

RPisco - study case using minimum temperature

RPisco: tools for manipulate PISCO data of SENAMHI (Peru)

RPisco: Herramientas para manipular datos PISCO del SENAMHI (Perú)

La Librería RPisco contiene herramientas para manipular datos de precipitación y temperatura de PISCO (SENAMHI).

RPisco package contains tools for manipulate precipitation and temperature data of PISCO (SENAMHI).

```
library(RPisco)
```

1. Installation - Instalación

Instale el paquete RPisco desde Github:

Install RPisco from Github:

```
> library(devtools)
> install_github("GeomarPerales/RPisco")
```

2. RPisco Package - Librería RPisco

El paquete RPisco contiene las siguientes herramientas: extracción de valores de datos PISCO diarios y mensuales, procesar los datos de PISCO de las series diarias/mensuales a series anuales, y obtener el promedio mensual/anual de la serie PISCO mensual/anual.

RPisco package contains the following tools: values extraction of daily/monthly PISCO data, processing PISCO data from daily/monthly series to annual series, and obtain monthly/yearly average from PISCO monthly/yearly serie.

3. Minimum Temperature - Temperatura mínima

Daily data - Datos diarios

```
PISCO.file <- "D:\\PISCOd_tmn_v1.1.nc"
x <- data.frame(PISCO.file, -76.11, -13.11)
data <- piscod(x)
```

```
## Loading required namespace: ncdf4
```

```
head(data)
```

```
##           date values
## 1 1981-01-01   16.7
## 2 1981-01-02   16.6
## 3 1981-01-03   17.1
## 4 1981-01-04   17.4
## 5 1981-01-05   18.0
## 6 1981-01-06   17.7
```

Monthly data - Datos Mensuales

```
PISCO.file <- "D:\\PISCOm_tmn_v1.1.nc"
x <- data.frame(PISCO.file, -76.11, -13.11)
data <- pisco(x)
head(data)
```

```
##          date values
## 1 1981-01-01      18
## 2 1981-02-01      20
## 3 1981-03-01      20
## 4 1981-04-01      18
## 5 1981-05-01      14
## 6 1981-06-01      12
```

4. Study Case: Huarpa Basin - Caso de estudio: Cuenca Huarpa

- Stations data of Huarpa Basin - Datos de estaciones de la Cuenca Huarpa

```
head(Huarpa.stations)
```

```
##          Estacion      Lat      Lon  Alt
## 1      San Miguel -13.01667 -73.98333 3323
## 2 Hacienda Cochas -13.03333 -73.88333 3323
## 3      La Quinoa -13.05528 -74.14139 3240
## 4    Wayllapampa -13.07639 -74.21667 2470
## 5      Huamanga -13.15000 -74.23694 2761
## 6    Allpachaca -13.38333 -74.26667 3600
```

- Extraction of monthly PISCO data - Extracción de datos mensuales de PISCO.

```
PISCO.file <- "D:\\PISCOm_tmn_v1.1.nc"
monthly.data <- pisco(group(data.frame(PISCO.file, Huarpa.stations)))
head(monthly.data)
```

```
##          date San Miguel Hacienda Cochas La Quinoa Wayllapampa Huamanga
## 1 1981-01-01    9.8509          8.1048    9.7807    11.2008    10.5469
## 2 1981-02-01   10.2991          8.7006   10.2054    11.7339    11.1248
## 3 1981-03-01    9.7092          7.9114    9.2600    11.3890    10.2941
## 4 1981-04-01    8.0927          6.2863    6.9531    9.3928    8.4095
## 5 1981-05-01    5.9398          3.9641    4.8941    7.2115    6.0819
## 6 1981-06-01    4.7009          3.0736    3.6540    5.3764    4.6611
## Allpachaca Huanta Huanta gore San Pedro Acobamba Lircay Hacienda Tocaz
## 1    6.4502 10.1869    10.1869    10.0235    6.5908    6.7057    5.8289
## 2    7.3740 10.5697    10.5697    10.5304    7.0936    7.7152    6.0193
## 3    5.8990 10.1100    10.1100    10.0772    6.4770    7.0951    5.4816
## 4    4.1272 8.3945     8.3945    8.8171    5.3648    5.1867    4.8077
## 5    1.7191 6.4090     6.4090    6.9472    3.8655    2.8778    3.2067
## 6    0.9674 4.3886     4.3886    4.9507    2.3044    0.8046    2.1314
## Paucarbamba Lauricocha Huancavelica Paras Chuschi Libertadores 706
## 1    5.8289    8.9768        3.7881    5.5325    6.3783        4.0738
## 2    6.0193    9.1674        4.9043    6.6600    7.4471        5.3674
## 3    5.4816    8.6377        4.5238    5.6224    6.1024        4.7727
## 4    4.8077    7.0447        2.1411    4.1490    4.9148        2.4736
## 5    3.2067    5.2934       -0.7392    1.7937    2.6743       -0.1375
## 6    2.1314    3.3125       -1.9166   -0.2898    1.4114       -1.9251
## Libertadores 156139 Choclococha Acnocochoa Tunel cero
## 1            4.0738        3.1947        3.4721        3.4721
## 2            5.3674        4.3259        4.8122        4.8122
```

```
## 3      4.7727      3.8290      4.1769      4.1769
## 4      2.4736      1.2317      1.7992      1.7992
## 5     -0.1375     -0.9944     -0.8405     -0.8405
## 6     -1.9251     -2.9522     -3.1286     -3.1286
```

- Monthly average of San Miguel station - Promedio mensual de la estación San Miguel

```
monthlyavg(data.frame(monthly.data$date, monthly.data[,2]), variable = "temperature")
```

```
##      Jan      Feb      Mar      Apr      May      Jun      Jul      Aug      Sep
## 1 10.15534 10.0863 9.8546 8.648586 6.4583 5.401756 4.526081 5.645728 7.298558
##      Oct      Nov      Dec
## 1 8.7584 9.015689 9.956247
```

- Yearly average of San Miguel station - Promedio anual de la estación San Miguel

```
yearlyavg(data.frame(monthly.data$date, monthly.data[,2]), variable = "temperature")
```

```
## [1] 7.983799
```

- Annual serie of San Miguel station - serie anual de la estación San Miguel

```
head(pisco2annual(data.frame(monthly.data$date, monthly.data[,2]), variable = "temperature"))
```

```
##   date   values
## 1 1981 7.748533
## 2 1982 7.741325
## 3 1983 8.286633
## 4 1984 7.671800
## 5 1985 7.222492
## 6 1986 7.388267
```

5. References - Referencias

Aybar. (2017). Uso del producto grillado PISCO de precipitación en estudios, investigaciones sistemas operacionales de monitoreo y pronóstico hidrometeorológico. Lima: SENAMHI.