# Preliminary work for statistical regionalization aplication

Proyect 9: Training in development and evaluation of statistical algorithms to obtain regionalized climate change scenarios.

Area of Climate Change Evaluation and Modelization

Irene Mestre Guillén
Eduardo Petisco de Lara

# Outline

1. Programming language learning
    - 1.1 Unix
    - 1.2 Fortran
    - 1.3 R

2. Preliminar activities
    - 2.1 Temperature gradient predictor
    - 2.2 Relative humidity data handling
    - 2.3 Maximum period of rainy days
    - 2.4 Data sorting by Autonomous Regions

3. Future Work

# 1. Programming lenguage learning

## 1.1 Unix

| Programms | Commands and functions learned |
|---|---|
| A) Userinfo | *"**echo**", "**date**" and "**who**"* |
| B) Greetings | "***read***" |
| C) Create file: | "***cd***" , "***mkfile***" and "***touch***" |
| D) Create directory | "***mkdir***", "***awk***" and loop "***for-do***". |
| E) Create file/directory | loop "***if***" and use of array |

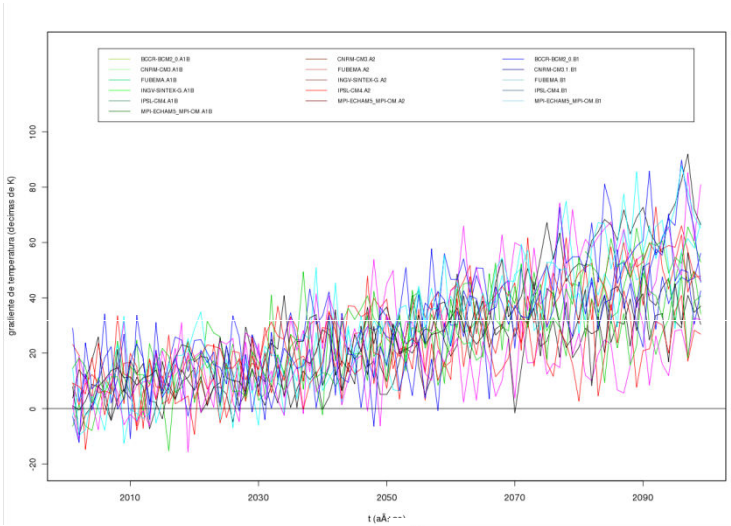
## 1.2 Fortran

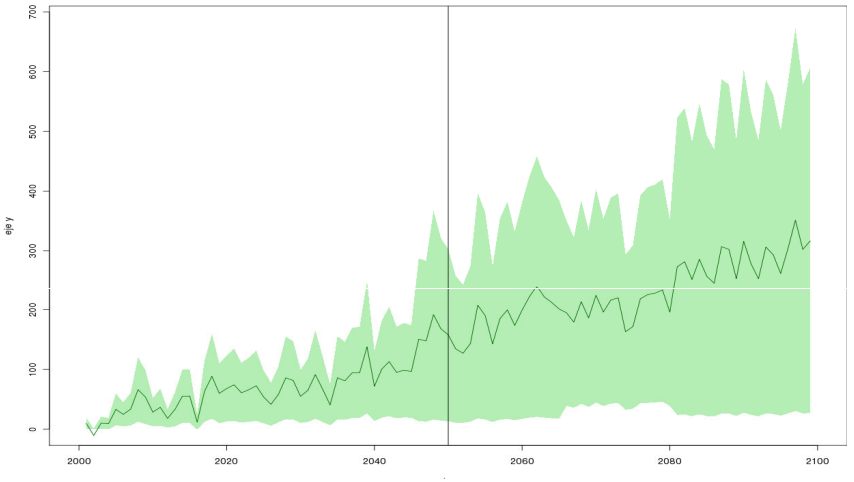
| Programms | Commands learned |
|---|---|
| A) Questions and answers | "***PRINT***", "***READ***", ***for*** loop , ***arrays*** and ***parameters*** |
| B) Integer part | "***MOD***" and "***if*** " loop |
| C) Split | "***Open***", "***Close***", "***read()***", "***write()***" and "***format()***" |
| D) Median | ***Allocatable arrays***, "***allocate***" and the ***nested loops*** |
| E) Linear equation system<br>F) Non linear equations | user defined ***functions***, ***"subroutines"*** and implementation of the ***bisection method*** |
| H) Percentile | ***Modules*** |

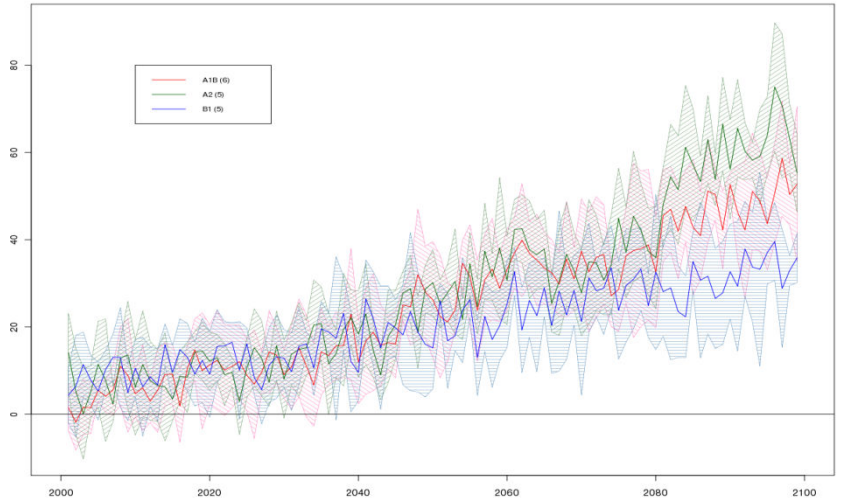
# 1.3 R

Data: increase in temperature (ºC). (2000-2099)

| | |
|---|---|
| **A1B** | BCCR-BCM2_0, CNRM-CM3, FUBEMA, INGV-SINTEX-G, IPSL-CM4, MPI-ECHAM5_MPI-OM |
| **A2** | CNRM-CM3, FUBEMA, INGV-SINTEX-G, IPSL-CM4, MPI-ECHAM5_MPI-OM |
| **B1** | CNRM-CM3.1, FUBEMA, IPSL-CM4, MPI-ECHAM5_MPI-OM |



