo = "#2166AC",
                color_perhumedo = "grey20")

# Colores personalizados y años de registro distintos (temperatura-precipitación)
climatodiagrama(clima_ejemplo,
                estacion = "Estación de ejemplo", elevacion = 2000,
                anios = "5-6",
                color_seco = "#D95F02", color_humedo = "#66C2A5",
                color_perhumedo = "#08306B",
```

```
                color_temp = "#B2182B", color_prec = "#2166AC",
                color_fondo = "#FAFAF5", alpha_area = 0.9)

# Como devuelve un ggplot, se puede seguir modificando
climatodiagrama(clima_ejemplo, "Estación de ejemplo", 2000, "6") +
  ggplot2::theme(text = ggplot2::element_text(family = "serif"))


# Guardar y leer datos desde un archivo temporal CSV
tf <- tempfile(fileext = ".csv")
utils::write.csv(clima_ejemplo, tf, row.names = FALSE)
datos <- utils::read.csv(tf)
g <- climatodiagrama(datos, "ROCOTAL", 2010, "6")
tf_png <- tempfile(fileext = ".png")
ggplot2::ggsave(tf_png, g, width = 7, height = 5.5, dpi = 300)
unlink(c(tf, tf_png))
```

`pisco_aggregate` *Temporal Aggregation of PISCO Rasters*

Description

Aggregates a PISCO terra::SpatRaster across time: annual totals, monthly cycle, multi-year climatology, or SENAMHI hydrological seasons (Wet: Nov–Apr, Dry: May–Oct).

Usage

```
pisco_aggregate(
  x,
  by = c("year", "month", "season_senamhi", "hydrological_year", "climatology"),
  fun = "sum"
)
```

Arguments

`x`	A terra::SpatRaster with valid time attributes.
`by`	Character. Aggregation unit: • `"year"`: Aggregates across each calendar year (e.g., annual rainfall). • `"month"`: Multi-year monthly aggregation (produces 12 layers for Jan–Dec). • `"season_senamhi"`: SENAMHI official hydrological seasons: Wet season (`wet_Nov_Apr`: Nov, Dec, Jan, Feb, Mar, Apr) and Dry season (`dry_May_Oct`: May, Jun, Jul, Aug, Sep, Oct). November and December are grouped with the following calendar year's hydrological period. • `"hydrological_year"`: Annual aggregation based on the Peruvian hydrological year starting in November (Nov 1 to Oct 31). • `"climatology"`: Multi-year monthly mean normals (12 layers).
`fun`	Character or function. Aggregation function (`"sum"`, `"mean"`, `"max"`, etc.). Default is `"sum"` (for precipitation accumulations).

Value

An aggregated terra::SpatRaster.

Examples

```
# Toy SpatRaster with time attribute
r <- terra::rast(xmin = -80, xmax = -70, ymin = -15, ymax = -5,
                 resolution = 1, crs = "EPSG:4326", nlyrs = 24)
terra::values(r) <- rep(1:24, each = terra::ncell(r))
terra::time(r) <- seq(as.Date("2000-01-01"), by = "month", length.out = 24)

# Annual rainfall accumulation (mm/year)
r_ann <- pisco_aggregate(r, by = "year", fun = "sum")

# Multi-year mean monthly cycle
r_cycle <- pisco_aggregate(r, by = "month", fun = "mean")


# Real PISCO download
r_pisco <- pisco_read("monthly")
r_seas <- pisco_aggregate(r_pisco, by = "season_senamhi", fun = "sum")
```

---

pisco_anomaly *Calculate Rainfall Anomalies*

Description

Computes precipitation anomalies relative to a baseline climatology (such as PISCOp_clim2 or a multi-year monthly mean). Anomalies can be expressed in absolute difference (mm) or percentage deviation (\%).

Usage

```
pisco_anomaly(
  x,
  baseline = NULL,
  type = c("percentage", "difference"),
  eps = 0.1
)
```

Arguments

x	A monthly terra::SpatRaster with valid time attributes.
baseline	Optional terra::SpatRaster of monthly normals (12 layers) representing the climatological baseline (e.g. pisco_read("climatology")). If NULL, the baseline is computed internally as the multi-year monthly mean of x.

type	Character. Type of anomaly: "difference" (absolute anomaly: x - baseline in mm) or "percentage" (relative anomaly: ((x - baseline) / baseline) * 100 in \%). Default is "percentage".
eps	Numeric. Small epsilon to prevent division by zero in arid regions when type = "percentage". Default is 0.1 (mm).

Value

A terra::SpatRaster of anomalies with preserved time attributes.

Examples

