

Climatol v. 4: New functionalities and tools

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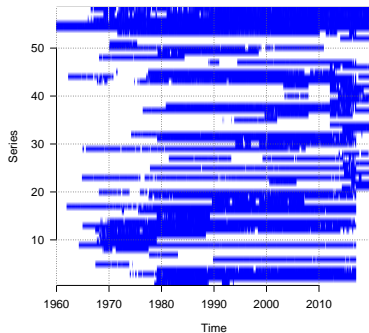
Outlook

- Why to choose *climatol*
- Preparation of the input files
- Series homogenization
- Post processing functions
- Graphic products
- Conclusion

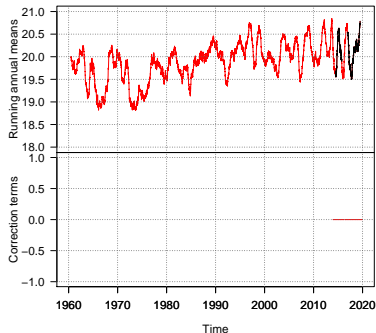
Why to choose *climatol*

- There are several well known homogenization packages (ACMANT, climatol, HOMER & sons, MASH, RHtests, ...) with similar performances (Guijarro *et al.*, 2023). So, why to choose *climatol*?
- Its distinctive feature is its capability of using most series of your database, including those of short lived stations, whose missing data will be estimated, allowing the calculation of statistics and normal values useful for climate monitoring. Real example application for variable TXac in 1960-2019:

TXac data availability



TXac 52 (6028001)
Río Tinguiririca Bajo Los Briones



Input files format

Only two input files (plain text) are needed:

- 1 Stations coordinates (longitud X, latitude Y, elevation Z), codes and names.

TXac_1960-2019.est example:

```
-71.2592 -30.0022 100 4400002 "Pan De Azucar"  
-70.4819 -30.1939 1560 4311005 "La Ortiga"  
...
```

- 2 Complete data blocks, in the stations order. TXac_1960-2019.dat example:

```
14.7 15.1 16.7 15.3 13.7  
14.8 15.5 12.7 17.9 20.5  
14.8 NA NA NA NA  
NA NA NA NA 13.3  
16.3 13.6 15.7 15.1 15.1  
...
```

Help functions to build the input files

Previously existing functions:

- `db2dat` creates input files directly from a database (accessible through the ODBC protocol).
- `daily2climatol` compiles the data from individual station files.
- `rclimindex2climatol` converts the data from RClimDex files.

New helping functions:

- `sef2climatol` compiles the data from SEF¹ files.
- `xls2csv` dumps data from individual *.xls or *.xlsx files into a single CSV file.
- `csv2climatol` converts data existing in a single CSV file.

¹SEF (Station Exchange Format) is the Copernicus Climate Change Service format for Data Rescue projects.

Series homogenization

- The call to the homogenization function is now very simple, since only three parameters are needed: `homogen(Variable, FirstYear, LastYear)`. The rest of parameters are guessed or have safe default values. However, users should revise the results and optionally run `homogen` again if they want to modify any parameter.
- An interesting novelty for daily precipitation is the possibility to disaggregate values accumulated during several days.
- A new initial quality control has been implemented in the `homogen` function, showing, for every series, boxplots of values (detecting and deleting clear errors), differences between consecutive values and lengths of sequences with the same value.
- Alternatively to SNHT the user can choose the Cucconi test to simultaneously detect changes in the mean and the variance, but only if reference series do not change along time, because that would introduce variability in the spatial anomalies.

Example for the homogenization of daily series

Following our example with TXac daily series from 1960-2019, the recommended homogenization steps would be:

```
homogen('TXac',1960,2019,onlyQC=TRUE) #Check data quality  
dd2m('TXac',1960,2019) #Create monthly aggregates TXac-m  
homogen('TXac-m',1960,2019) #Homogenize the monthly series
```

At this point, the user should revise the output graphics and optionally edit the break-points file TXac-m_1960-2019_brk.csv to adjust the dates to the available metadata. Then the last step would then be to homogenize the daily series using the (edited?) monthly break-points list:

```
homogen('TXac',1960,2019,metad=TRUE) #Final homogenization
```

Post processing functions

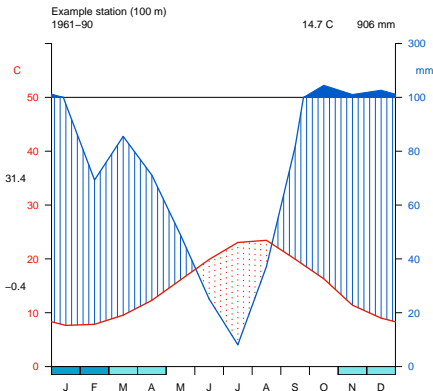
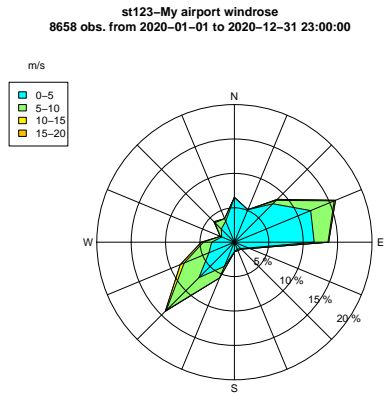
Apart from *dahstat* (to calculate various monthly statistics, trends and p-values, etc) and *dahgrid* (to generate grids of normalized values in NetCDF format) the new version adds:

- *fix.sunshine* to prune any excess in sunshine hours produced in adjusted daily series.
- *QCthresholds* to obtain, for every daily (or subdaily) series, monthly quantiles of extreme values, increments between consecutive values and sequences of identical values. These quantiles can be used to implement Quality Control alerts in Climate Data Management Systems.

