United Nations
Educational, Scientific and
Cultural Organization
1945-2015

International
Hydrological
Programme

RALCEA EUROPE LATIN AMERICA

CAZALAC

Applicación de simgen al Valle del Huasco

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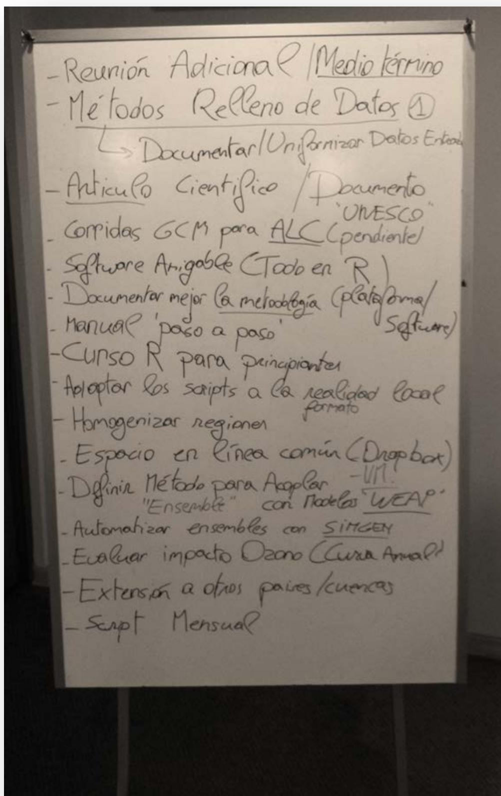
Zonas Aridas
CAZALAC

Managing Water Resources in Arid and Semi-Arid Regions of Latin America and the Caribbean

Providing the Tools to Identify Climate Risks

5) Provide Water Resources Projections at the Near Term Climate Change Horizon

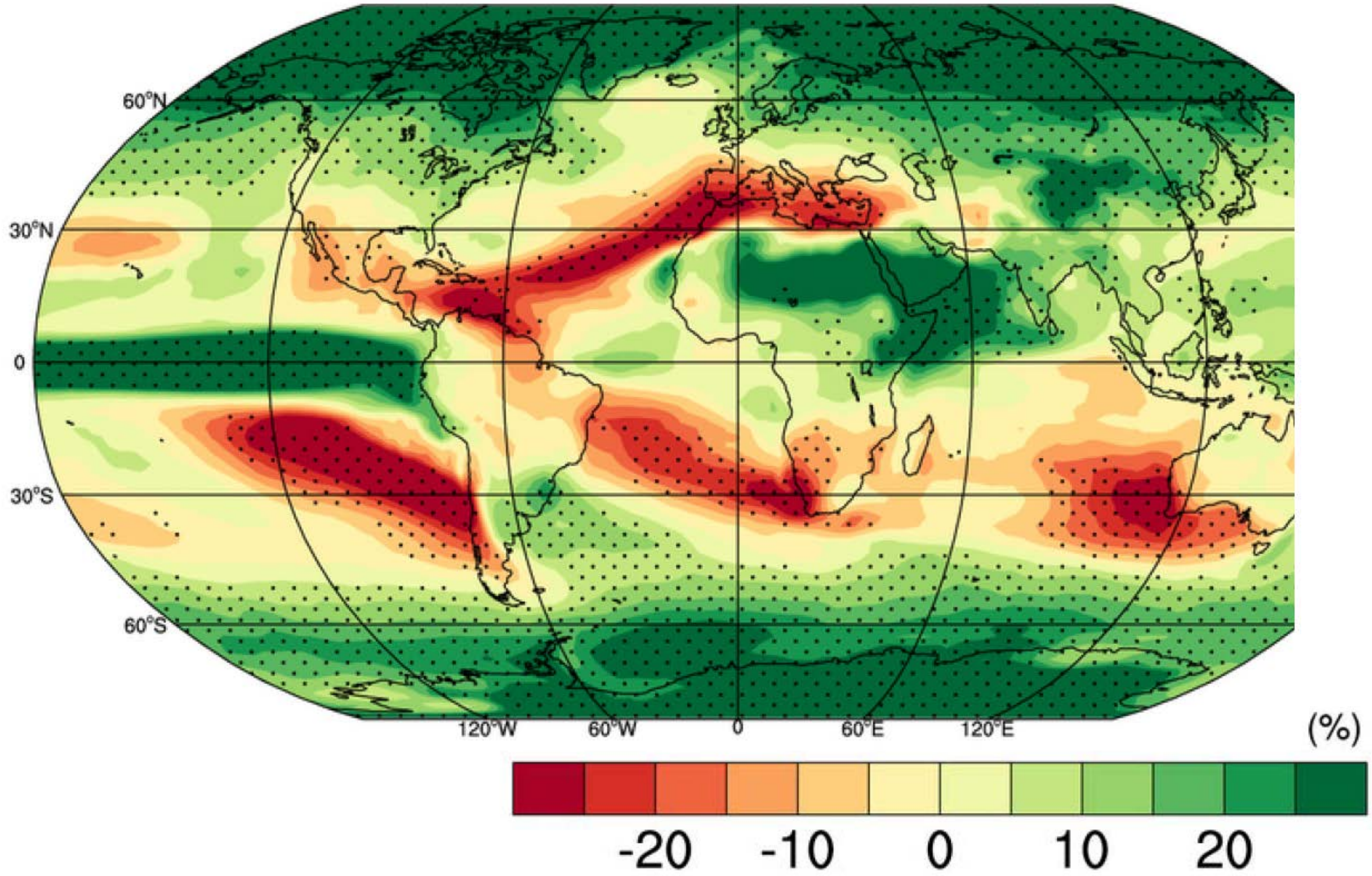
Primer taller en La Serena, 4-8 de Agosto de 2014



Identificación de desafíos futuros

- Aplicación en el caso de falta de datos (relleno de datos)
- Evaluar la relación entre los modelos globales climáticos (GCM) y el clima observado
- Evaluar las tendencias futuras de los GCM para las cuencas pilotos de forma automática
- Regionalizar, dado que la metodología requiere identificar las estaciones discordantes.
- Generar manual de uso integral
- Generar un caso de estudio aplicado a modelos de gestión de cuencas (p.e. WEAP)
- Aplicar la metodología a cuencas piloto: Chile (Huasco), Perú (Chancay, Huaral y Chillón) y Colombia (Neusa).
- <u>realizar una reunión adicional 'medio término'</u>

Como conseguir las proyecciones para cada cuenca piloto?



Polade et al., Nature, 2014

Promedio de precipitación proyectada utilizando todos los modelos CMIP5

Valores del periodo 2060–2089 con respecto al periodo 1960–1989, utilizando el escenario RCP8.5. Puntos indican regiones donde por lo menos 70% de los modelos concuerdan en el signo del cambio

Que información se requiere para cada cuenca piloto?

Greene et al. (2012)

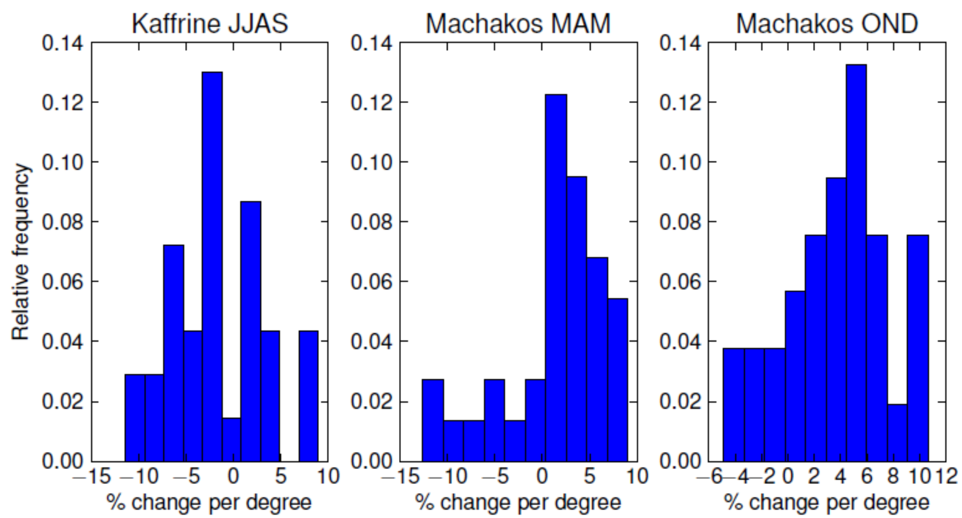


Figure 14: Probability distribution functions for local precipitation sensitivity for each of the regional/seasonal targets. The values express the percent change in local precipitation per degree global warming.