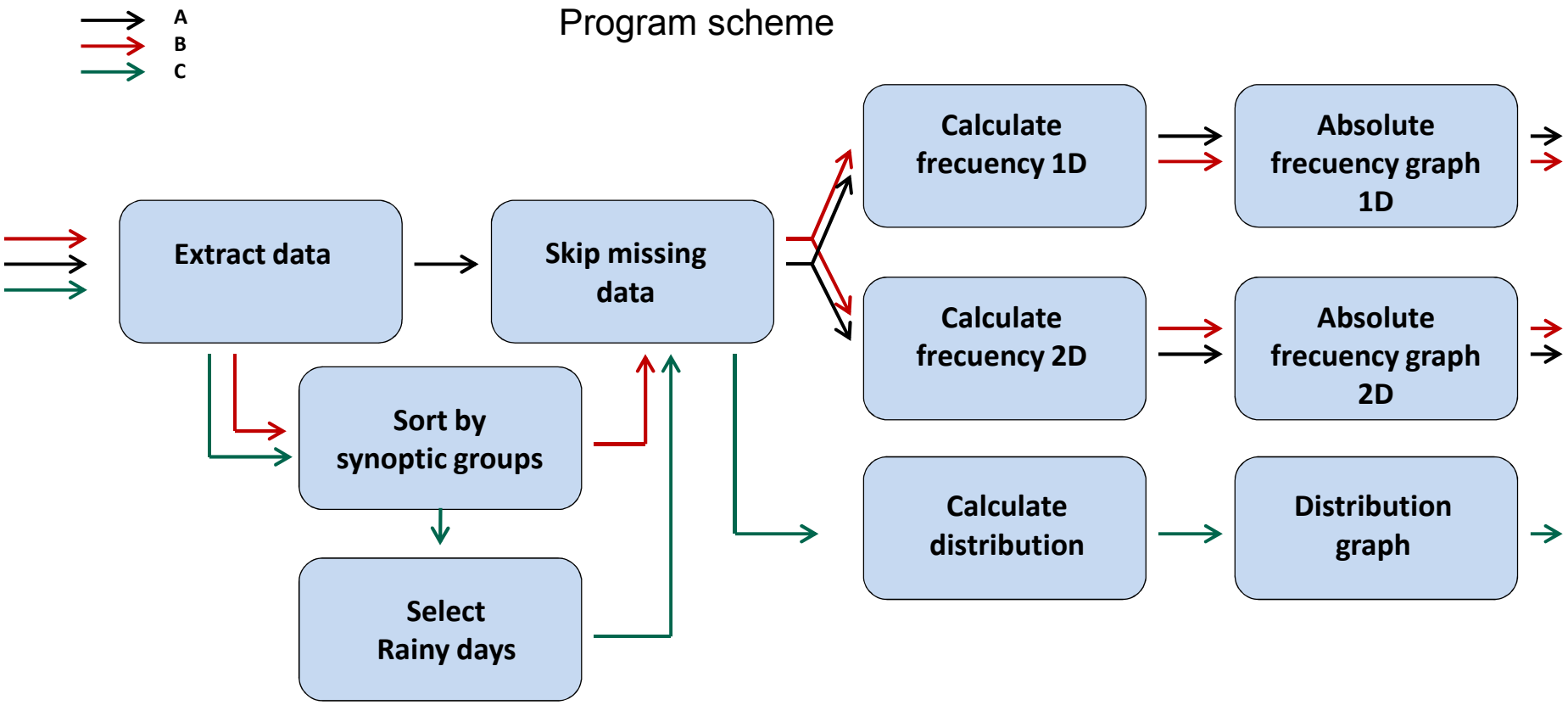



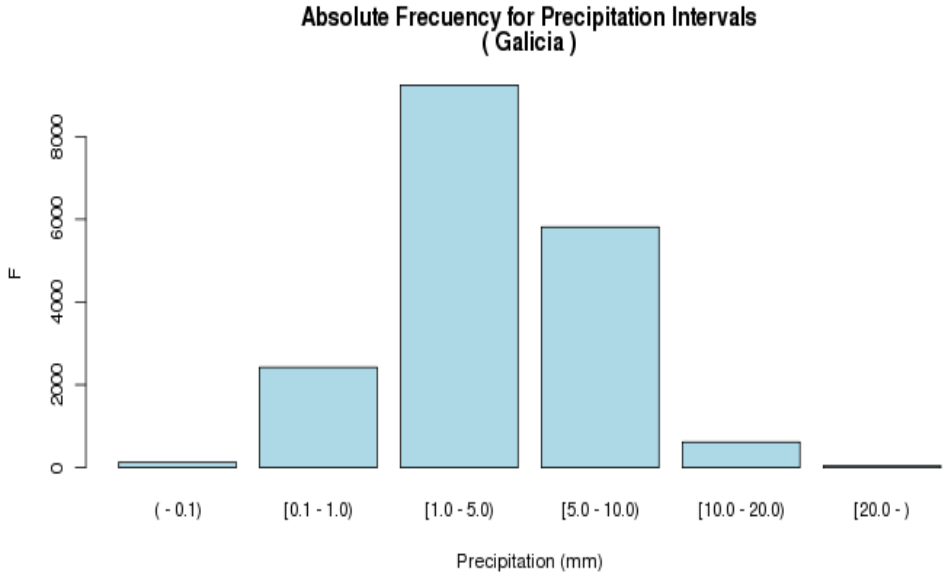
# 2. Preliminar Activities

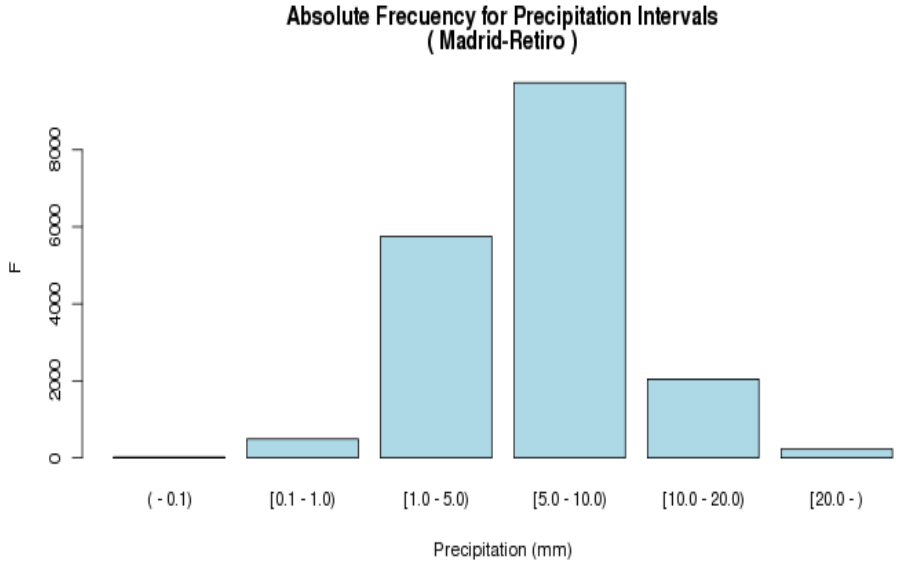
## 2.1 Temperature gradient predictor (R)