Graphic products (1)

Former versions included two graphic products:

- *windrose*: Wind rose from wind direction and speed data
- *diagwl*: Walter & Lieth diagram from daily data of precipitation and extreme temperatures

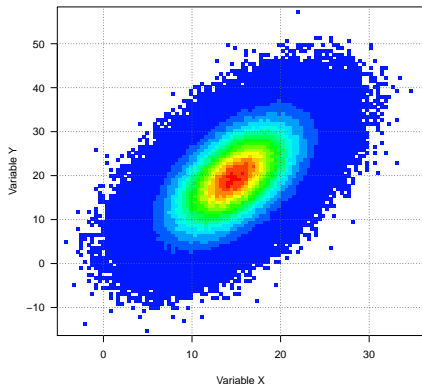


Graphic products (2)

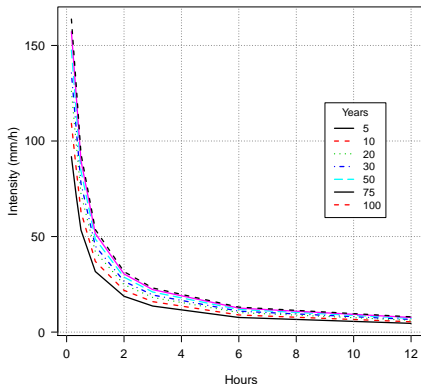
Climatol v.4 adds a few more. Examples:

- *dens2Dplot*: Two dimensional scatterplot
- *IDFcurves*: Intensity-Duration-Frequency diagram from subdaily precipitation data

Example of dens2Dplot



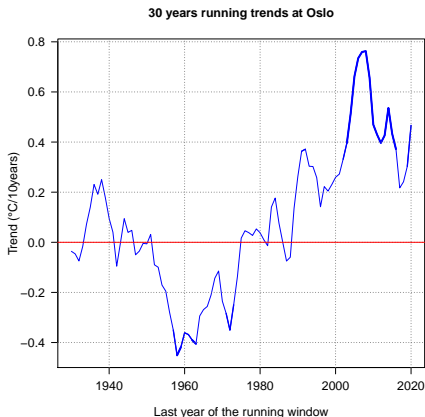
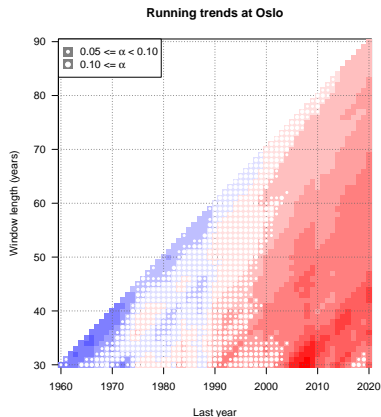
IDF at My airport (1993–2020)



Graphic products (3)

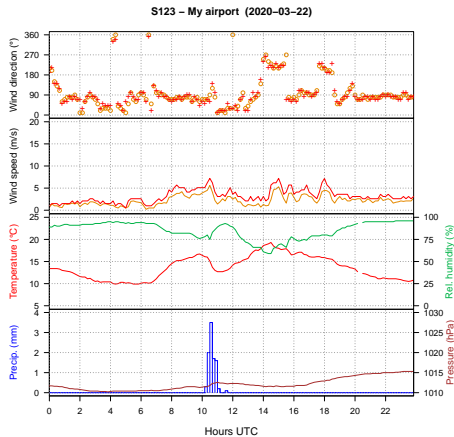
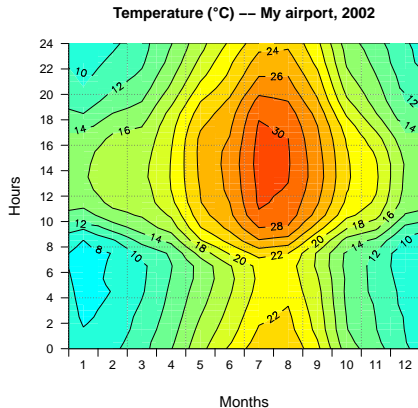
- *runtn*:

- ▶ Diagram of running trends on time windows of different lengths
- ▶ Running trends on a fixed length time window (thicker lines indicate significance)



Graphic products (4)

- *MHisopleths*: Months-Hours isopleths
- *meteogram*: Meteogram of 1 day AWS data



Conclusion

The varied features of the *climatol* R package makes it very useful for many climatological practices.

Resources:

- R package: <https://CRAN.R-project.org/package=climatol>
- Web page (more frequent updates and varied documentation): <https://climatol.eu>
- MULTITEST intercomparison results of monthly homogenizations: <https://climatol.eu/MULTITEST>
- Guijarro et al. (2023): Homogenization of monthly series of temperature and precipitation: Benchmarking results of the MULTITEST project. *Int. J. Climatol.*, 19 pp, <http://doi.org/10.1002/joc.8069>

Many thanks for your attention!!!