Vinculo entre CMIP5 y Simgen

CMIP5

Promedio de todas los modelos CMIP5

Desviación estándar de todas los modelos CMIP5

Como conseguir las proyecciones para cada cuenca piloto?

Fuente de Información

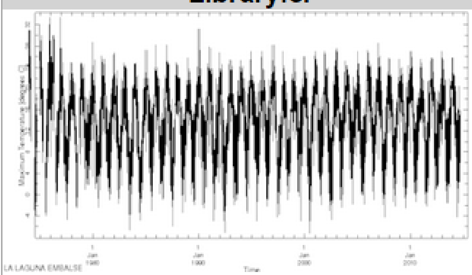
www.climatedatalibrary.cl

Chile
Climate Data Library

Climate Data Library

The Data Library is a powerful and freely accessible online data repository and analysis tool that allows a user to view, analyze, and climate-related data through a standard web browser.

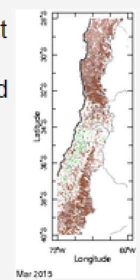
Nuevas Adiciones al Climate Data Library.cl



Se agregó una nueva base de datos de temperatura diario histórica (1900-2014) al Climate Data Library.cl, proveniente del Banco Nacional de Aguas (BNA) de la Dirección General de Aguas (DGA).

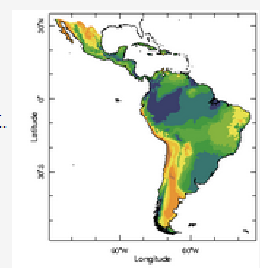
Agroclimatic Observatory (UNEA)

The Drought Observatory is a collection of maps and other figures that monitor drought at present, near future and in the recent past. The maps and figures can be manipulated and are linked to the original data.



Drought and Dryland Atlas of Latin America and the Caribbean (CAZALAC)

The maproom is a collection of maps and other figures that give insight into dryland distribution in Latin America and the Caribbean and on the vulnerability to drought.



Navigating Through the IRI Data Library: A Tutorial

The goal of this tutorial is to introduce you to the structure of the Data Library and the many ways to navigate through it.

Data by Source

Datasets organized by source, i.e. creator and/or provider.

Statistical Techniques in the Data Library: A Tutorial

Statistical techniques are essential tools for analyzing large datasets; this statistics tutorial thus covers essential skills for many data library users.

Help Resources

The Help Resources include basic and statistics tutorials, function documentation, and other resources to help you get the maximum utility out of the Data Library

IRI

Data Library

Finding Data
Tutorial
Questions and Answers
Function Documentation

help

WCRP CMIP5 options | Help | Expert Mode

SOURCES | WCRP | CMIP5

WCRP CMIP5

CMIP5 from WCRP: Wor

Documents

overview an outline showi

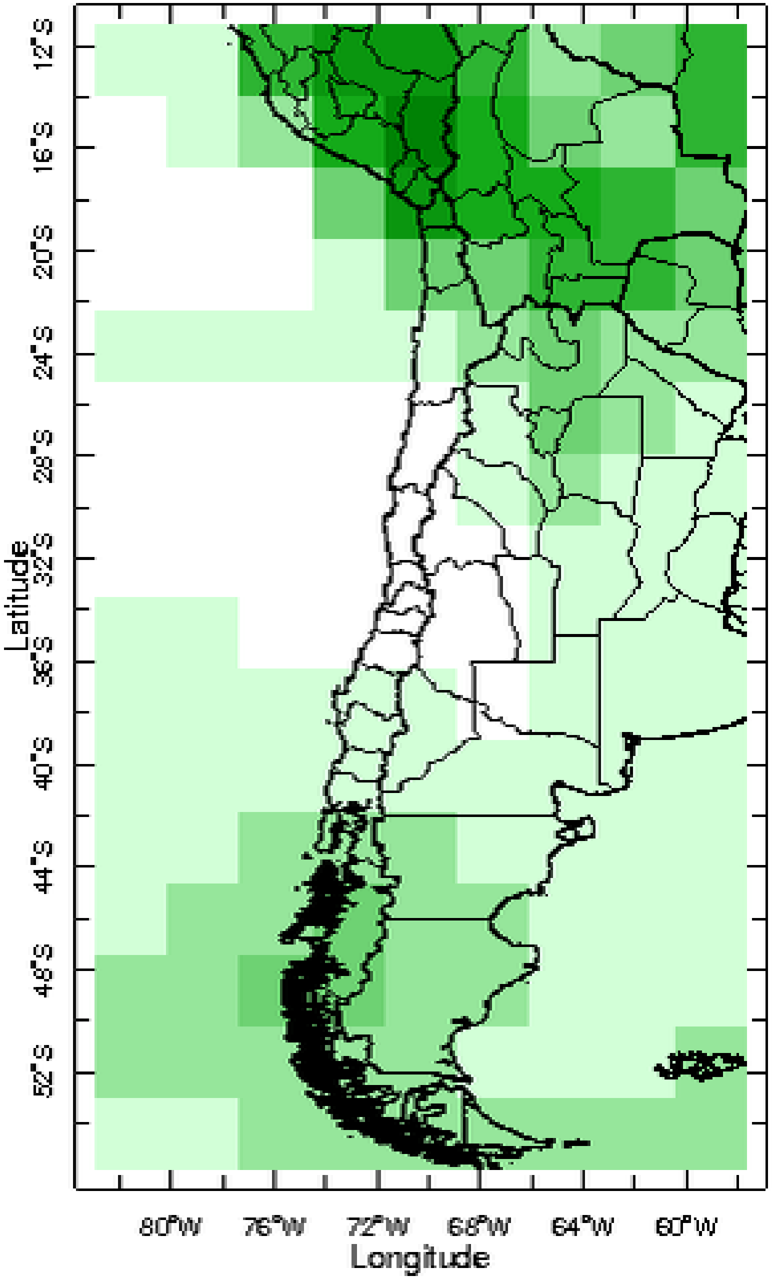
Datasets and variables

Historical	WCRP CMIP5 Historical[**MON**
rcp26	WCRP CMIP5 rcp26[**MONTHL**
rcp85	WCRP CMIP5 rcp85[**MONTHL**

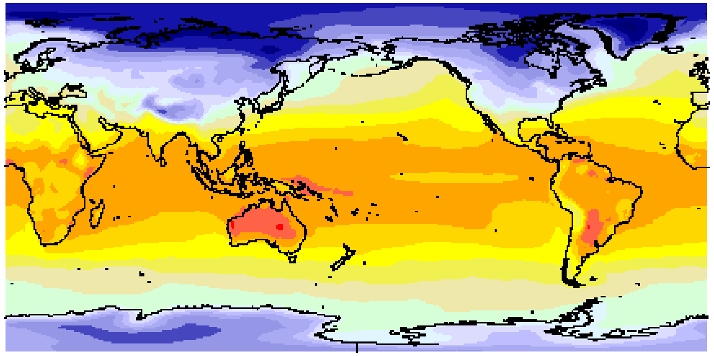
Last updated: *Wed, 03 Jun 2015 12:43:54 G*