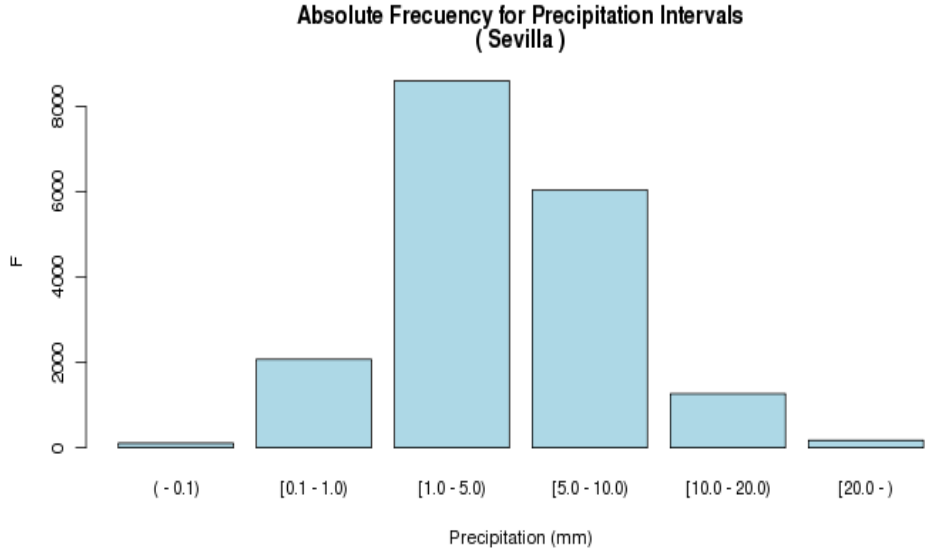
| | |
|---|---|
| **Objective** | ¿Is ΔT a good predictor for precipitation? |
| **Data** | T850 hPa, T500 hPa and p(dmm) for La Coruña (1387), Madrid-Retiro (3195), Sevilla (5783) and Valencia (8416) stations |
| **Time range** | From 01/01/1951 to 31/12/2005 (time step of 1 day) |
| **Special values** | -999 (no record) and -3.0 (p amount so weak to be measured) |

