



<http://www.meteo.unican.es>

# **ECOMS-UDG. A User-friendly Data access Gateway to seasonal forecast datasets allowing R-based remote data access, visualization-validation, bias correction and downscaling**

**A.S. Cofiño, J.M. Gutiérrez, J. Fernández, J. Bedia, M. Vega, S. Herrera, M.D. Frías, M. Iturbide, M.E. Magariño, and R. Manzanas**

<http://www.meteo.unican.es/udg-wiki>

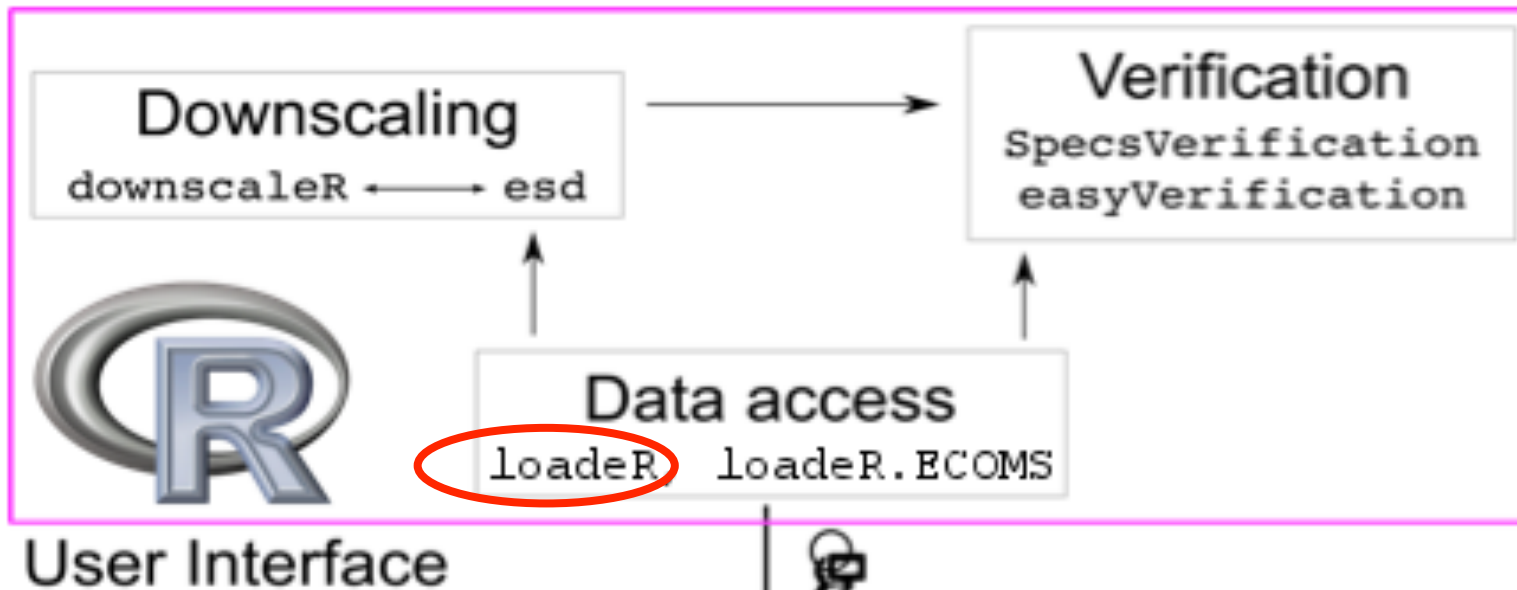
**José M. Gutiérrez**

gutierjm@unican.es

Instituto de Física de Cantabria  
Santander Meteorology Group



## An R-based integrated framework for (remotely) accessing and processing climate data in the era of climate services



Existing **visualization**, **validation** and **downscaling** packages are transparently linked to UDG using **common data structures**.

**Public and restricted data** via virtual catalogs, allowing **homogenization** (a single vocabulary) and **data collocation**.



The User Data Gateway (UDG) is a **THREDDS** server with two in-house layers for:  
**1) Authentication**  
**2) R-based data access.**

**UDG** provides (homogeneous) access to locally stored daily data:

- ◆ **observations** (ECA, GSN, WFDEI),
- ◆ **reanalysis** (NCEP-R1, JRA55, ERA-Interim) and
- ◆ **CMIP5** data (several GCM projections).

and also to any other **OPENDAP remote data**.