ACCESS1-0	WCRP CMIP5 rcp85 MONTHLY ACCESS1-0[**pr tas**]
ACCESS1-3	ACCESS1-3 model output prepared for CMIP5 RCP8.5.
bcc-csm1-1	bcc-csm1-1 model output prepared for CMIP5 RCP8.5.
bcc-csm1-1-m	bcc-csm1-1-m model output prepared for CMIP5 RCP8.5.
BNU-ESM	BNU-ESM model output prepared for CMIP5 RCP8.5.
CanESM2	CanESM2 model output prepared for CMIP5 RCP8.5.
CCSM4	CCSM4 model output prepared for CMIP5 RCP8.5.
CESM1-BGC	CESM1-BGC model output prepared for CMIP5 RCP8.5.
CESM1-CAM5	CESM1-CAM5 model output prepared for CMIP5 RCP8.5.
CESM1-CAM5-1-FV2	CESM1-CAM5.1-FV2 model output prepared for CMIP5 RCP8.5.
CESM1-WACCM	CESM1-WACCM model output prepared for CMIP5 RCP8.5.
CMCC-CESM	CMCC-CESM model output prepared for CMIP5 RCP8.5.
CMCC-CM	CMCC-CM model output prepared for CMIP5 RCP8.5.
CMCC-CMS	CMCC-CMS model output prepared for CMIP5 RCP8.5.
CNRM-CM5	CNRM-CM5 model output prepared for CMIP5 RCP8.5.
CSIRO-Mk3-6-0	CSIRO-Mk3-6-0 model output prepared for CMIP5 RCP8.5.
EC-EARTH	EC-EARTH model output prepared for CMIP5 RCP8.5.
FGOALS-g2	FGOALS_g2 model output prepared for CMIP5 RCP8.5.
FGOALS-s2	FGOALS-s2 model output prepared for CMIP5 rcp85.
FIO-ESM	FIO-ESM model output prepared for CMIP5 RCP8.5.
GFDL-CM3	WCRP CMIP5 rcp85 MONTHLY GFDL-CM3[**pr tas**]

(clic para acceder)



2006



Jan 2020

~ 40 Modelos
1850 – 2100
Pp, T.

Se establece un área de estudio

- Considerar un área: ~ 100 [km] * ~100 [km]

```
#Study area
#-----------
#- Huasco Basin is established as study area (as an example).

#Study area boundaries
LongMin <- -70.7
LongMax <- -70.2
LatMin <- -28.8
LatMax <- -28.0


#
```

Lectura de fechas de Modelos

Datasets and variables

Precipitation	WCRP CMIP5 rcp85 MONTHLY BNU-ESM pr[X Y | T]
Near-Surface Air Temperature	WCRP CMIP5 rcp85 MONTHLY BNU-ESM tas[X Y | T]

Independent Variables (Grids)

Time (time) grid: /T (months since 1960-01-01) ordered (Jan 2006) to (Dec 2100) by 1.0 N= 1140 pts :grid

Descarga de información (Pp y T)

Partial Information Formats These files contain only some of the available metadata.	
Columnar Table	A table with separate columns of numbers foi this size. This file will be approximately 149
2-Dimensional Tab-Separated Tables Y X Table X Y Table	Tab-separated-values (tsv) file with informati across the top of the table (identifing columns
GIS-Compatible Formats There are three GIS-compatible formats available.	
2-Dimensional Table	A 2-dimensional ascii file that includes an Ar
IDA Image	File(s) in the Image Display and Analysis fon
LAN Image	File(s) in the ERDAS LAN format. Typically
GeoTIFF Image	File in GeoTIFF format. Typically used with

Data Only Formats These files contain just the data without any of the available metad	
Binary direct access	A big-endian, ieee single-precision file in floa information. The data is structured to corresp
DEC ALPHA direct access	Same as the binary random/direct access forn

Formateo

- USO DE SCRIPT DE CADA PAÍS PARA FORMATEAR DATOS.

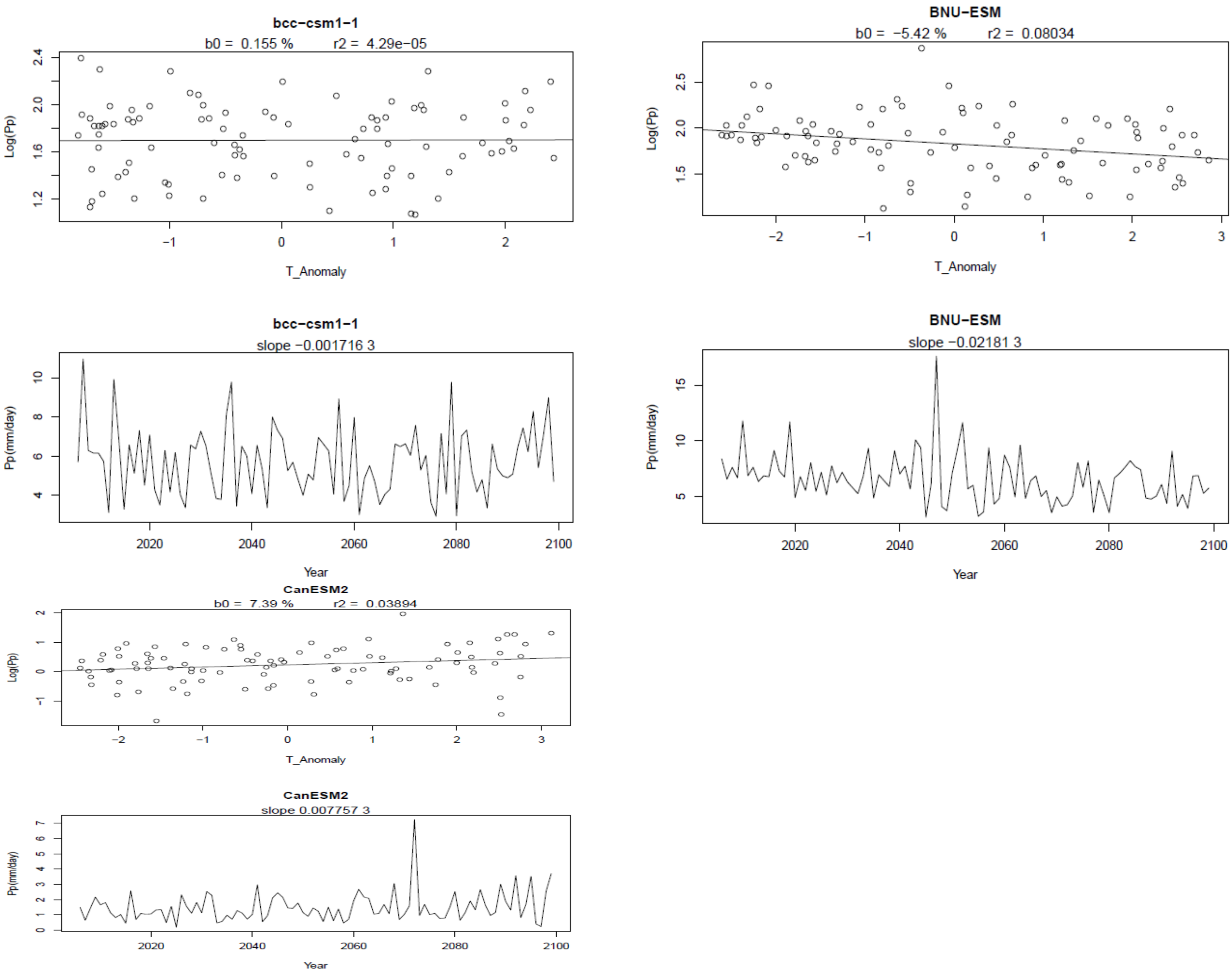
year	yday	t_min	t_max	precip	solar	date
1971	121	10.0	15.3	0.0	4.7	1971-05-01
1971	122	4.4	16.7	0.0	4.6	1971-05-02
1971	123	2.8	14.3	0.0	4.6	1971-05-03
1971	124	3.7	13.4	0.0	4.5	1971-05-04
1971	125	3.7	13.4	0.0	4.5	1971-05-05
1971	126	7.3	16.0	0.0	4.4	1971-05-06
1971	127	10.4	14.3	0.0	4.4	1971-05-07
1971	128	8.8	17.8	0.0	4.4	1971-05-08
1971	129	8.0	17.3	0.0	4.3	1971-05-09
1971	130	7.3	20.2	0.0	4.3	1971-05-10
1971	131	5.0	21.2	0.0	4.3	1971-05-11
1971	132	6.3	21.3	0.0	4.3	1971-05-12
1971	133	8.3	18.3	0.0	4.2	1971-05-13
1971	134	3.0	18.3	0.0	4.2	1971-05-14