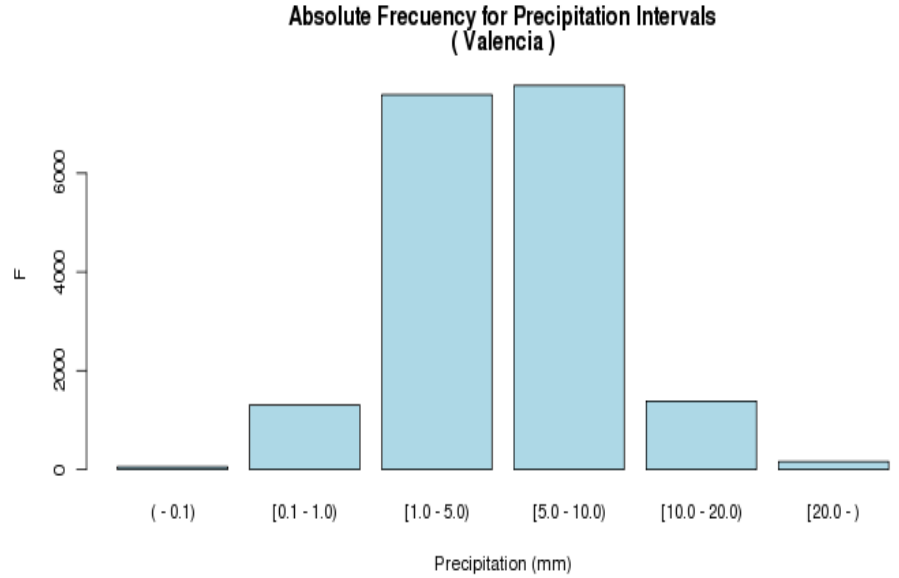


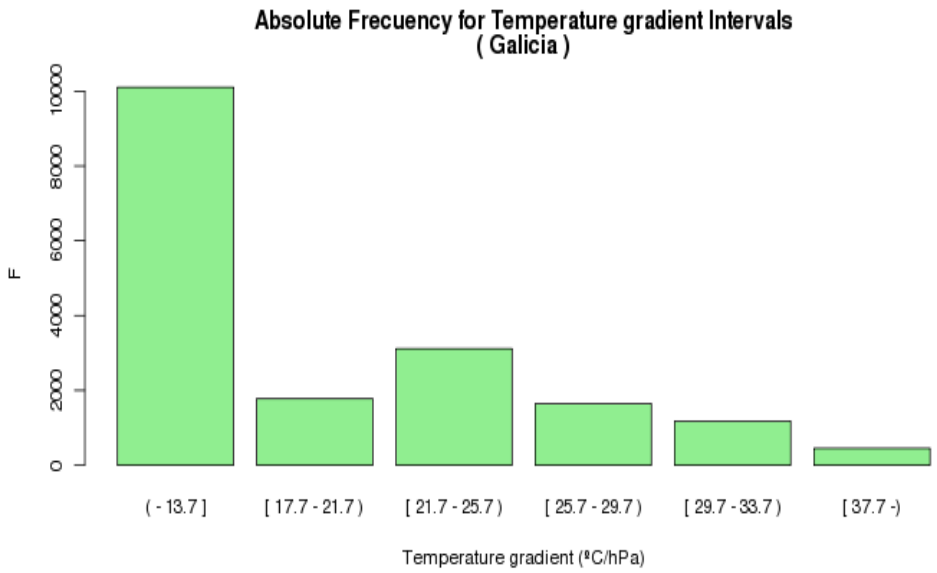
# A) ΔT and p intervals

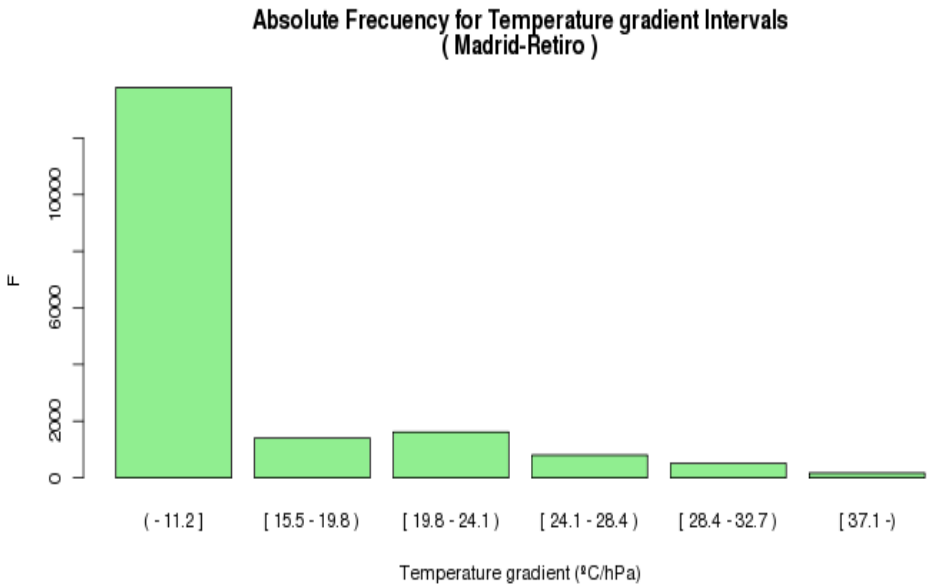


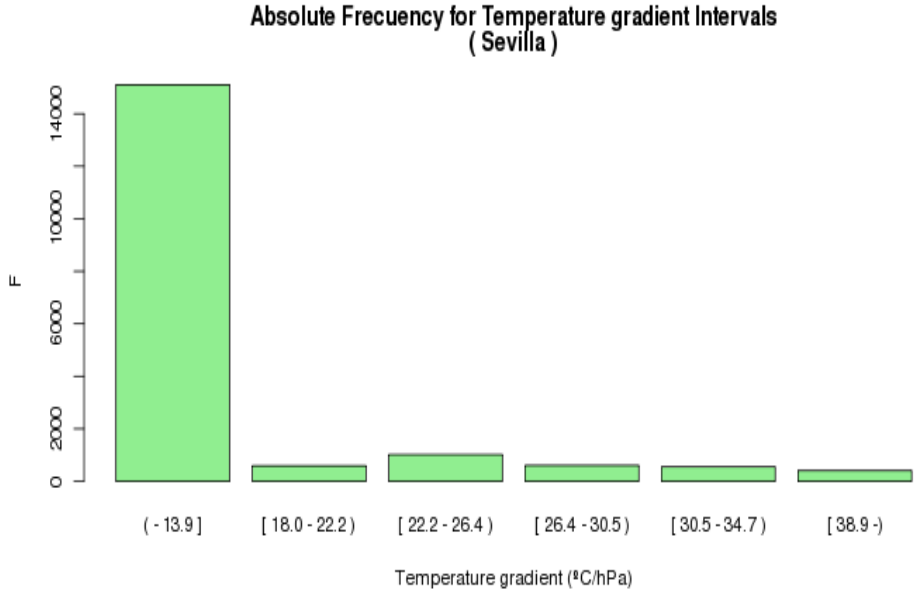



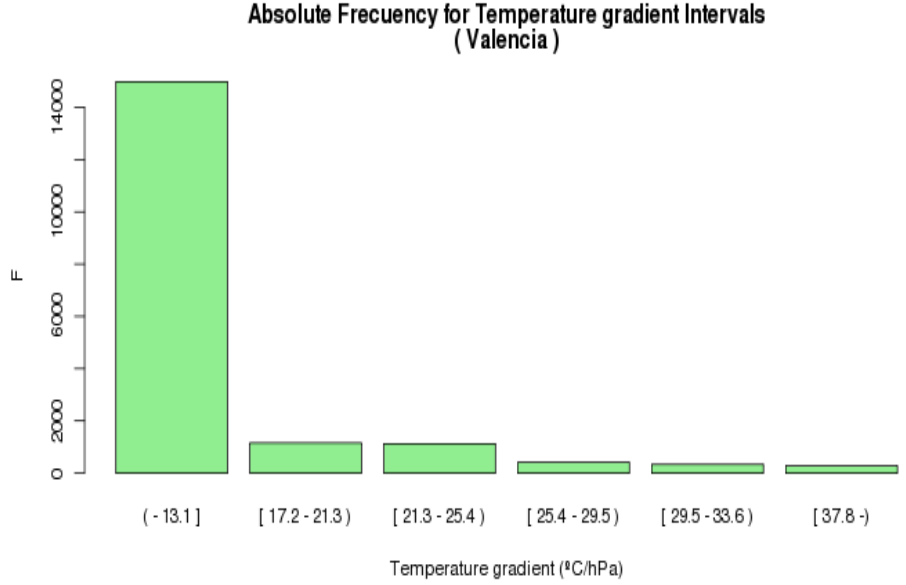



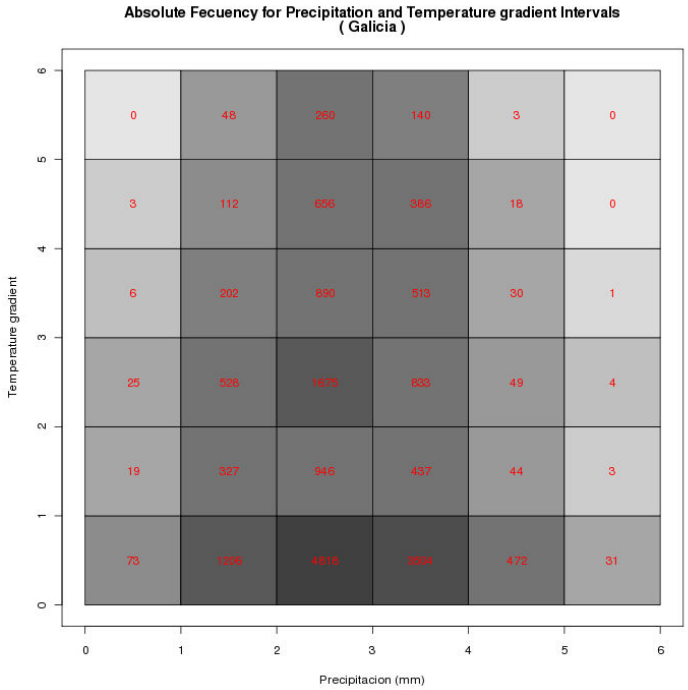



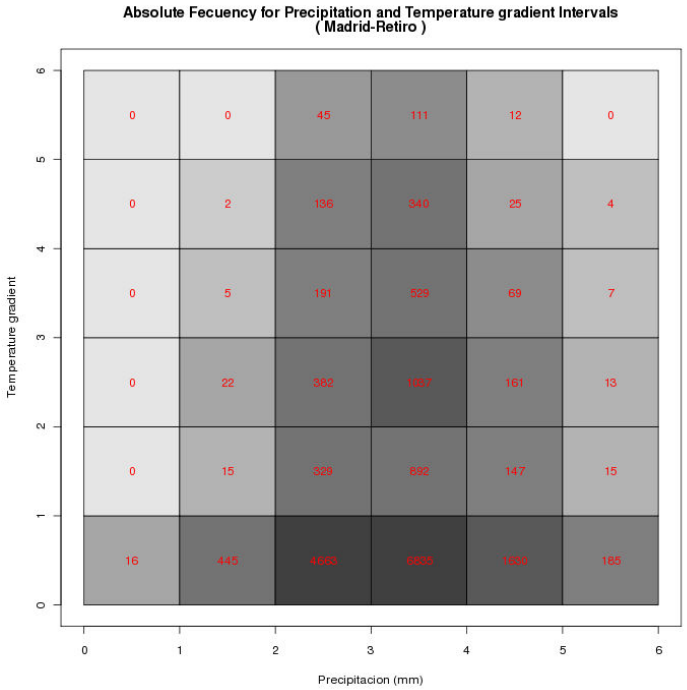

Absolute Frecuency for Temperature gradient Intervals
( Galicia )
F
0
2000
4000
6000
8000
10000
( - 13.7 ]
[ 17.7 - 21.7 )
[ 21.7 - 25.7 )
[ 25.7 - 29.7 )
[ 29.7 - 33.7 )
[ 37.7 -)
