

Uncertainty assessment of climate impact indicators in future scenarios projections for water allocation in small catchments

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What is it?

It is commonly used as the recommended value to assess climate change effects in impacts studies

How it is composed?

Mean of combinations of Global Circulation Models (GCM) and Regional Climate Models (RCM) called members

Climate Model ENSEMBLE

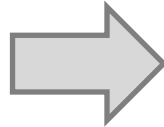
How choose the number of members to build the ensemble?

Is an issue currently under debate

Where the methodology might not be efficient?

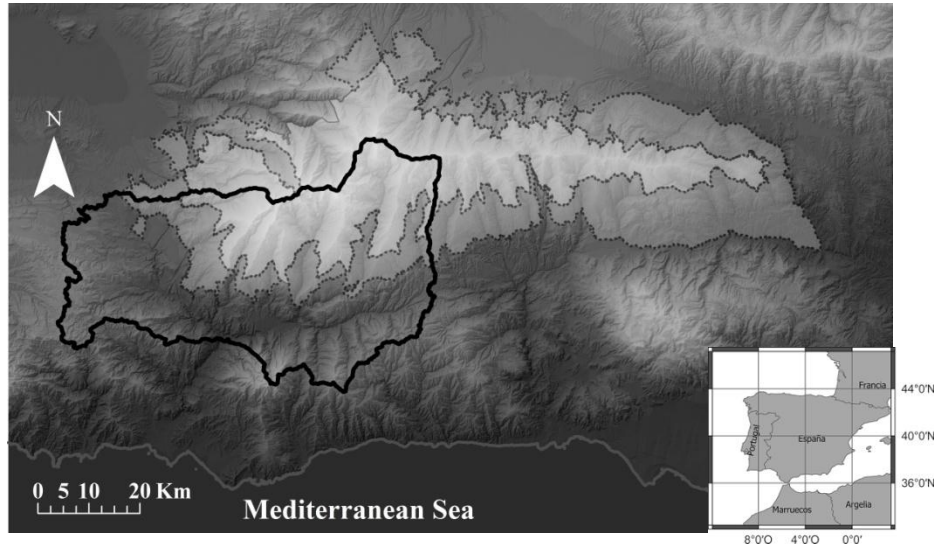
In heterogeneous and/or small areas where the spatial significant scales cannot be adequately captured by certain climate models

OBJECTIVE



This work proposes an alternative methodology to project hydrological variables without using model ensemble mean, selecting only the model that best represents climate regime, defining transfer functions to overpass the spatial scale issues, and assessing uncertainty by using stochastics techniques.

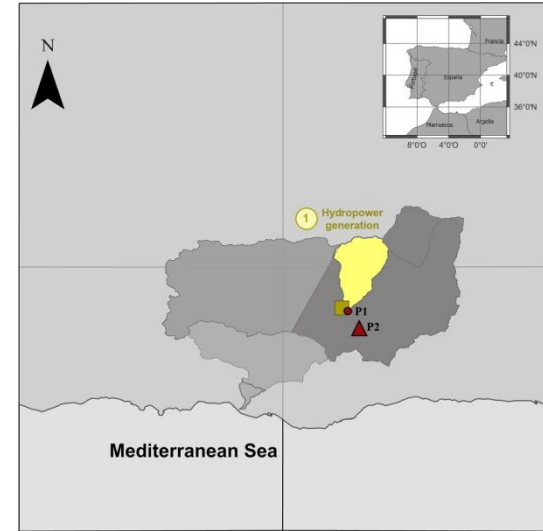
STUDY AREA



Sierra Nevada Mountains, in Southern Spain, are a linear mountainous range, parallel to the shoreline of the Mediterranean Sea. The typical alpine climate is modified by the **proximity to the Mediterranean sea**, only 40 km south, surrounding features and, thus, snow is significantly affected.

	Area (Km ²)	Height (mts)	Precip. (mm)	Snowfall (mm)	Tmean (°C)
Guadalfeo River basin	1058	1418.5	660.4	109.3	13.14

PAN-EU STUDY AREA & CASES



HYDROPOWER GENERATION: Their production is conditioned by different values of streamflow (X1, X2, X3).. Variables defined are:

N1: N° days per year in which the mean daily flow at section P1 does not exceed X1 threshold.

N2 : N° days per year in which the mean daily flow at P1 is higher than X1 but does not exceed X2.

N3: N° days per year in which the mean daily flow at P1 is higher than X2 but does not exceed X3.

1. Extracting Climate Projections

1

Data are collected from the Pan-European CS for the water sector SWICCA (www.swicca.eu). Meteorological and water related variables, for both reference period (1970-2000) and future scenarios (2010 - 2100).