Correlación

Modelo	CO_3802005_CMCC_CM_1960-2099.txt_completo.csv	CO_3802006_CMCC_CM_1960-2099.txt_completo.csv
ACCESS1-0	0.16526204	0.14731288
ACCESS1-3	0.07007153	0.05083420
bcc-csm1-1	0.27570407	0.25754900
bcc-csm1-1-m	0.15528471	0.14598454
BNU-ESM	0.23947247	0.25112929
CanESM2	0.27178609	0.29951491
CCSM4	0.14428084	0.13059621
CESM1-BGC	0.08278791	0.07589253
CESM1-CAM5	0.20167714	0.21845445
CESM1-CAM5-1-FV2	0.06544875	0.05431255
CESM1-WACCM	0.02646196	0.02305312
CMCC-CESM	0.31200061	0.32752740
CMCC-CM	0.90355186	0.92689212
CMCC-CMS	0.16720641	0.16319902
CNRM-CM5	0.11169768	0.10822347

En base al promedio de TODAS las estaciones

Definir un umbral, de tal manera de descartar modelos con poca correlación


bcc−csm1−1
b0 = 0.155 % r2 = 4.29e−05
Log(Pp)
T_Anomaly
BNU−ESM
b0 = −5.42 % r2 = 0.08034
Log(Pp)
T_Anomaly
bcc−csm1−1
slope −0.001716 3
Pp(mm/day)
Year
BNU−ESM
slope −0.02181 3
Pp(mm/day)
Year
CanESM2
b0 = 7.39 % r2 = 0.03894
Log(Pp)
T_Anomaly
CanESM2
slope 0.007757 3
Pp(mm/day)
Year

CMIP5_Model	b0
bcc-csm1-1	0.15480356
BNU-ESM	-5.42340886
CanESM2	7.38690147
CESM1-CAM5	1.31463420
CMCC-CESM	4.34183241
CMCC-CM	-13.13252301
CSIRO-Mk3-6-0	-0.92737918
EC-EARTH	-9.11264117
FGOALS-g2	-12.73553770
FGOALS-s2	-0.50867390
FIO-ESM	-1.33598400
GFDL-ESM2G	-30.02330701
GFDL-ESM2M	-25.28941089
GISS-E2-R	13.76523750
GISS-E2-R-CC	-0.38725203

Mean
SD
(a partir de b0)

```
> Parameters
$mean
[1] -2.352875

$sd
[1] 15.4637

>
```

1) Ubicarse en la carpeta correcta

pwd (present working directory)

cd /media/compartido/simgen_Huasco (change directory)

ls (list directory)

```
simgen@simgen-VirtualBox: /media/compartido/simgen_Huasco
simgen@simgen-VirtualBox:~$ pwd
/home/simgen
simgen@simgen-VirtualBox:~$ ls
Desktop    Downloads         Music     projection.jpeg  R          Videos
Documents  examples.desktop  Pictures  Public           Templates
simgen@simgen-VirtualBox:~$ cd /media/compartido/simgen_Huasco
simgen@simgen-VirtualBox:/media/compartido/simgen_Huasco$ ls
01_prep_ntcc_chile_HUASCO.R    LEAME              readqc.py
02_analisis_ntcc_chile.R       mvn32.py           readqc.pyc
acru                           mvn32.pyc          simgen9s_cmip5.py
daily                          notasDesarrollo    simgen9s_cmip5.pyc
dat                            obs                simgen9s.diff
Data_simgen_Format_UCHILE.R    output_sim         simgen9s.py
detrend2.py                    pickled            simgen9s.py~
detrend2.pyc                   python             simgen9s.pyc
environment_for_R.RData        quantsearch.diff   simgenExtras.py
Huasco_DA_Final_missforest.R   quantsearch.py     simgenExtras.pyc
Input_Datos                    quantsearch.pyc
input_sim                      readqc.diff
simgen@simgen-VirtualBox:/media/compartido/simgen_Huasco$
```

2) Instalar ipython

pip install ipython

IP[y]: IPython
Interactive Computing

Install · Docs · Videos · News · Cite · Sponsors · Donate

Installing IPython

There are multiple ways of installing IPython. This page contains simplified installation instructions that should work for most users. Our official documentation contains detailed instructions for manual installation targeted at advanced users and developers.

I already have Python

If you already have Python installed and are familiar with installing packages, you can get IPython with **pip**:

```
pip install ipython
```

3) Determinar simix para simgen

Iniciar ipython (en simgen_Huasco/input_sim)

```
simgen@simgen-VirtualBox:/media/compartido/simgen_Huasco/input_sim$ ipython
```

Cargar quantsearch y ejecutar para un periodo decadal (10 años) y un percentil (10)

```
In [25]: from quantsearch import generar

In [26]: generar(10, 10)
Args to mvn32: [-0.0003942   0.00210184  0.00090612] [[ 0.00101961 -0.00320778 -
0.0020597 ]
 [-0.00320778  0.03668461  0.02377475]
 [-0.0020597   0.02377475  0.02819676]] -0.0416129383 0
ppr,munew: -0.0416 0.1318 0.0842
prlims: -0.0448 -0.0384
malims: -0.0597 0.3233
milims: -0.0837 0.2521
prelims:-0.0323 0.0315
sort 1 completed...
sort 2 completed
Should be about equal to ppr: -0.0416
339 realizations to search, not a problem!
162 instances found!
[836, 5248, 9302, 7541, 3213, 1570, 6028, 7989, 8366, 3255, 7680, 4890, 1909, 39
23, 2389, 6520, 9395, 4370, 3720, 4676, 7744, 3728, 3225, 5036, 6203, 8846, 4561
, 8473, 808, 7764, 6334, 8470, 9836, 1516, 9468, 137, 291, 1052, 7040, 9797, 470
8, 2895, 9123, 4492, 9887, 5370, 5276, 3304, 6285, 1418, 8034, 5673, 5289, 3174,
 7455, 3449, 5734, 49, 3320, 8429, 8925, 9871, 2338, 1838, 9119, 5718, 7965, 701
2, 5419, 6997, 6103, 3021, 6599, 7809, 5838, 643, 4562, 9321, 7949, 2166, 9479,
9490, 6141, 6006, 6427, 5750, 1440, 6487, 3060, 3995, 2572, 6036, 515, 6542, 732
7, 7419, 168, 8634, 1127, 978, 8081, 8802, 2471, 6704, 8745, 1583, 7797, 457, 26
74, 1155, 5943, 6044, 9313, 7408, 8146, 3973, 646, 8113, 838, 4341, 1494, 1671,
4873, 8658, 8520, 655, 1339, 2541, 4736, 1607, 9823, 1842, 8269, 8851, 8281, 912
6, 252, 4582, 97, 7044, 5138, 6483, 3997, 2539, 3496, 9567, 4967, 4166, 6289, 79
27, 1541, 4085, 1564, 1167, 547, 2384, 6522, 3113, 3244, 8570, 7507, 5158]
```

4) el script 'simgen_cmip5.py'

Vector de estaciones

Posición donde comienza la secuencia a imponer en la secuencia simulada.

