

10- 12 September 2014, Santander

Hands-on training workshop on “ Seasonal forecasting and downscaling”

Data access, bias correction and downscaling

Verónica Torralba Fernández

EUPORIAS





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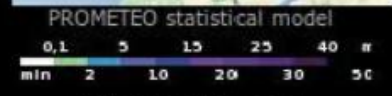
- Research
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- Computing resources
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Hands-on training workshop on "seasonal forecasting and downscaling" (Santander 8-12 September 2014)

FINAL PROGRAM:
8-9 September 2014 (An introduction to R for climate data analysis)
 J Bedia, S Herrera, MD Frias, D SanMartín, M Tuní
 Quick R start: data structures, basic operations, control structures.
 PRACTICE: using a climate data object
 DEMO: Introduction to R objects [OO-Reference]
 PRACTICE: Weather generators

10 September 2014
 [09:00-09:15] JM Gutiérrez. Welcome and presentation
 [09:15-10:00] JM Gutiérrez. Basic concepts on S2D forecasting
 [10:00-10:30] M De Felice. Impact models and data I
 [10:30-11:00] K Nicklin. Impact models and data II
 [coffee break]
 [11:30-12:00] PA Bretonniere. SPECS experiments and access
 [12:00-12:30] JM Gutiérrez. ECOMS User Data Gateway
 [12:30-13:00] AS Cofiño, J Bedia. Demo: ECOMS-UDG [DEMO1: Accessing seasonal forecast data using R] [DEMO2: Validating and visualizing tercile-based probabilistic predictions]
 [14:30-17:30] J Bedia, S Herrera. Hands-on training: ECOMS-UDG and R-access package [PRACTICE1: Bias of System4 hindcast] [PRACTICE2: Drift of System4 hindcast]

Local weather forecast (physics and statistics) [+ info]
 Rainfall (mm) | Max temp. (°C)
 Sun (today) Mon Tue Wed



WRF dynamical model



For more information iMeteo

The demos and hands-on sessions were based on three R packages (accessible from GitHub):

1. **ecomsUDG.Raccess.** R package for accessing data (seasonal forecasts: System4, reanalysis: NCEP, etc.) from the ECOMS User Data Gateway

<https://github.com/SantanderMetGroup/ecomsUDG.Raccess>

2. **downscaleR.** An R package for statistical bias correction and downscaling

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

3. **esd.** Climate analysis and empirical-statistical downscaling R package

<https://github.com/metno/esd>

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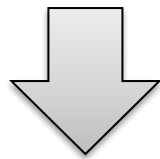
<https://github.com/SantanderMetGroup/ecomsUDG.Raccess>

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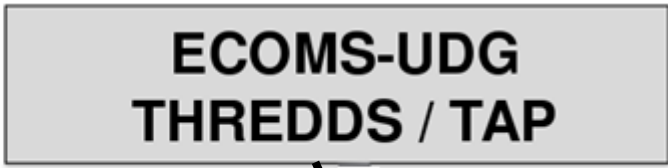
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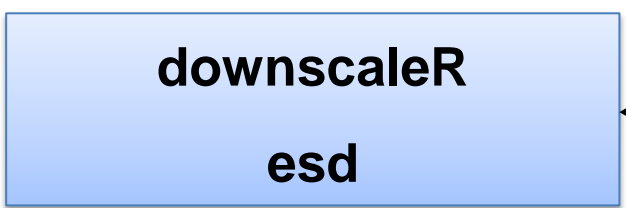
<https://github.com/metno/esd>



Subset of vars for pilot impact studies locally stored and harmoized.



Unique interface



ECOMS User data Gateway's wiki:

The screenshot shows a web browser window displaying the ECOMS User Data Gateway wiki page. The browser address bar shows the URL `https://meteo.unican.es/trac/wiki/EcomsUdg`. The page title is "EcomsUdg - TracMeteo". The navigation menu includes "Wiki", "Blog", "Eventos", "Ver incidencias", "Nueva incidencia", and "Buscar". The main content area is titled "The ECOMS User Data Gateway" and contains the following text:

The European Climate Observations, Modelling and Services initiative (⇒ **ECOMS**) coordinates the activities of three ongoing European projects (⇒ **EUPORIAS**, ⇒ **SPECS** and ⇒ **NACLIM**). Different activities carried out in these projects require seasonal forecasts from state-of-the-art forecasting systems (e.g. NCEP/CFSv2 or ECMWF/System4) for a reduced number of variables. This information can be obtained directly from the data providers, but the resulting formats, aggregations and vocabularies may not be homogeneous across datasets, thus requiring some post processing. Moreover, different data policies hold for the various datasets—which are freely available only in some cases—and therefore data access may not be straightforward. Thus, obtaining seasonal climate forecast data is typically a time consuming task.