```
# Toy SpatRasters
r_m <- terra::rast(xmin = -80, xmax = -70, ymin = -15, ymax = -5,
                   resolution = 1, crs = "EPSG:4326", nlyrs = 12)
terra::values(r_m) <- rep(50, terra::ncell(r_m) * 12)
terra::time(r_m) <- seq(as.Date("2000-01-01"), by = "month", length.out = 12)

r_clim <- terra::rast(xmin = -80, xmax = -70, ymin = -15, ymax = -5,
                      resolution = 1, crs = "EPSG:4326", nlyrs = 12)
names(r_clim) <- c("Jan", "Feb", "Mar", "Apr", "May", "Jun",
                   "Jul", "Aug", "Sep", "Oct", "Nov", "Dec")
terra::values(r_clim) <- rep(40, terra::ncell(r_clim) * 12)

# Absolute difference anomaly
anom_diff <- pisco_anomaly(r_m, baseline = r_clim, type = "difference")

# Percentage anomaly
anom_pct <- pisco_anomaly(r_m, baseline = r_clim, type = "percentage")


# Real PISCO download
r_m <- pisco_read("monthly", dates = c(1997, 1998))
r_clim <- pisco_read("climatology")
anom_pct <- pisco_anomaly(r_m, baseline = r_clim, type = "percentage")
```

---

pisco_cache_dir *PISCO Cache Management*

Description

Functions to inspect, set, and clear the local cache directory used by rpisco to store downloaded NetCDF files.

Usage

```
pisco_cache_dir(path = NULL)

pisco_cache_status()

pisco_cache_clear(dataset = "all")
```

Arguments

path	Character. Custom path to set as cache. If NULL, returns current cache.
dataset	Character. Dataset name ("monthly", "daily", "climatology"), or "all" to remove every cached file known to rpisco. Files unrelated to rpisco are never removed.

Value

A character path to the cache directory, or logical status invisibly.

Examples

```
pisco_cache_dir()
pisco_cache_status()
```

---

pisco_catalog *Catalog of PISCO Products*

Description

Lists the available PISCO datasets, variables, metadata, temporal ranges, resolution, official file names, hosting repositories, and local cache status across the full PISCO family (SENAMHI DHI-SEH).

Usage

```
pisco_catalog(
  variable = c("all", "precipitation", "temperature", "evapotranspiration", "erosivity",
    "streamflow"),
  dataset = NULL,
  refresh = FALSE
)
```

Arguments

variable	Character. Variable filter: "all", "precipitation", "temperature", "evapotranspiration", "erosivity", or "streamflow". Default is "all".

dataset	Character. Optional dataset filter (e.g., "monthly", "daily", "tmax_daily", "tmax_clim", "streamflow_monthly"). Supports all dataset aliases and file names. Default is NULL.
refresh	Logical. If TRUE, explicitly refreshes the in-session metadata from the Figshare and HydroShare APIs. This never downloads data.

Value

A tibble::tibble containing metadata for the selected PISCO datasets.

Examples

```
# Complete catalog
pisco_catalog()

# Filter by variable family
pisco_catalog("precipitation")
pisco_catalog("temperature")
pisco_catalog("streamflow")

# Filter by specific dataset
pisco_catalog(dataset = "tmax_daily")
pisco_catalog(dataset = "climatology")
```

---

pisco_citation *Citation Information for PISCO Products*

Description

Prints and returns official citation metadata for datasets in the PISCO family and their associated scientific publications from SENAMHI and international journals.

Usage

```
pisco_citation(
  dataset = c("all", "precipitation", "temperature", "evapotranspiration", "erosivity",
    "streamflow"),
  format = c("text", "bibtex"),
  variable = NULL
)

pisco_cite(
  dataset = c("all", "precipitation", "temperature", "evapotranspiration", "erosivity",
    "streamflow"),
  format = c("text", "bibtex"),
  variable = NULL
)
```

Arguments

dataset	Character. Filter citations for a specific dataset or group: "all", "precipitation" ("piscop"), "temperature" ("piscot"), "evapotranspiration" ("piscoeo"), "erosivity" ("pisco_reed"), or "streamflow" ("pisco_hym"). Default is "all".
format	Character. Citation format: "text" (formatted string for papers/reports) or "bibtex" (BibTeX entry). Default is "text".
variable	Character. Optional alias for dataset for consistency with pisco_catalog(). Default is NULL.

Value

A character string containing the requested citation (invisibly if printed).

Examples