2. Selection model

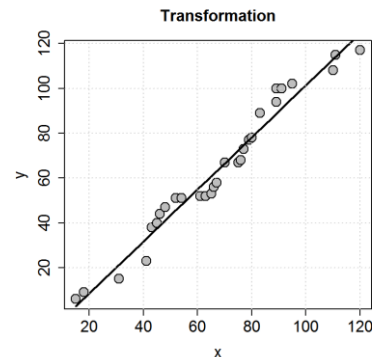
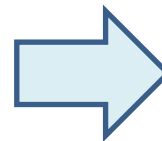
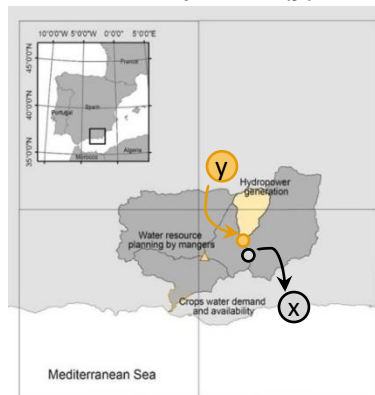
2

Single Climate Model was chosen from the model ensemble mean available in SWICCA. This selection was based on the performance of specific case study metric (RE of daily streamflow) in the reference period. SMHI_RCAH_EC-EARTH was the model selected.

3. Downscaling

3

Quantile mapping was applied as downscaling technique for target variables (N1,N2,N3), mimicking statistical distributions of the variable (x), in this case derived from the pan-European CS, to the statistical distribution of the same variable obtained from the local knowledge on the historical period (y).



1. Extracting
Climate
Projections

2. Selection
model

3.
Downscaling

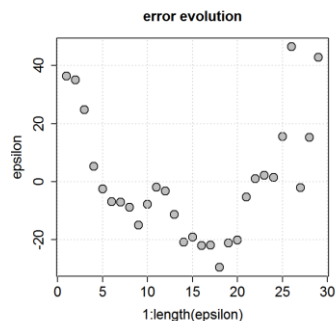
4. Assessing
uncertainty

5. Assessment
of changes in
water resource
availability

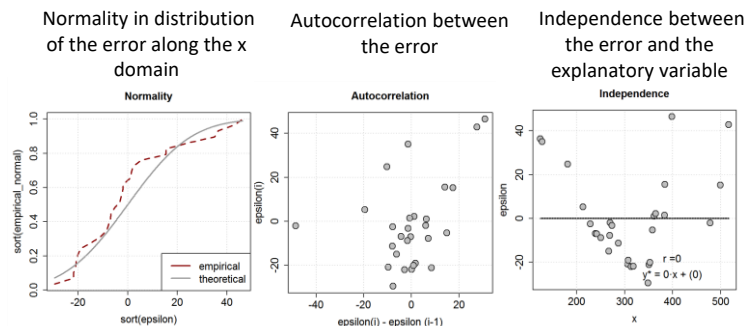
4

Statistical uncertainty is derived stochastically. Being x (explanatory variable) a variable derived from the Pan-European CS, y (target variable) the same variable obtained from the local knowledge, and $f(x)$ the fitted function that relates the statistical distributions of both variables (see step 3 in this section), we can define our target variable (y) as the sum of the value obtained from the transformation previously defined by $f(x)$ and a random error (ϵ)

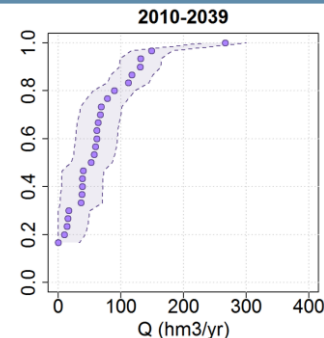
4.1 Obtención del error



4.2 Guarantee this assumptions



4.3 Stochastic error simulation



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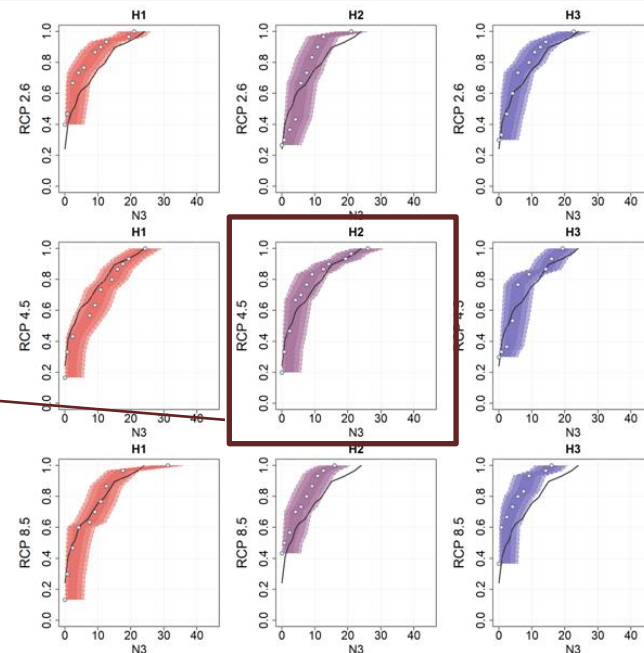
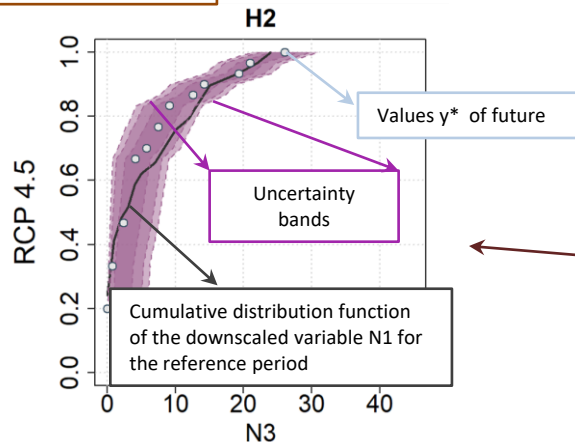
5