Temperature gradient (ºC/hPa)

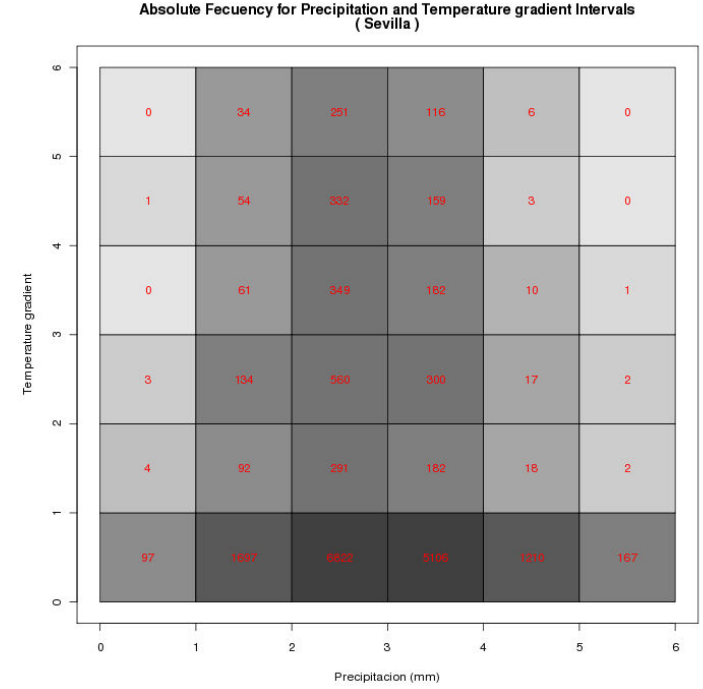

Absolute Frecuency for Temperature gradient Intervals
( Madrid-Retiro )
F
0
2000
6000
10000
( - 11.2 ]
[ 15.5 - 19.8 )
[ 19.8 - 24.1 )
[ 24.1 - 28.4 )
[ 28.4 - 32.7 )
[ 37.1 -)
Temperature gradient (ºC/hPa)

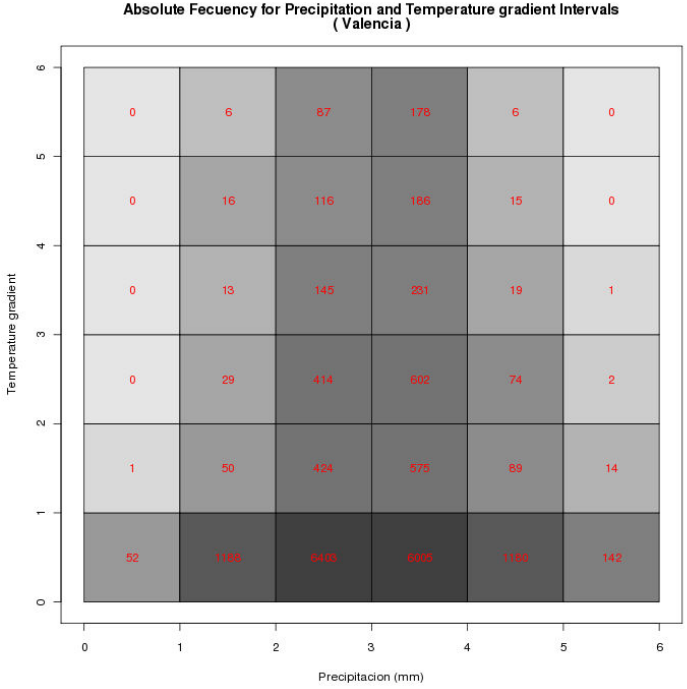

Absolute Frecuency for Temperature gradient Intervals
( Sevilla )
F
0
2000
6000
10000
14000
( - 13.9 ]
[ 18.0 - 22.2 )
[ 22.2 - 26.4 )
[ 26.4 - 30.5 )
[ 30.5 - 34.7 )
[ 38.9 -)
Temperature gradient (ºC/hPa)


