

Quantifying the impact of climate change on floods by using both continuous and event-based hydrological modelling



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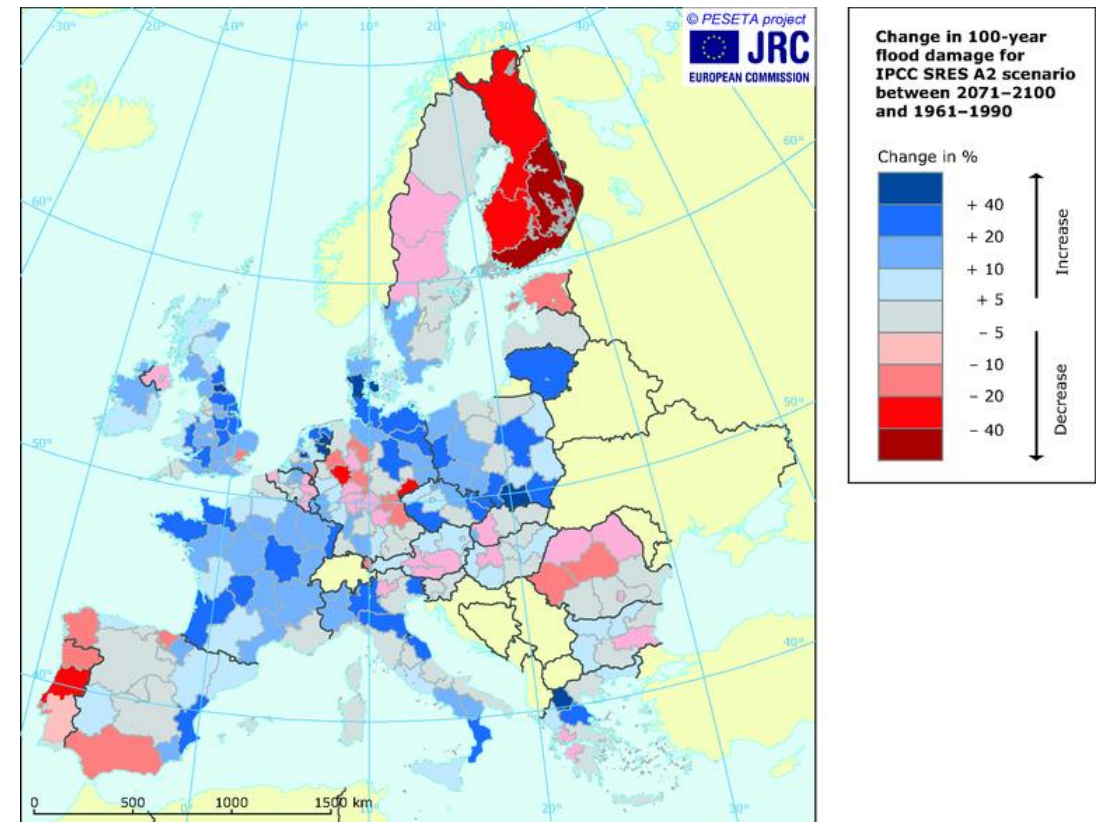
POLITÉCNICA

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- **Climate change has changed the pattern of floods in Europe in last decades:**
 - Changes in date of occurrence
 - Changes in the magnitude
 - Changes in the timing



European Environment Agency

- **These changes are expected to continue in the future.**
- **Current methodologies are based on the use of continuous models on a daily scale, to simulate the complete series of climate change. However, such models fail to characterize flood hydrographs.**
- **In this study is proposed the joint use of a continuous simulation model with the modified curve number method. The objective is improving the flood hydrographs characterization and future changes identification.**