As part of the data management activities in these projects, the *ECOMS User Data Gateway* (**ECOMS-UDG**) has been developed by the ⇒ **Santander MetGroup** in order to facilitate seasonal forecasting data access to end users. The needed variables have been downloaded from data providers and locally stored in a THREDDS data server implementing fine-grained user authorization (see the available **datasets** and **variables**). Thus, users can efficiently retrieve the subsets best suited to their particular research aims (for particular regions, periods and/or ensemble members) from a large volume of information. Since ⇒ **R** has been adopted for a number of tasks in these projects (validation, downscaling, etc.), an R package for data exploration and access has been developed (**ecomsUDG.Raccess**) and additional functionalities will be developed to meet the users' needs. Moreover, a number of alternative tools are being developed in order to provide different user-friendly interfaces for accessing the information (Python, Matlab, web portals, ...).

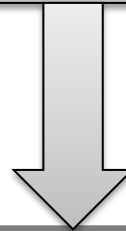
This wiki page provides an up-to-date description of the **ECOMS-UDG**, including information on the available datasets and variables, and the documentation of the available tools. The following documents and links are the basic references:

Recent Changes:

- **New stable minor version release of ecomsUDG.Raccess (v2.2-1)** -- Posted on 2014-08-05 19:14 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **New stable minor version release of ecomsUDG.Raccess (v2.2-0)** -- Posted on 2014-07-16 13:42 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **New patch release (v2.1-1) of ecomsUDG.Raccess package** -- Posted on 2014-07-11 16:16 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **ecomsUDG.Raccess v2.1-0 released** -- Posted on 2014-07-11 16:14 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **ecomsUDG.Raccess v2.0-0 released** -- Posted on 2014-06-16 20:24 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **ecomsUDG.Raccess v1.0-0 released** -- Posted on 2014-02-17 13:50 : author **juaco** : categories **Specs Euporias Data Server Ecoms Udg**
- **Re-branding to ECOMS UDG** -- Posted on 2014-01-23 20:06 : author **antonio** : categories **Euporias Data Specs Server Ecoms Udg**
- **Defined an initial list of variable** -- Posted on 2013-12-13 10:52 : author **gutierjm** : categories **Specs Euporias Data Server**
- **The CFSRR dataset has been added to the portal** -- Posted on 2013-09-24 12:26 : author **antonio** : categories **Euporias Data Specs Server**
- **First version of the user data portal** -- Posted on 2013-04-25 20:07 : author **antonio** : categories **Specs Euporias Data Server**

Example

```
prd<-loadECOMS(dataset = "CFSv2_seasonal_16", var = "tas", members = 1:2,  
lonLim = c(-15,35), latLim = c(32, 75), season = c(12,1,2), years = 1991:2000,  
leadMonth = 3, time = "DD")
```



- **\$Variable.** A list with: varName, isStandard and Level
- **\$Data:** A N-dimensional array. N can take values from 4 to 1 [member, time, lat, lon].
- **\$xyCoords:** A list with x and y components. In addition, the attribute projection provides geo-referencing information
- **\$Dates:** A list with two POSIXct time elements of the same length as the 'time' dimension in Data
- **\$InitializationDates:** A POSIXct time object corresponding to the initialization times selected.
- **\$Members:** A character vector with the names of the ensemble members returned.

The limitations in data loading depend essentially on two factors:

- **Memory**
- **Loading time**

For detailed information about the package:

<https://meteo.unican.es/trac/wiki/EcomsUdg/RPackage>

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downscaleR

- **Climate data access. It is the basis of the ecomsUDG.Raccess package**
- **Statistical Downscaling Methods**
 - **Bias Correction and Model Output Statistics (MOS)**
 - **Perfect Prog Downscaling**
- **Visualising and validating seasonal forecasts**