Absolute Frecuency for Temperature gradient Intervals
( Valencia )
F
0
2000
6000
10000
14000
( - 13.1 ]
[ 17.2 - 21.3 )
[ 21.3 - 25.4 )
[ 25.4 - 29.5 )
[ 29.5 - 33.6 )
[ 37.8 -)
Temperature gradient (ºC/hPa)

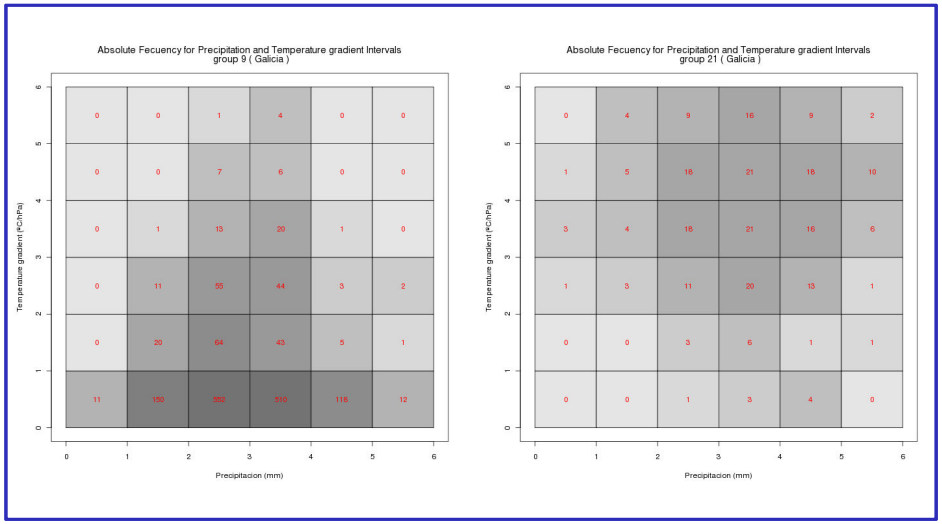

Absolute Fecuency for Precipitation and Temperature gradient Intervals
( Galicia )
Temperature gradient
Precipitacion (mm)
0 48 260 140 3 0
3 112 656 366 18 0
6 202 890 513 30 1
25 528 1679 833 49 4
19 327 946 437 44 3
73 1398 4818 2554 472 31

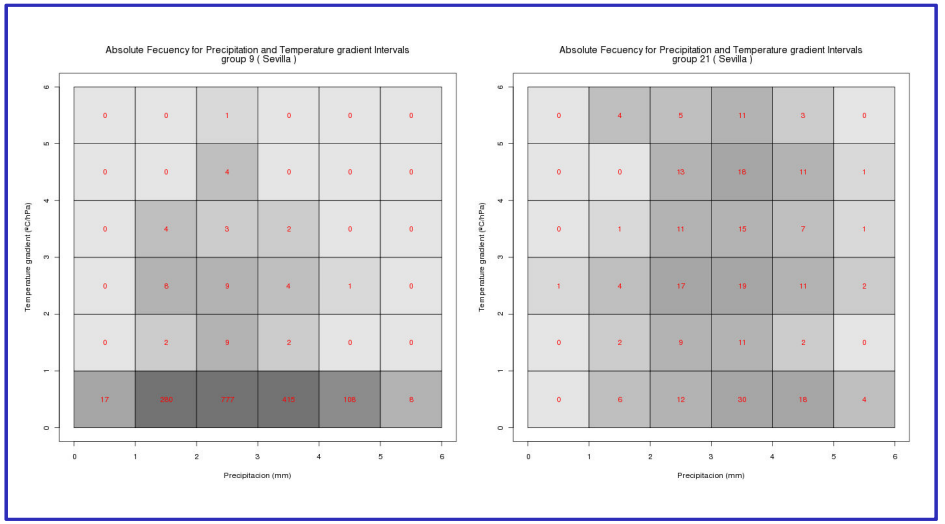

Absolute Fecuency for Precipitation and Temperature gradient Intervals
( Madrid-Retiro )
Temperature gradient
Precipitacion (mm)
0 0 45 111 12 0
0 2 136 340 25 4
0 5 191 529 69 7
0 22 382 1027 161 13
0 15 329 892 147 15
16 445 4663 6825 1539 185

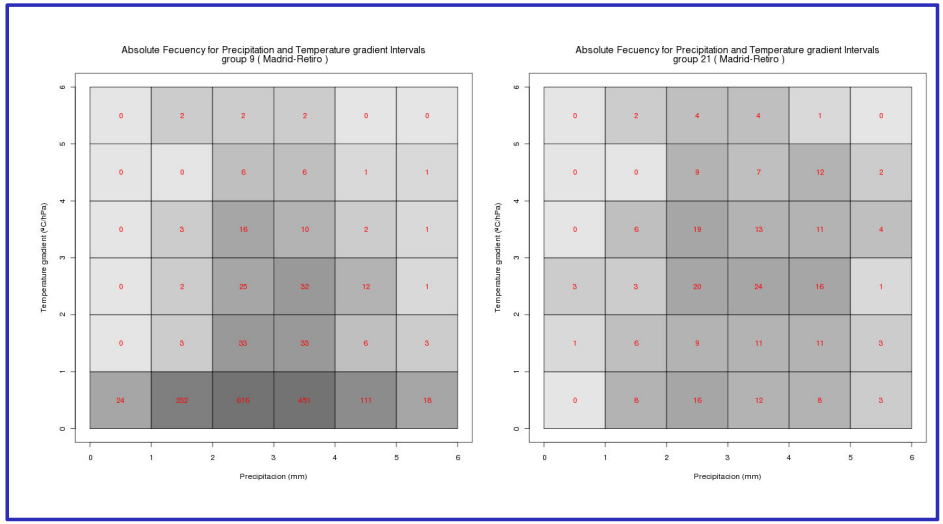

Absolute Fecuency for Precipitation and Temperature gradient Intervals
( Sevilla )
Temperature gradient
Precipitacion (mm)
0 34 251 116 6 0
1 54 332 159 3 0
0 61 349 182 10 1
3 134 560 308 17 2
4 92 291 182 18 2
97 1627 5822 5196 1219 167