Especifica el cuantil del TMMM a usar en la pp futura

Escribe los resultados (1-0)

Archivo con la simulación largo

Duración de la simulación

```
gen(obsix=[2000],simix=2955,trendq=0.5,write=1,fname='sim_100kyr.dat', simlen=62,
locate=2041, xval=0, M=1, trendmean=-0.125968, trendsd=1.76931)
```

Año en la simulación donde se impondran as fluctuaciones decadales

Periodo observado se replica (0) o se simula (1)

(1) Utiliza la distancia Mahalanobis para pr y temp, (0) solo pr

Promedio de la distribución de los modelos CMIP5 para la cuenca seleccionada

Desviación estándar de la distribución de los modelos CMIP5 para la cuenca seleccionada

4) el script 'simgen_cmip5.py'

Iniciar ipython (en simgen_Huasco)

```
simgen@simgen-VirtualBox:/media/compartido/simgen_Huasco$ ipython
```

Cargar simgen9s_cmip5

```
In [1]: run simgen9s_cmip5.py

In [2]: from simgen9s_cmip5 import gen
```

gen? (genera la documentación de la función 'gen')

```
In [5]: gen?
Type:        function
String Form:<function gen at 0x2265c08>
File:        /media/compartido/simgen_Huasco/simgen9s_cmip5.py
Definition: gen(obsix=[2000], simix=2955, trendq=0.5, write=1, fname='sim_100kyr
.dat', simlen=62, locate=2041, xval=0, M=1, trendmean=-0.125968, trendsd=1.76931
)
Docstring:  Main routine
```

Puedes copiar la función y pegarlo en el terminal

```
In [7]: gen(obsix=[2000,2001,2002,2003,2004,2005,2006,2007,2008], simix=2955, tr
endq=0.5, write=1, fname='sim_100kyr.dat', simlen=55, locate=2041, xval=0, M=1,
trendmean=-0.125968, trendsd=1.76931)
Now fetching simulation file...
```

4) el script 'simgen_cmip5.py'

Un ejemplo de una corrida exitosa

```
Processing station file obs/obshis_2008.txt
20089 days in file...
Done!
0 filled values, of 20089
obs/obshis_2008.txt is read!
55
Imposed pr trend: -0.125968
Local pr trend: -1.27270034776
Weighted local trend departure: -0.636350173881
trend for 2000-2005 (transitional): -1.0175
trend for 2005-2065: -0.7623
Regression coeffs, catchment on regional sig:   0.78   0.57   0.65
Variance adjustment factors: 0.0366 0.2022 0.1601
Variances for obs and sim...
pr: 0.0095 0.0087
ma: 0.1113 0.1129
mi: 0.0970 0.1012
Strip, inject means: 1.0000 1.0000
Strip, inject rmse (first 50 yr): 10.6611
Nudging 7 injectratios...
Wrote 40178 lines!
```

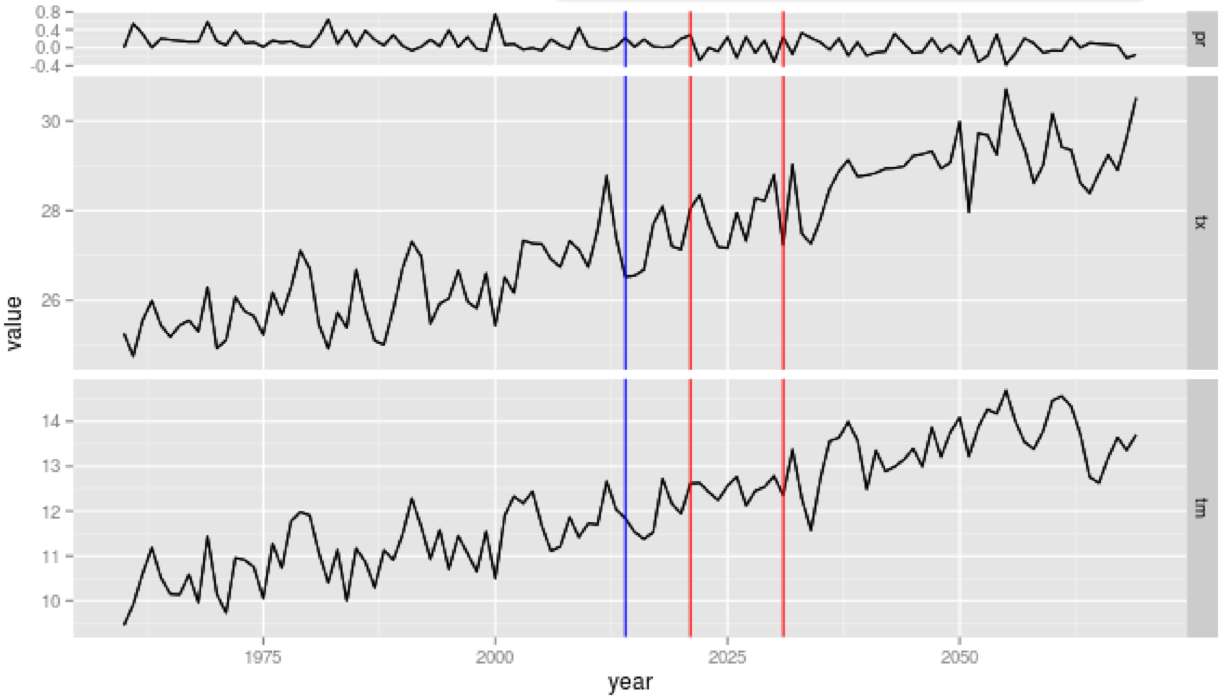
5) Correr el 'postprocesamiento en R

Nombre de la estación de interés

```
library(ggplot2) ; library(reshape)
# Leo el archivo anualizado de una estacion

data <- read.table("/media/compartido/simgen_Huasco/output_sim/yearly_simulation_obshis_2000_002955.txt", qu
names(data) <- c("pr", "tx", "tm")
data$year <- seq(1960, by=1, length.out=110)

grafdata <- melt(data, id="year")

q <- ggplot(grafdata, aes(year, value))  +geom_line()

m <-q + geom_line(aes(year, value)) + facet_grid(variable ~ . , scales = "free", space = "free" ) + geom_vli
m + geom_vline(xintercept=c(2014), colour="blue" )

##################################
```

Inicio de las observaciones
Longitud de la serie completo (observ. + proyectada)

Fin de las observaciones



6) Uso de series proyectadas (diarias o mensuales) en modelos hidrológicos

año mes dia prec tmax tmin

sim_100k_obshis_2008_002955.txt

```
2024 723  0.0  21.8  10.6
2024 724  0.0  21.4  10.2
2024 725  0.0  21.3   7.8
2024 726  0.0  20.2  10.2
2024 727  0.0  20.1   9.5
2024 728  0.0  19.8   8.2
2024 729  0.0  21.6  10.2
2024 730  0.0  22.1  10.5
2024 731  0.0  20.4   9.9
2024 8 1  0.0  17.2   9.5
2024 8 2  0.0  19.6   9.5
2024 8 3  0.0  18.2   9.9
2024 8 4  0.0  17.5  10.1
2024 8 5  0.0  16.3   6.0
2024 8 6  0.0  18.5   7.5
2024 8 7  0.0  20.6   9.9
2024 8 8  0.0  18.8   9.2
2024 8 9  0.0  19.7   9.1
2024 810  0.0  21.2   9.9
2024 811  0.0  22.1  10.9
2024 812  0.0  22.4  12.0
2024 813  0.0  21.5  12.0
2024 814  0.0  20.4  10.6
2024 815  0.0  20.2  10.5
```

7) Análisis de la distribución histórica y proyectada

En desarrollo....