**ECMOS-UDG** is an extension for **seasonal forecasting** data, including hindcasts from state-of-the-art seasonal forecasting models: **ECMWF-System4, NCEP-CFSv2, UKMO-GloSea5**.



**User-tailored** design (SPECS and EUPORIAS) including variables needed for impact studies, mostly at surface level:

**Precip., temperatures, 10m wind speed, specific humidity, short/longwave radiation, SLP**, but also **upper-air** information at 1000,850,700,500,300,200 mb (for statistical downscaling).

## Worked example: UDG - Data access

```
# login in UDG .
```

```
# request user at http://www.meteo.unican.es/udg-tap
```

```
loginUDG(username = "???", password = "???.")
```

```
# loading observations for Brazil (precip for MAM)
```

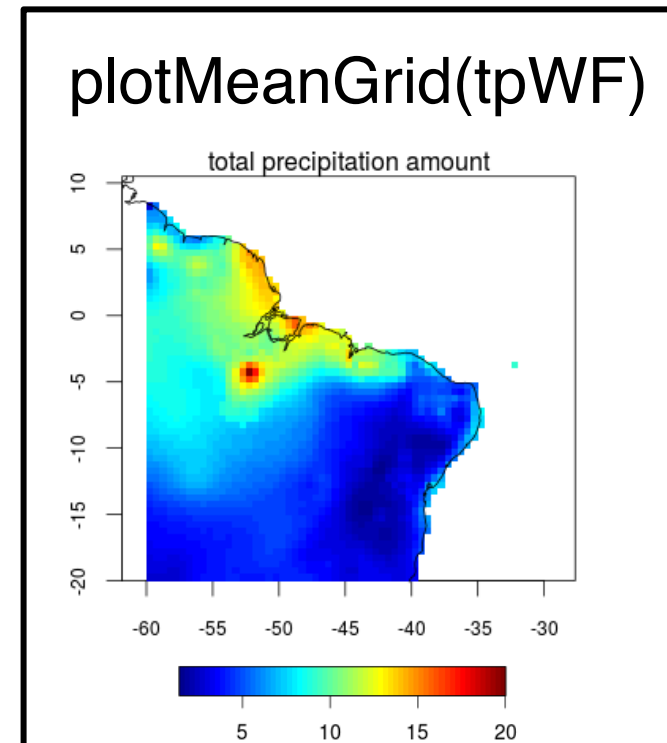
```
tpWF <- loadGridData(dataset = "WFDEI", var = "tp", vocabulary = T,  
  lonLim = c(-60, -30), latLim = c(-20, 10),  
  season = 3:5, years = 1981:2010)
```

For remote datasets no need to login and no homogenization (*vocabulary = F* by default).

An example with **E-OBS precipitation**

```
ds<-"http://opendap.knmi.nl/knmi/thredds/dodsC/  
e-obs_0.25regular/rr_0.25deg_reg_v12.0.nc"
```

```
loadGridData(dataset = ds, var = "RR", ...
```



## *Bias correction and downscaling*

- **downscaleR** has been designed to work with daily data (seasonal predictions, multidecadal projections). Extends the **loadeR** capabilities for data manipulation
  - Regridding/interpolation, subsetting and aggregation
  - PCA/EOF analysis
- Bias correction/calibration (including cross-validation)
  - Scaling, IS-MIP, qq-mapping (various forms), parametric.
- Perfect-prog downscaling (including cross-validation)
  - Analogs, regression (linear and generalized linear), weather typing.
- Parallel execution options