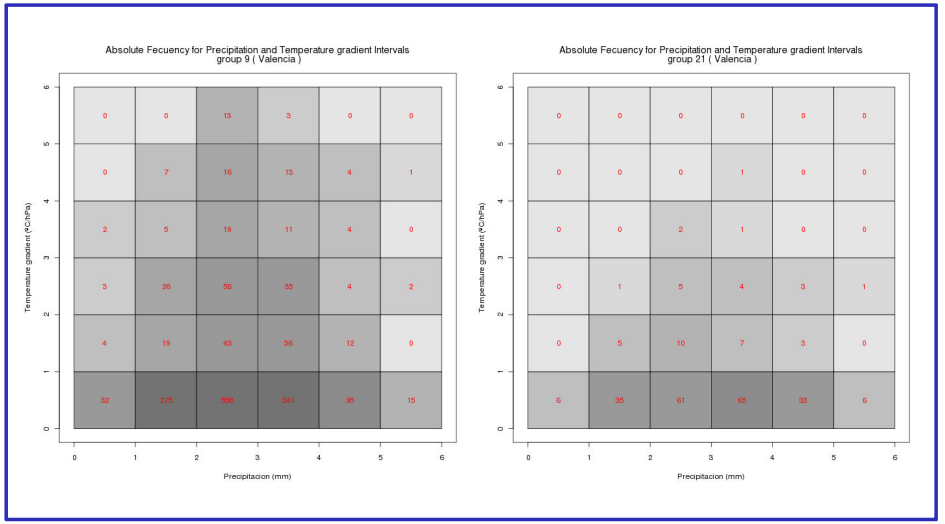

Absolute Fecuency for Precipitation and Temperature gradient Intervals
( Valencia )
Temperature gradient
Precipitacion (mm)
0 6 87 178 6 0
0 16 116 186 15 0
0 13 145 231 19 1
0 29 414 602 74 2
1 50 424 575 89 14
52 1163 6403 6905 1136 142