(pero se puede hacer también en Excel)

8) Ejemplo de aplicación de series proyectadas en un modelo hidrológico

Ejemplo de la cuenca del Huasco

JUNTA DE VIGILANCIA

DE LA CUENCA DEL RÍO HUASCO Y SUS AFLUENTES

AUTOMATIZACIÓN DE WEAP

Automating WEAP (API)

WEAP can act as a standard "COM Automation Server," meaning that other programs (e.g., Excel via VBA), programming languages (e.g., Visual Basic, C) or scripts (e.g., VB script, JavaScript, Perl, Python) can control WEAP directly--changing data values, calculating results, and exporting them to text files or Excel spreadsheets. This can be enormously powerful. For example, you could write a 10-line script that would run WEAP calculations 100 times, each time with a different value of an input assumption, and output the results to Excel for later analysis. WEAP can also call scripts directly (from the Call function in an expression, or from the Advanced, Scripting menu item), and these scripts can use the WEAP API.

The WEAP Application Programming Interface (API) consists of several "classes," each with their own "properties" and "methods." Properties are values that can be inspected or changed, whereas methods are functions that do something.

The following classes are defined:

WEAPApplication: top-level properties and methods, including access to all other classes

WEAPArea: a WEAP Area (dataset)
WEAPAreas: collection of all WEAP Areas

WEAPScenario: a WEAP Scenario in the active area
WEAPScenarios: collection of all Scenarios in the active area

url: http://www.weap21.org/webhelp/api.htm

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The WEAPApplication class contains top-level properties and methods, including access to all other classes.

Note: in the following examples, a reference to WEAP, as in WEAP.ActiveArea, assumes that there is an object named WEAP of class WEAPApplication. This can be created in VBScript by:

```
SET WEAP = CreateObject("WEAP.WEAPApplication")
```

However, this is not necessary when running scripts inside WEAP (e.g. using the Call function in an expression, from the menu (Advanced, Scripting, Run), or from the script editor) because an object named WEAP is automatically added to the internal scripting environment.

WEAPApplication Properties and Methods	Example (using VB script)

ActiveArea: Set or get the active WEAP area (i.e., dataset). Read or write.	`WEAP.ActiveArea = "Weaping River Basin"`
	`'Note: This is equivalent to WEAP.Areas("Weaping River Basin").Open`
	
	`PRINT WEAP.ActiveArea.Name`

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UTILIZANDO LA API DE WINDOWS EN PYTHON

```
In [34]: import win32com.client #Libreria para poder usar win32com
         import numpy as np
         import glob, os
         import pandas as pd
         import matplotlib.pyplot as plt

In [35]: #ABRIMOS Y LLAMAMOS WEAP
         WEAP=win32com.client.Dispatch("WEAP.WEAPApplication")
         WEAP.ActiveArea = "Cuenca del Huasco calibrada5 clima nieve2"
         #indicamos año base
```

t url: http://www.weap21.org/webhelp/api.htm

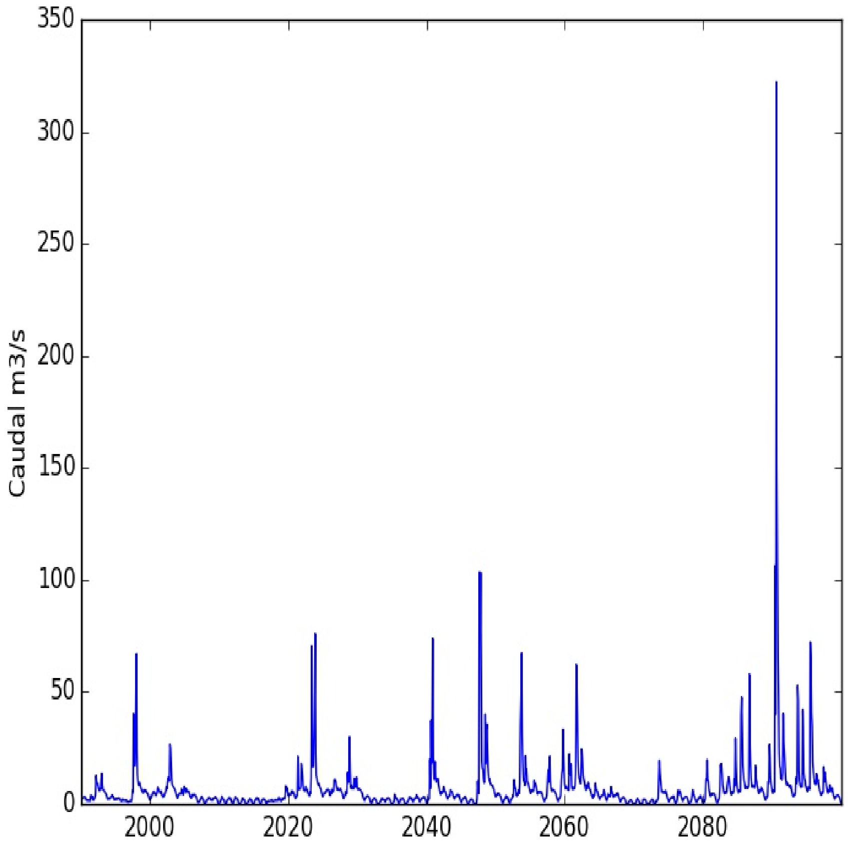
UTILIZANDO LA API DE WINDOWS EN PYTHON

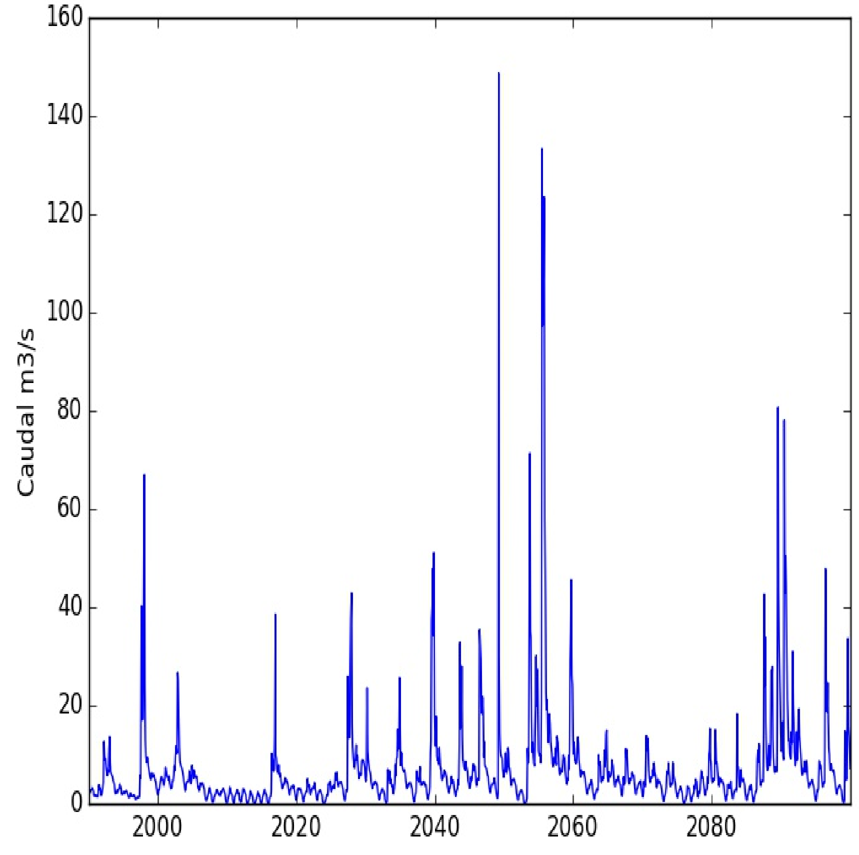
```
#reescribimos los archivos de WEAP
DIRWPFILES="C:/Users/Pablo/Documents/Weap/Cuenca del Huasco calibrada5
np.savetxt(DIRWPFILES+"P conay.csv", ppconayfinal, delimiter=",", fmt=
np.savetxt(DIRWPFILES+"P sanfelix.csv", ppSXfinal, delimiter=",", fmt=
np.savetxt(DIRWPFILES+"P transito.csv", ppTRAfinal, delimiter=",", fmt
np.savetxt(DIRWPFILES+"Tsobreconay.csv", ttconayfinal, delimiter=",",
np.savetxt(DIRWPFILES+"Tsobresan felix.csv", ttSXfinal, delimiter=",",
np.savetxt(DIRWPFILES+"Tsobretransito.csv", ttTRAfinal, delimiter=",",

#CORREMOS EL MODELO
WEAP.Calculate(2099) #Empieza a calcular

#EXPORTAMOS
SALIDA="C:/Users/Pablo/Desktop/WEAP/salida/Resultado"+str(x)+".csv"
WEAP.ExportResults(SALIDA,False)
```