```
# Citation for all PISCO products
pisco_citation()

# BibTeX for temperature (PISCOt v1.2)
pisco_citation("temperature", format = "bibtex")

# Using variable = "precipitation"
pisco_citation(variable = "precipitation")

# Citation for streamflow (PISCO_HyM)
pisco_citation("streamflow")
```

---

pisco_clip *Spatial Cropping and Masking for PISCO Rasters*

Description

Crops and masks a PISCO terra::SpatRaster using a vector polygon (sf or SpatVector), an sf::st_bbox object, or a spatial bounding box numeric vector.

Usage

```
pisco_clip(x, mask, crop_only = FALSE, touches = TRUE, ...)
```

Arguments

x	A terra::SpatRaster object.
mask	An sf object, terra::SpatVector, sf::st_bbox, terra::SpatExtent, or numeric bounding box (c(xmin, ymin, xmax, ymax)).
crop_only	Logical. If TRUE, only crops to bounding box without masking values outside polygon. Default is FALSE.

touches	Logical. If TRUE, all cells touched by polygon boundaries are included in the mask. Default is TRUE (matching default terra::mask() behavior).
...	Additional arguments passed directly to terra::crop().

Value

A cropped (and optionally masked) terra::SpatRaster.

Examples

```
# Toy SpatRaster
r <- terra::rast(xmin = -80, xmax = -70, ymin = -15, ymax = -5,
                 resolution = 0.5, crs = "EPSG:4326")
terra::values(r) <- seq_len(terra::ncell(r))

# Crop by bounding box (c(xmin, ymin, xmax, ymax))
r_sub <- pisco_clip(r, mask = c(-78, -12, -76, -10))

# Crop and mask using an sf polygon
pt <- sf::st_point(c(-75, -10))
poly_sf <- sf::st_sf(data.frame(id = 1),
                     geometry = sf::st_sfc(sf::st_buffer(pt, 1), crs = 4326))
r_basin <- pisco_clip(r, mask = poly_sf)


# Real PISCO download
r_pisco <- pisco_read("monthly")
r_sub <- pisco_clip(r_pisco, mask = c(-77.5, -12.5, -76.0, -11.5))
```

---

pisco_download *Download PISCO Datasets*

Description

Downloads a PISCO dataset from official repositories (Figshare or HydroShare) to the local cache directory. If the file is already cached, download is skipped unless overwrite = TRUE.

Usage

```
pisco_download(
 dataset = c("monthly", "daily", "climatology", "tmax_daily", "tmin_daily", "tmax_clim",
  "tmin_clim", "eto_clim", "erosivity_r", "erosivity_density", "streamflow_monthly",
   "streamflow_daily", "catchments_gr2m", "rivers_gr2m"),
  destdir = pisco_cache_dir(),
  overwrite = FALSE,
  verify_md5 = TRUE,
  timeout = 3600,
  quiet = FALSE,
```

```
  refresh = TRUE
)
```

Arguments

dataset	Character. The dataset to download: • Precipitation: "monthly" ("PISCOp_m"), "daily" ("PISCOp_d"), "climatology" ("PISCOp_clim2"). • Temperature: "tmax_daily", "tmin_daily", "tmax_clim", "tmin_clim". • Evapotranspiration: "eto_clim" ("PISCOeo_pm"). • Erosivity: "erosivity_r", "erosivity_density". • Streamflow: "streamflow_monthly", "streamflow_daily", "catchments_gr2m", "rivers_gr2m", "catchments_arnovic", or "rivers_arnovic". Default is "monthly".
destdir	Character. Destination directory. Default is pisco_cache_dir().
overwrite	Logical. If TRUE, re-downloads the file even if present in cache.
verify_md5	Logical. If TRUE and an MD5 hash is registered, validates the checksum. Default is TRUE.
timeout	Numeric. Maximum seconds to allow for download. Default is 3600 (1 hour).
quiet	Logical. If TRUE, suppresses progress messages. Default is FALSE.
refresh	Logical. If TRUE, refreshes public repository metadata before downloading an uncached file. This is safe because calling this function is an explicit user request to download data. Default is TRUE.

Value

Character. The absolute path to the downloaded (or cached) file.

Examples