# B) ΔT and p intervals for different sinoptic groups

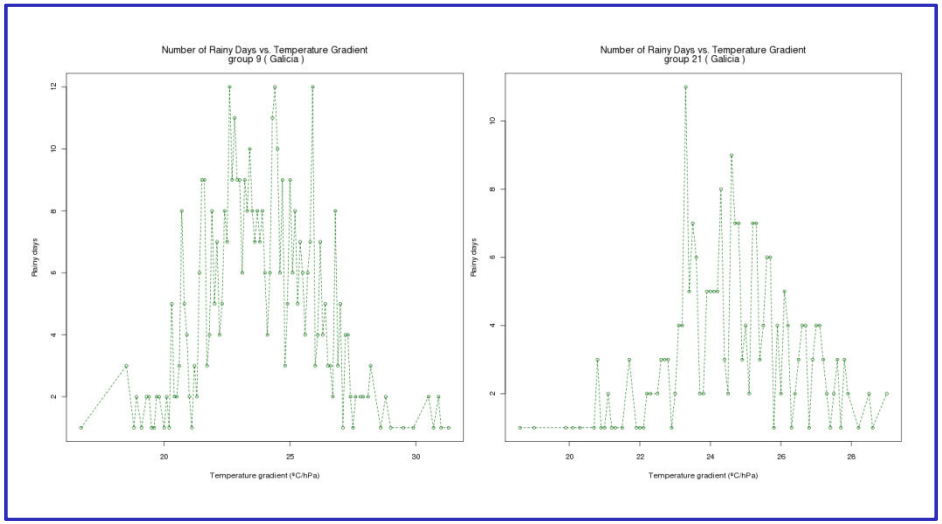


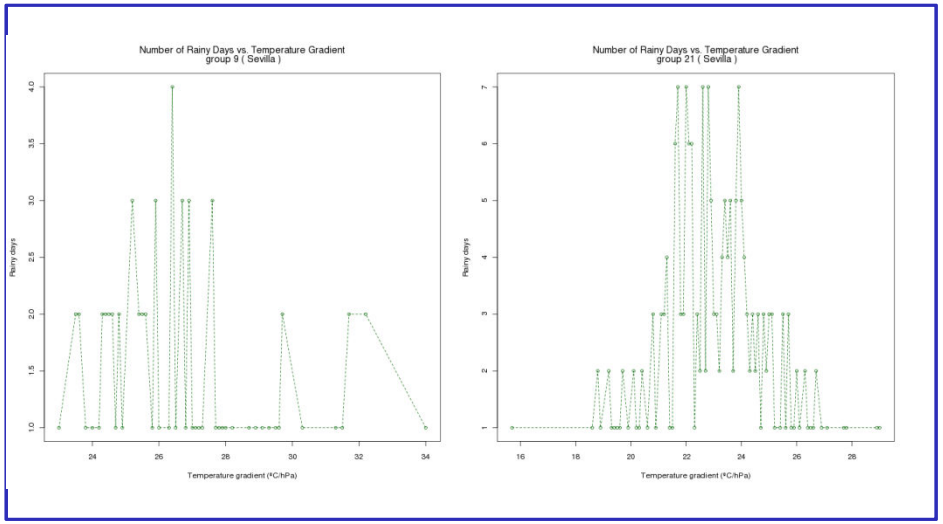



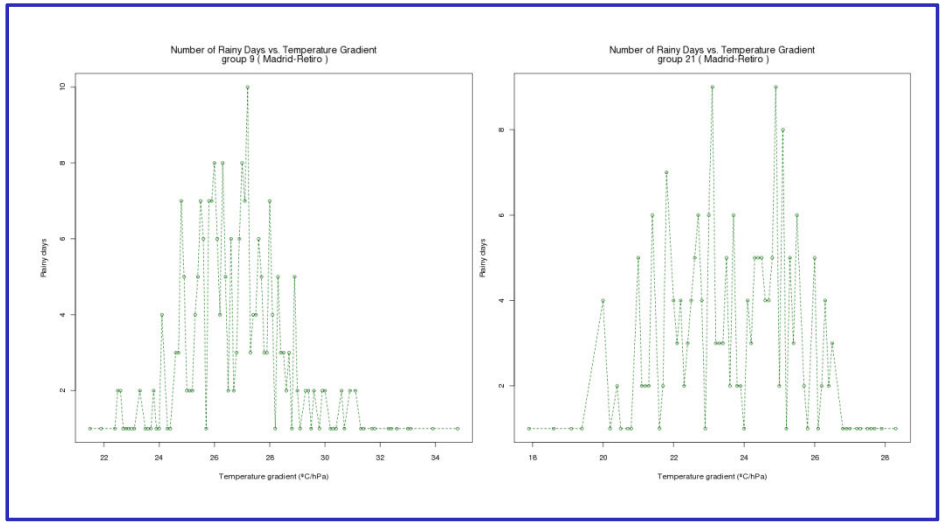



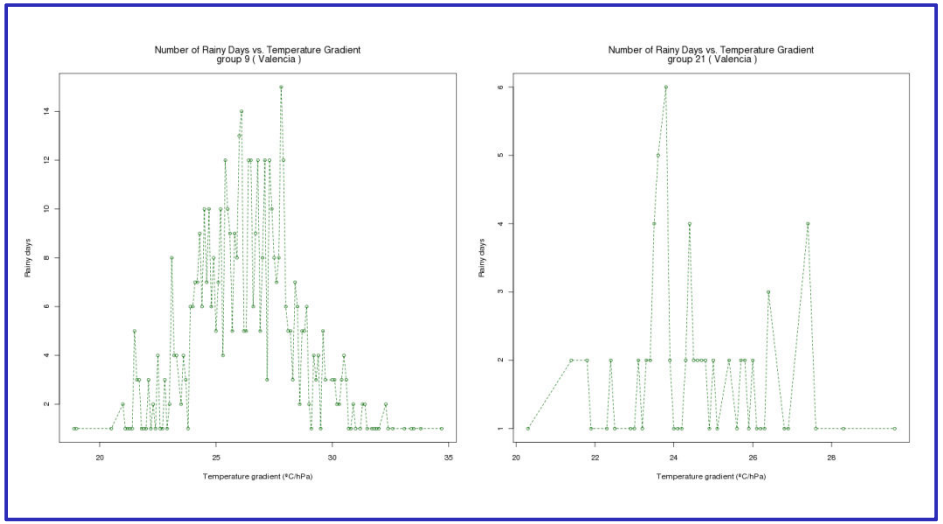



# C) Number of rainy days for each ΔT value for different sinoptic groups



# 2.2 Relative humidity data handling

Programming language: Unix and Fortran

Objective: learn to reac .nc files and call fortran programms from an unix script.

Data: mean daily relative humidity data at 850 and 1000 hPa in a 24 node grid (42.5N to 35.0 N and 7.5 W to -5.0 E ). Time range 01/01/1951 to 31/12/2005.

# 2.3 Maximum dry period

Programming language: Unix and Fortran

Objective: calculate the maximum dry period for different models, periods and scenarios.

Data: daily data of prec for all observatories in Spain

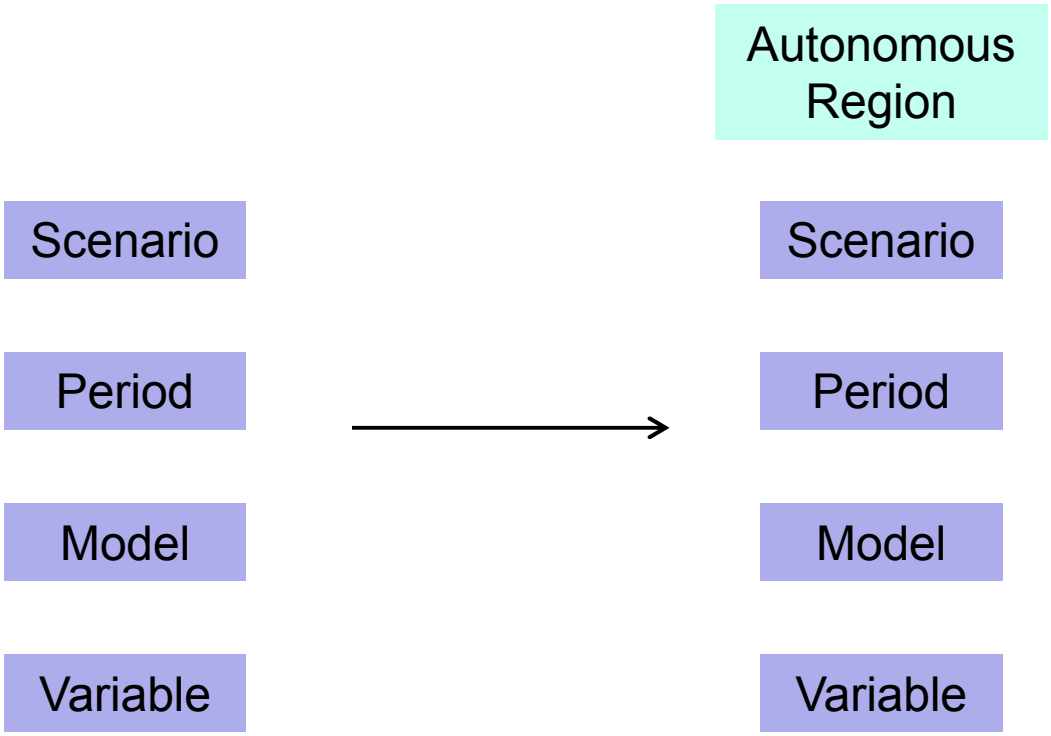
| | | | | |
|---|---|---|---|---|
| **giss_aom** | 20c3m | m_sresa1b | | m_sresb1 (2046-65) |
| **giss_model_e_r** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 |
| **inmcm3_0** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 |
| **miub_echo_g** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 (2046-65) |
| **mri_cgcm2_3_2a** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 |
| **mpi_echam5** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 |
| **cccma_cgcm3_1** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 (2081-00) |
| **cccma_cgcm3_1_t63** | 20c3m | m_sresa1b | | m_sresb1 |
| **gfdl_cm2_1** | 20c3m | m_sresa1b | m_sresa2 | m_sresb1 |

# 2.4 Data sorting by Autonomous Regions

Programming language: Unix

Objective: sort data from different observatories by “comunidades autónomas”.

Data: p for all observatories in Spain, different scenarios, models and time ranges and the correspondance between observatorie code and Comunidad Autónoma. The models and scenarios folder scheme is the same as the previous programm.



# Future work

1. Obtentain data of models from the 5º IPCC Report in order to obtain new regionalized climate change scenarios.

2. Integrate the statistical regionalization programms developed so far in a unique aplication for the obtention of regionalized climate change scenarios.

3. Explore new algorithms for statistical regionalization.