Se exporta a un archivo csv

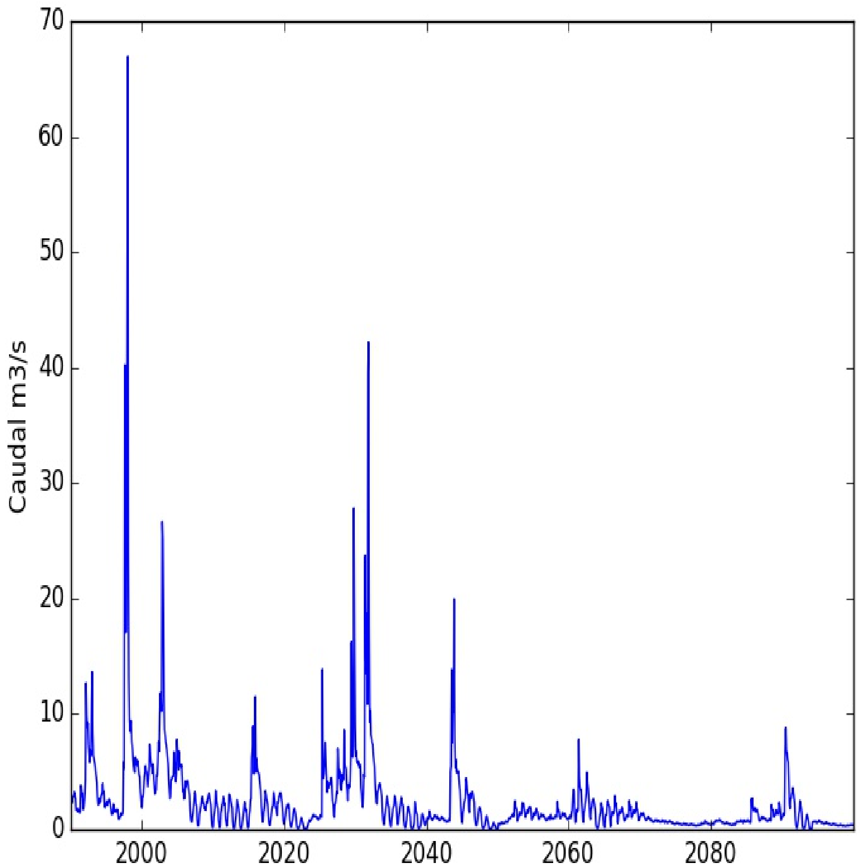
url: http://www.weap21.org/webhelp/api.htm