```
# Download monthly precipitation (56.6 MB)
fpath_pr <- pisco_download("monthly")

# Download climatological normal maximum temperature (0.52 MB)
fpath_tx <- pisco_download("tmax_clim")

# Download rainfall erosivity R-factor (1.75 MB)
fpath_re <- pisco_download("erosivity_r")
```

pisco_extent *Spatial Coverage Extent of PISCO*

Description

Returns the official geographic bounding coordinates for the PISCOp v3.0 domain, covering Peru and its transboundary hydrologic basins (2 deg N to 19 deg S, 64 deg W to 82 deg W).

Usage

```
pisco_extent(format = c("vector", "bbox", "ext"))

pisco_bbox()
```

Arguments

format	Character. Output format: "vector" (named numeric vector c(xmin, ymin, xmax, ymax)), "bbox" (sf::st_bbox object), or "ext" (terra::ext object). Default is "vector".

Value

A named numeric vector, sf::st_bbox, or terra::ext representing the domain boundaries.

Examples

```
pisco_extent()
pisco_extent("bbox")
pisco_extent("ext")
```

pisco_extract *Extract Time Series from PISCO Rasters*

Description

Extracts precipitation time series from a PISCO terra::SpatRaster at given point coordinates or computes zonal summaries (e.g. areal mean) over spatial polygons.

Usage

```
pisco_extract(x, points = NULL, polygons = NULL, fun = "mean", id_col = NULL)
```

Arguments

x	A terra::SpatRaster object.
points	Optional. An sf point object, a matrix/data.frame with lon and lat columns, or a numeric coordinate vector c(lon, lat).
polygons	Optional. An sf polygon object or terra::SpatVector for zonal statistics.
fun	Character or function. Summary statistic when extracting across polygons (e.g., "mean", "sum", "median"). Default is "mean".
id_col	Character. Name of the column in polygons or points to identify features.

Value

A tibble::tibble containing the extracted time series in tidy format.

Examples

```
# Toy SpatRaster with time attribute
r <- terra::rast(xmin = -80, xmax = -70, ymin = -15, ymax = -5,
                 resolution = 0.5, crs = "EPSG:4326", nlyrs = 6)
terra::values(r) <- rep(1:6, each = terra::ncell(r))
terra::time(r) <- seq(as.Date("2020-01-01"), by = "month", length.out = 6)

# Extract at point coordinates
df_pt <- pisco_extract(r, points = c(-75.5, -10.5))

# Extract areal means over polygons
p1 <- sf::st_buffer(sf::st_point(c(-76, -11)), 0.8)
poly_sf <- sf::st_sf(basin_name = "Rimac",
                     geometry = sf::st_sfc(p1, crs = 4326))
df_basin <- pisco_extract(r, polygons = poly_sf, id_col = "basin_name")


# Real PISCO download
r_pisco <- pisco_read("monthly")
df_pt <- pisco_extract(r_pisco, points = c(-71.96, -13.53))
```

---

pisco_metrics *Statistical Validation Metrics for PISCO*

Description

Implements the statistical evaluation metrics used in the official PISCOp v3.0 validation report (Gutierrez & Lavado-Casimiro, 2025; Willmott et al., 2012):

- Pearson correlation coefficient (COR)
- Refined Index of Agreement (d_r) (Willmott et al., 2012)
- Normalized Mean Bias (NMB, \

- Normalized Mean Gross Error (NMGE)
- Root Mean Squared Error (RMSE)
- Mean Absolute Error (MAE)

Usage

```
pisco_metric_cor(sim, obs, na.rm = TRUE)

pisco_metric_dr(sim, obs, na.rm = TRUE)

pisco_metric_nmb(sim, obs, na.rm = TRUE)

pisco_metric_nmge(sim, obs, na.rm = TRUE)

pisco_metrics(sim, obs, na.rm = TRUE)
```

Arguments

sim	Numeric vector of simulated or gridded values (e.g. PISCO).
obs	Numeric vector of observed values (e.g. rain gauge stations).
na.rm	Logical. If TRUE, pairs with missing values (NA) are removed. Default is TRUE.

Value

pisco_metrics() returns a tibble::tibble containing all validation metrics.

Examples