VARIABLE N3:

ASSESSMENT OF FUTURE SCENARIOS

Almost for all time horizons and scenarios, reference distribution is located within the confidence band simulated. That could indicate that the number of days with streamflow higher values are not going to experiment significant changes. However, on a general basis the probability of having N3 values equal to zero has increased. Interesting enough is to remark that bigger differences, about 30%, appear for higher values in RCP 8.5-H3.

H1: HORIZONT 1 (2010-2039)
H2: HORIZONT 2 (2040-2069)
H3: HORIZONT 3 (2070-2099)



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Projections

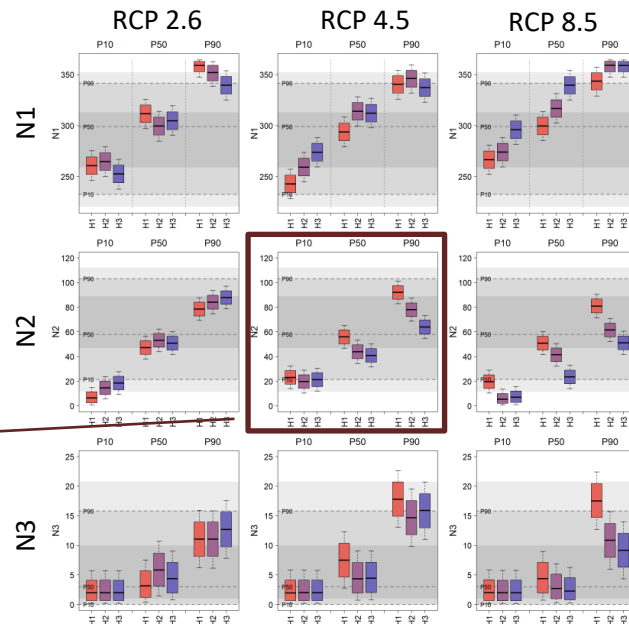
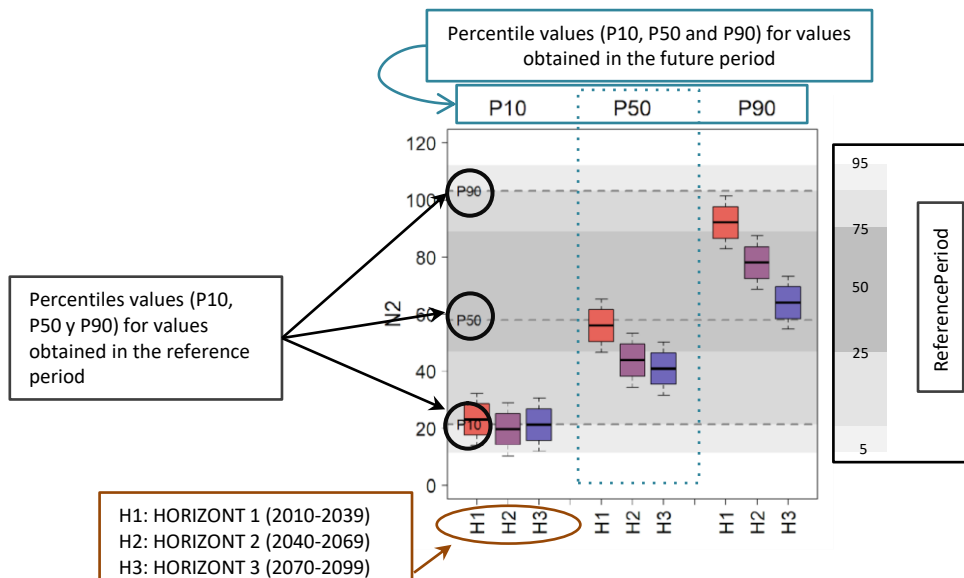
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5



1 - Existing and new methods differ in statistical uncertainty accounted for. The main advantage is that only a specific model, which better represents hydrometeorological variables in the reference period for the area is used, avoiding the “noise” of those that not correctly represent these variable. Statistical uncertainty is included by quantifying errors of the selected model in the reference period and stochastically simulated for the future. This allows defining confidence intervals as it is done using all members of the ensemble.

2 - Moreover, the proposed method proves to increase confidence level of users' perspective regarding CS:

- Quantifying the uncertainty of impacts on specific variables regarding water management issues
- Helping to foresee and anticipate close in time conflicts of water uses.



Thanks!

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