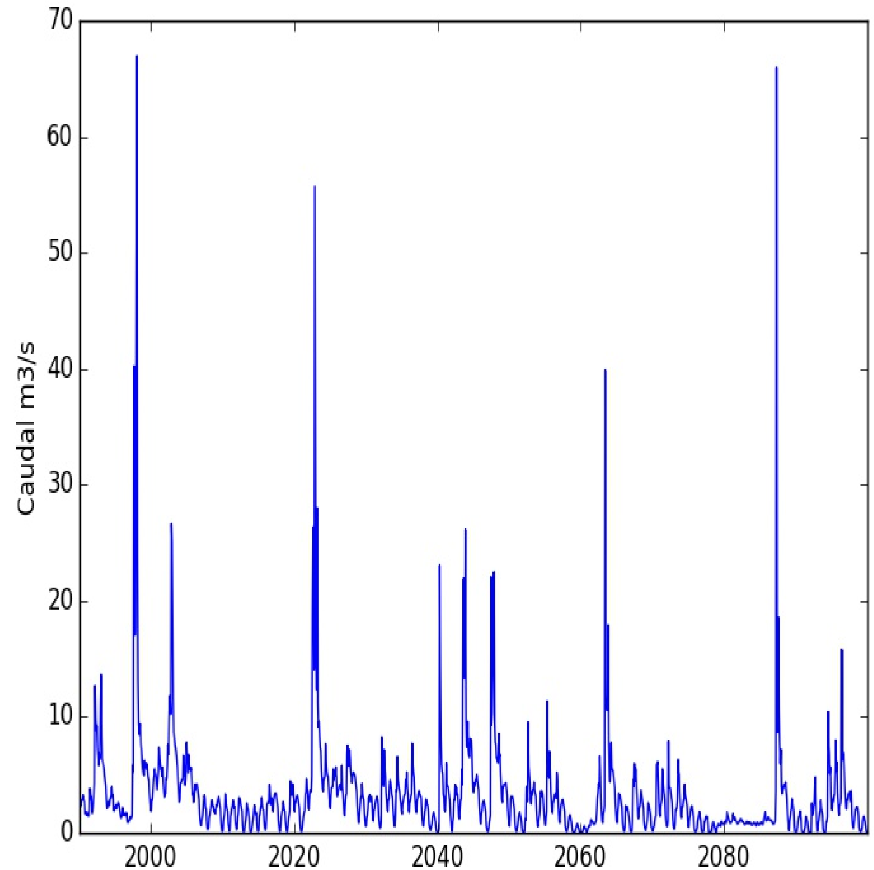
MODELOS 0 Y 1


Caudal m3/s
0
50
100
150
200
250
300
350
2000
2020
2040
2060
2080

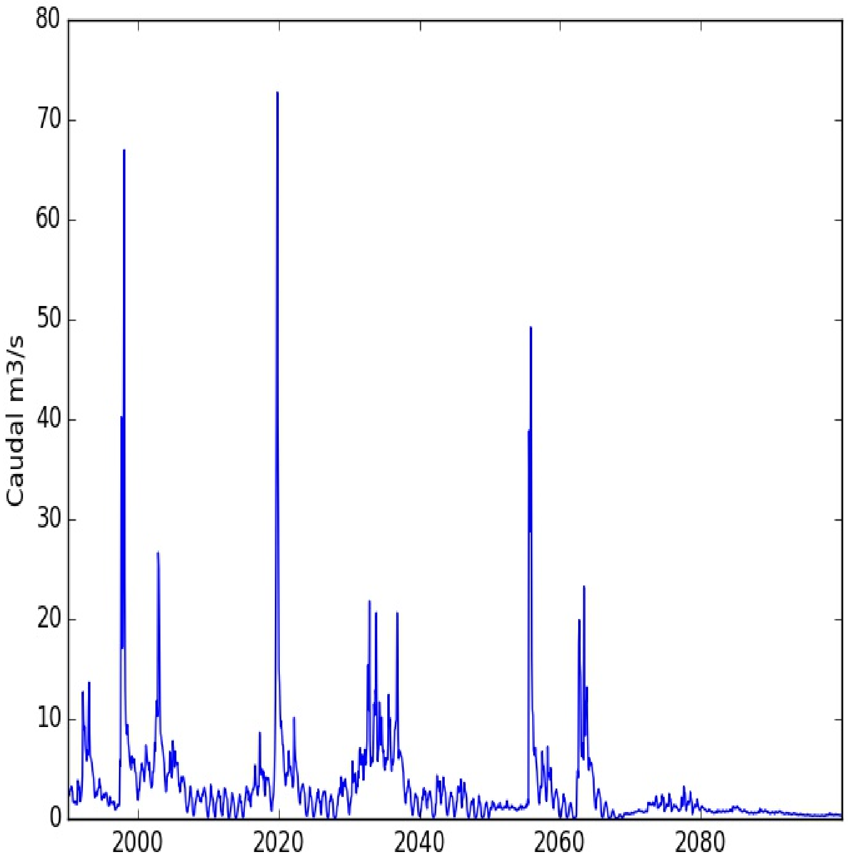

Caudal m3/s
0
20
40
60
80
100
120
140
160
2000
2020
2040
2060
2080

MODELOS 2 Y 3

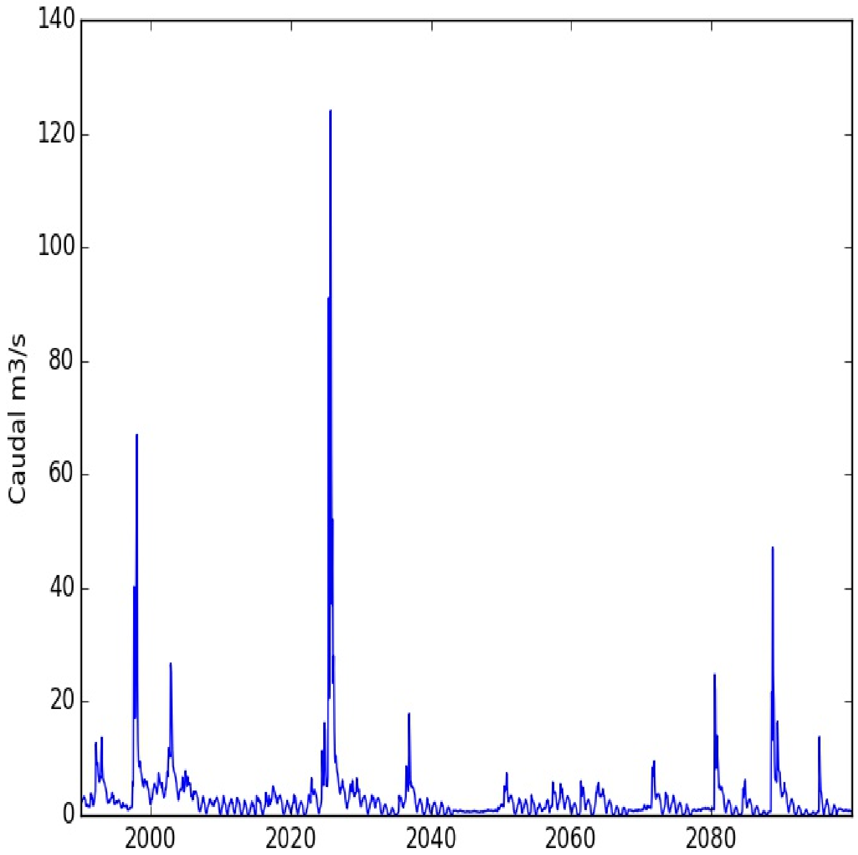

Caudal m3/s
70
60
50
40
30
20
10
0
2000
2020
2040
2060
2080


Caudal m3/s
70
60
50
40
30
20
10
0
2000
2020
2040
2060
2080

MODELOS 4 Y 5

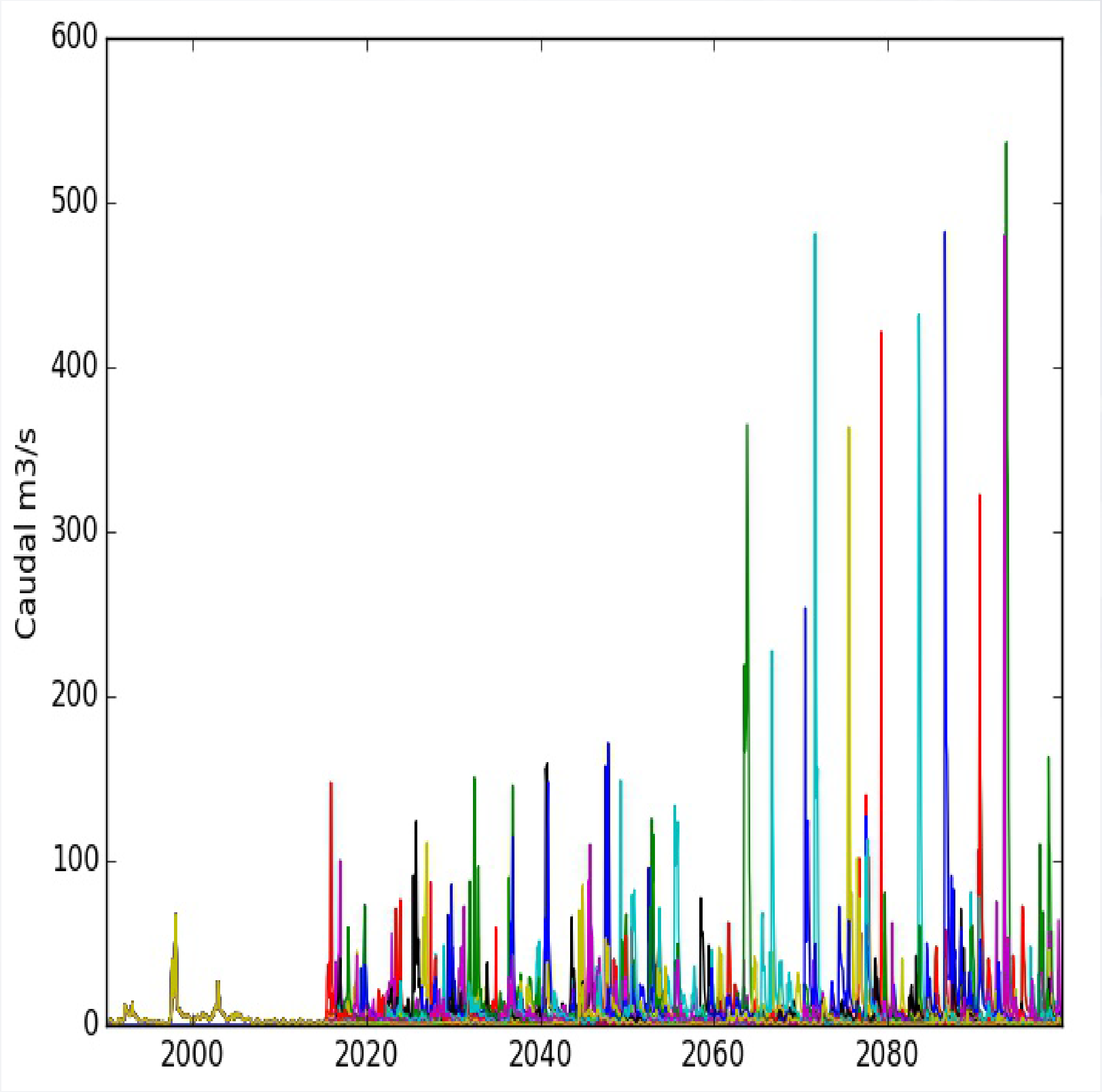


80
70
60
50
40
30
20
10
0
Caudal m3/s
2000
2020
2040
2060
2080



140
120
100
80
60
40
20
0
Caudal m3/s
2000
2020
2040
2060
2080

RESUMEN



Modelo	Promedio $[m^3/s]$	Modelo	Promedio $[m^3/s]$
Reach	7.8	Reach13	9.8
Reach1	7.9	Reach14	4.8
Reach2	3.0	Reach15	7.4
Reach3	1.9	Reach16	7.4
Reach4	2.6	Reach17	9.6
Reach5	2.7	Reach18	4.5
Reach6	2.7	Reach19	11.2
Reach7	3.6	Reach20	5.0
Reach8	4.3	Reach21	2.2

Descripción	Series
Total de Series	25
Aumento de Caudal promedio	8
Disminución de Caudal promedio	17
Aumento de Máximo caudal promedio Histórico	25
Disminución de Máximo caudal promedio Histórico	0