```
obs <- c(12.5, 34.2, 0.0, 5.4, 60.1, 105.3)
sim <- c(10.1, 31.0, 0.2, 7.8, 55.0, 98.4)

pisco_metrics(sim, obs)
pisco_metric_dr(sim, obs)
pisco_metric_nmb(sim, obs)
pisco_metric_nmge(sim, obs)
```

---

pisco_read *Read PISCO Datasets as SpatRaster or sf Vector*

Description

Reads a PISCO dataset into memory or memory-mapped objects (terra::SpatRaster for raster grids, or sf for catchment/river vector layers). If the file is not present locally, it can be downloaded after the caller explicitly sets download = TRUE.

Usage

```
pisco_read(
 dataset = c("monthly", "daily", "climatology", "tmax_daily", "tmin_daily", "tmax_clim",
  "tmin_clim", "eto_clim", "erosivity_r", "erosivity_density", "streamflow_monthly",
   "streamflow_daily", "catchments_gr2m", "rivers_gr2m"),
  file = NULL,
  dates = NULL,
  aoi = NULL,
  mask = NULL,
  download = FALSE
)
```

Arguments

dataset	Character. The dataset to load: • Precipitation: "monthly" ("PISCOp_m"), "daily" ("PISCOp_d"), "climatology" ("PISCOp_clim2"). • Temperature: "tmax_daily", "tmin_daily", "tmax_clim", "tmin_clim". • Evapotranspiration: "eto_clim" ("PISCOeo_pm"). • Erosivity: "erosivity_r", "erosivity_density". • Streamflow: "streamflow_monthly", "streamflow_daily", "catchments_gr2m", "rivers_gr2m", "catchments_arnovic", or "rivers_arnovic". Default is "monthly".
file	Character. Optional custom path to a PISCO NetCDF or GeoPackage file. If NULL, looks in the local cache.
dates	Vector of dates, years, year-months, or indices to filter layers. • For daily/monthly rasters: Date objects, character dates ("1998-01-01"), character year-months (c("1997-01", "1998-12")), or numeric years (1998 or c(1997, 1998)). • For climatologies (12 months): integer month numbers (1:12) or month names.
aoi	Optional spatial object (sf, SpatVector, or bounding box vector) to crop/mask the raster upon reading. Alias for mask.
mask	Optional spatial mask. Same as aoi.
download	Logical. If TRUE and file is not cached, downloads it after this explicit request. Default is FALSE to avoid implicit network access.

Value

A terra::SpatRaster object (for gridded data) or an sf object (for vector hydrography).

Examples

```
# Read monthly precipitation
r_pr <- pisco_read("monthly")
```

```
# Read normal maximum temperature 1981-2010
r_tx <- pisco_read("tmax_clim")

# Read reference evapotranspiration climatology
r_eto <- pisco_read("eto_clim")

# Read rainfall erosivity R-factor
r_ero <- pisco_read("erosivity_r")
```

`pisco_refresh_catalog` *Refresh PISCO download metadata from public repositories*

Description

Queries the public Figshare and HydroShare metadata APIs and refreshes the download URLs, file sizes, and checksums held in the current R session. This operation retrieves metadata only; it never downloads a PISCO data file. It is opt-in so package loading and ordinary reads remain offline.

Usage

```
pisco_refresh_catalog(timeout = 30, quiet = FALSE)
```

Arguments

`timeout`	Numeric. Maximum seconds for each metadata request.
`quiet`	Logical. If `TRUE`, suppresses informational messages.

Value

A tibble::tibble with refreshed metadata, invisibly.

Examples

```
pisco_refresh_catalog()
```

`plot.SpatRaster` *Plot SpatRaster and SpatVector Objects*

Description

S3 plot methods for terra::SpatRaster and terra::SpatVector objects, ensuring that `plot(r)` works seamlessly when `rpisco` is loaded, even if `library(terra)` has not been explicitly attached.

Usage

```
## S3 method for class 'SpatRaster'
plot(x, y, ...)

## S3 method for class 'SpatVector'
plot(x, y, ...)
```

Arguments

`x`	A `terra::SpatRaster` or `terra::SpatVector` object.
`y`	Optional second argument for bivariate plotting in terra.
`...`	Additional graphical parameters forwarded to `terra::plot()`.

Value

Invisibly returns the plotted object or `NULL`, creating a plot on the active device.

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