Example

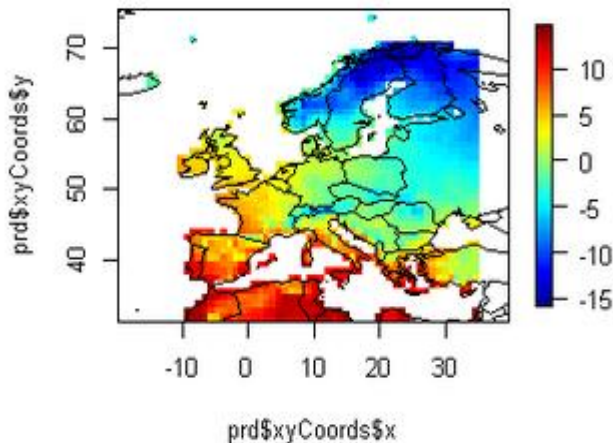
```
obs <- loadECOMS(dataset = "WFDEI", var = "tas", lonLim = c(-15,35), latLim = c(32, 75), season = c(12,1,2),  
years = 1991:2000)
```

```
prd <- loadECOMS(dataset = "CFSv2_seasonal_16", var = "tas", members = 1, lonLim = c(-15,35), latLim =  
c(32, 75), season = c(12,1,2), years = 1991:2000, leadMonth = 3, time = "DD")
```

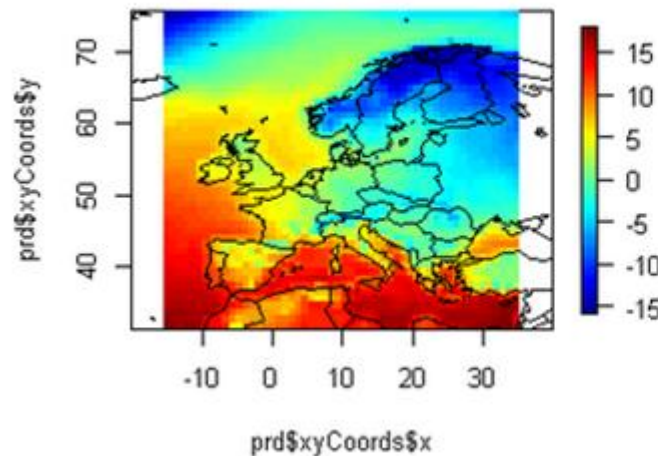
```
sim <- loadECOMS(dataset = "CFSv2_seasonal_16", var = "tas", members = 1, lonLim = c(-15,35), latLim =  
c(32, 75), season = c(12,1,2), years = 2001:2010, leadMonth = 3, time = "DD")
```

```
biasCorrection(obs, prd, sim, method = "unbiasing")  
biasCorrection(obs, prd, sim, method = "qqmap")  
isimip(obs, prd, sim)
```