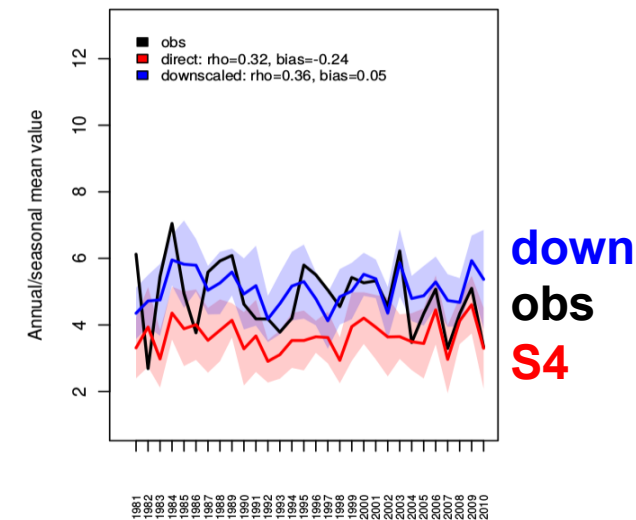
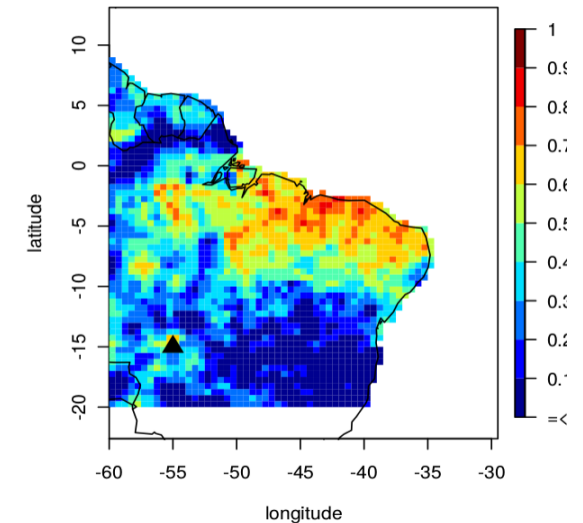
<https://github.com/SantanderMetGroup/downscaleR>



# Worked example Downscaling

```
ptor <- = {"psl", "ta@850", "hus@850"}  
# Loading NCEP and System4  
NCEP <- loadECOMS(dataset = "NCEP", var = ptor,  
lonLim = c(-60,-30), latLim = c(-20,10),  
season = 3:5, years = 1981:2010)  
  
S4 <- loadECOMS(dataset = "System4_15", var = ptor,  
lonLim = c(-60,-30), latLim = c(-20,10),  
season = 3:5, years = 1981:2010)  
  
# Computing EOFs and PCs  
Ncep.eof <- computeEOF(ncep, n.eofs = 15)  
  
# Interpolating S4 to the NCEP grid, and rescaling  
S4 <- interpData(S4, getGrid(NCEP))  
S4.sc <- rescaleMonthlyMeans(pred = NCEP, sim = S4)  
  
# Downscaling with Generalized Linear Models  
down<- downscale(obs = tp.wfdei, pred = ncep.eof,  
sim = s4.sc, cross.val = "loocv",  
method = "glm", n.pcs = 15,  
parallel = TRUE, ncores = 3)
```

# Analysis of results  
quickDiagnostics(down)



- ***visualizeR*** package (ECOMS initiative). Visualization of probabilistic forecasts
- ***easyVerification*** package (ECOMS initiative). Common validation scores for seasonal forecasting. Tutorials and worked examples for integration with `loadR` and `loadR.ECOMS`

Available documentation of the integration with worked-out examples

Verification of seasonal forecasts from the ECOMS User  
Data Gateway: a worked example

Joaquín Bedia<sup>1</sup> and Jonas Bhend<sup>2</sup>

<sup>1</sup>Santander Met Group. University of Cantabria - CSIC (Spain)

<sup>2</sup>Federal Office of Meteorology and Climatology MeteoSwiss, Zurich, Switzerland

*version 2 - '2015-05-18'*

**loadeR** relies on the powerful capabilities of the Unidata's netCDF-Java libraries.

Function *makeAggregatedDataset* to create virtual datasets (file collections) using the NetCDF Markup Language (NcML):

- Combine data from multiple files
- Add/delete/edit metadata
- Add/delete/rename/edit variables

This allows creating a one-stop entry point for datasets, aggregating multiple files from the same (or different) resources.

Further details and worked examples:

<https://github.com/SantanderMetGroup/loadeR/wiki/>



**Santander Meteorology Group**

*A multidisciplinary approach for weather & climate*

## *Links and packages*



UDG wiki with instructions for registration

<http://www.meteo.unican.es/udg-wiki>

Link to data access and downscaling packages:

<https://github.com/SantanderMetGroup/loadeR>

<https://github.com/SantanderMetGroup/downscaleR>