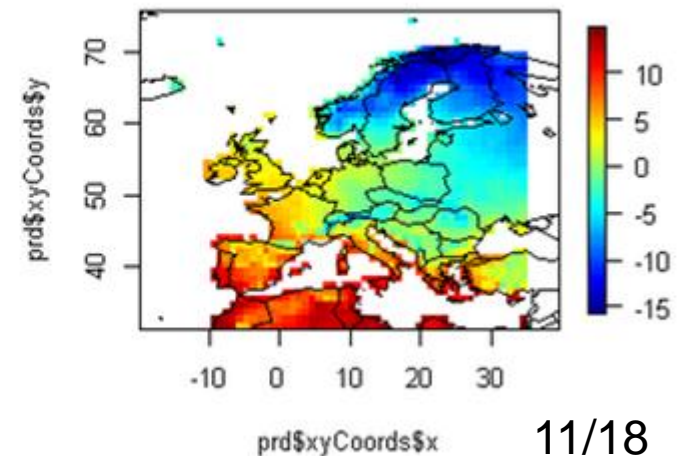
Unbiasing



QQ-Mapping

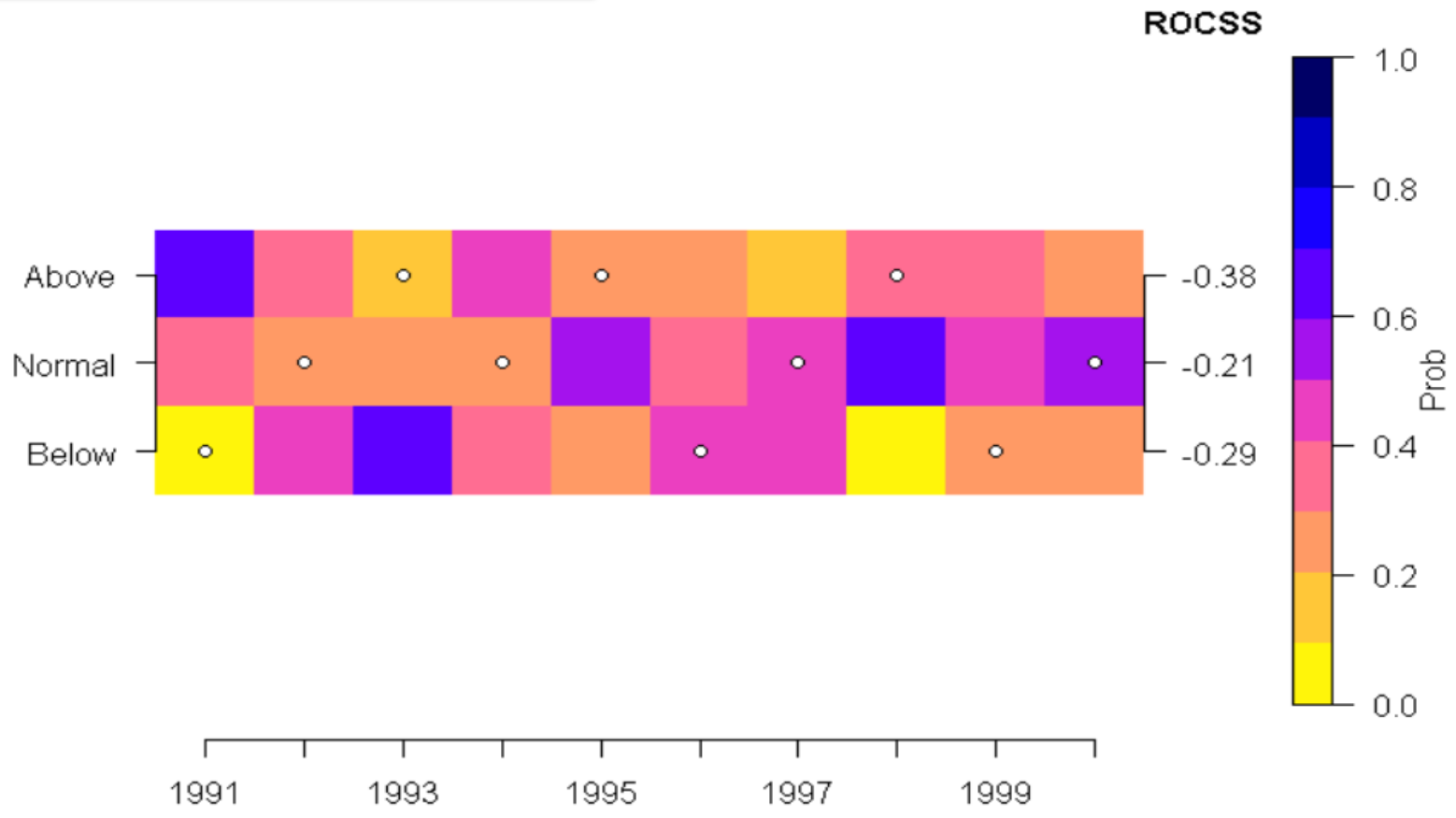


ISI-MIP

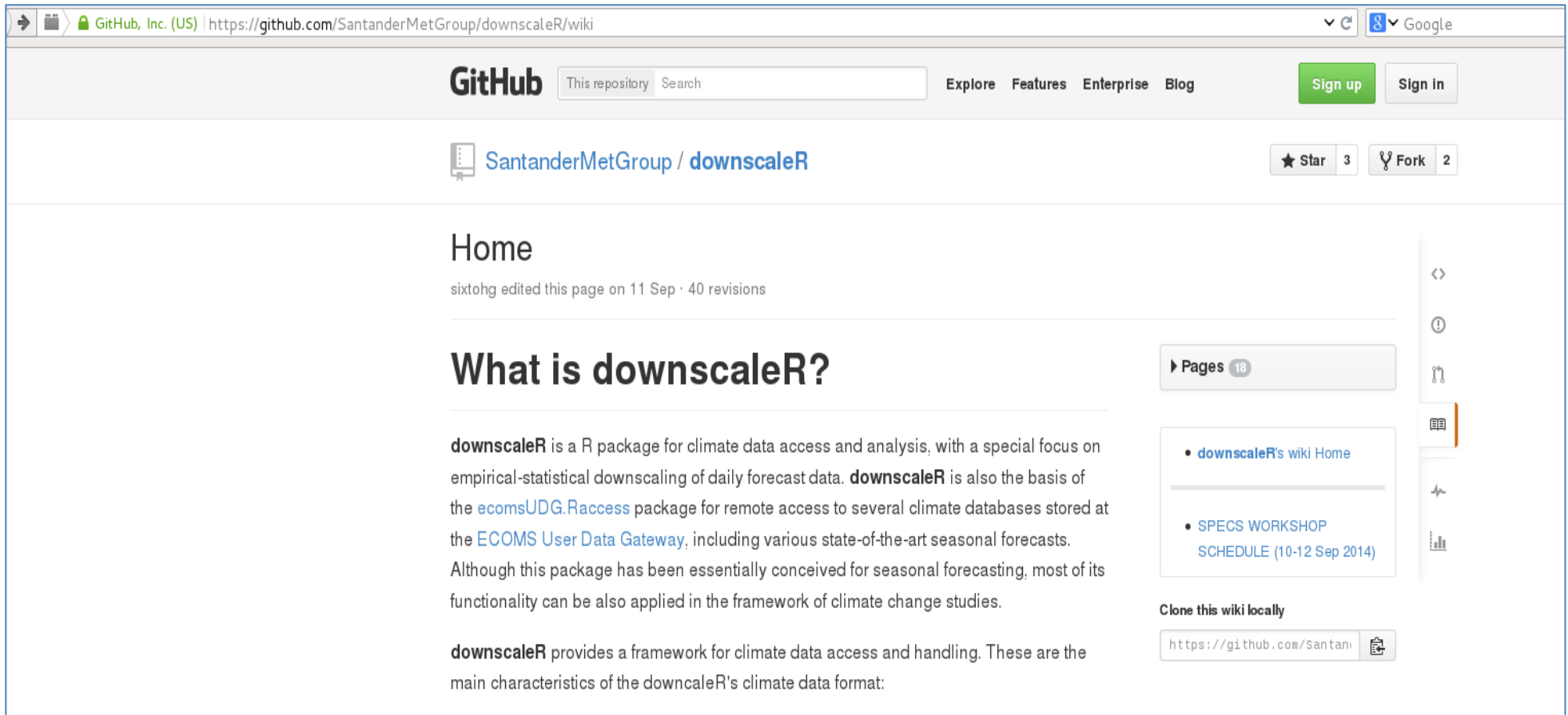


Example

```
tercileValidation(prd, obs = obs)
```



downscaleR's wiki:



The screenshot shows the GitHub wiki page for the `downscaleR` repository. The page title is "Home" and it was last edited by `sixtoh` on September 11. The main heading is "What is downscaleR?".

downscaleR is a R package for climate data access and analysis, with a special focus on empirical-statistical downscaling of daily forecast data. **downscaleR** is also the basis of the `ecomsUDG.Raccess` package for remote access to several climate databases stored at the [ECOMS User Data Gateway](#), including various state-of-the-art seasonal forecasts. Although this package has been essentially conceived for seasonal forecasting, most of its functionality can be also applied in the framework of climate change studies.

downscaleR provides a framework for climate data access and handling. These are the main characteristics of the downscaleR's climate data format:

On the right side of the page, there is a sidebar with a "Pages" section containing 18 items, including "downscaleR's wiki Home" and "SPECS WORKSHOP SCHEDULE (10-12 Sep 2014)". There is also a "Clone this wiki locally" button with the URL `https://github.com/Santani`.

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esd- Empirical and statistical downscaling package

- **Downscale climate information (variable or parameter) from large (global or regional) to local scales (station)**
- **Empirical-statistical relationships between a set of predictands and predictors**
- **Compare ESD to RCM results**
- **Main functionalities: data handling, data processing, downscaling and visualisations**

- The packages have different applications for the climate community
- They has been conceived for seasonal forecasting
- To install ecomsUDG.Raccess and downscaleR, it is important to take into account the dependencies between them

```
devtools::install_github(c("SantanderMetGroup/downscaleR.java@stable",  
"SantanderMetGroup/downscaleR@stable",  
"SantanderMetGroup/ecomsUDG.Raccess@stable"))
```

- The three packages are not available in CRAN yet



Climate Forecasting Unit



Dpto. Matemática Aplicada y
Ciencias de la Computación



Thank you!