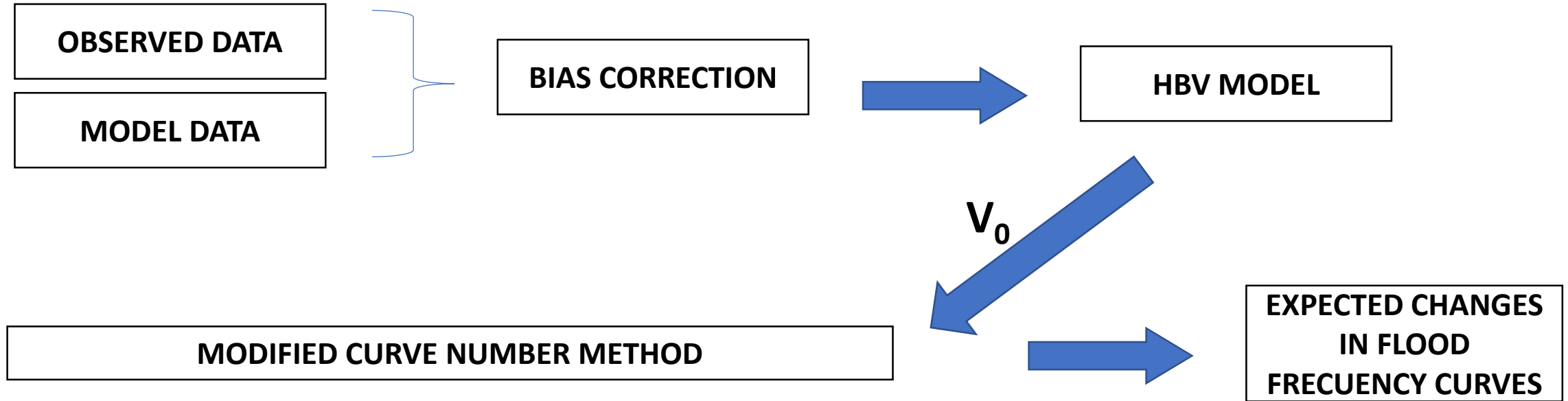
INTRODUCTION

METHODOLOGY

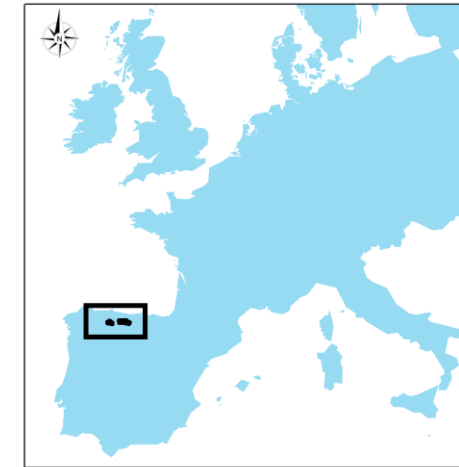
BIAS CORRECTION

FRECUENCY CURVES

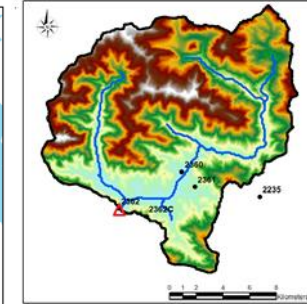
CONCLUSIONS



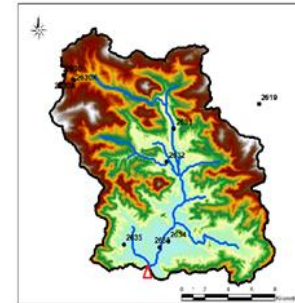
- Four catchments in the Douro River Basin located in the northwestern part of Spain have been selected as case studies
- The data from the four gauging stations have been obtained from the “Centro de Estudios Hidrográficos del CEDEX”
- The observed series of precipitation and temperature at 42 AEMET weather stations have been used.



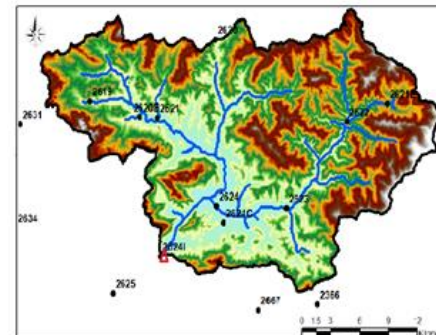
Camporredondo



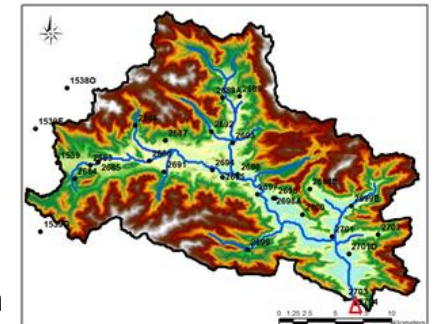
Porma



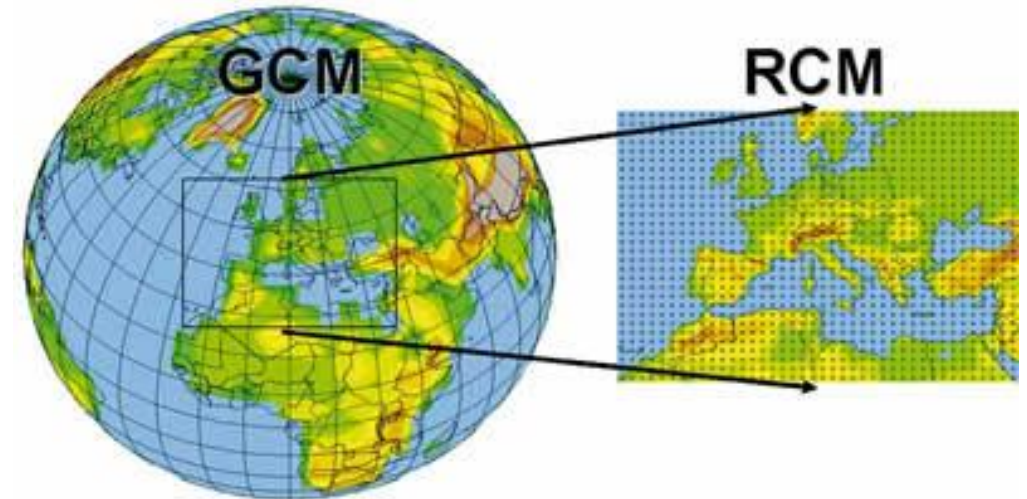
Riaño



Barrios de Luna



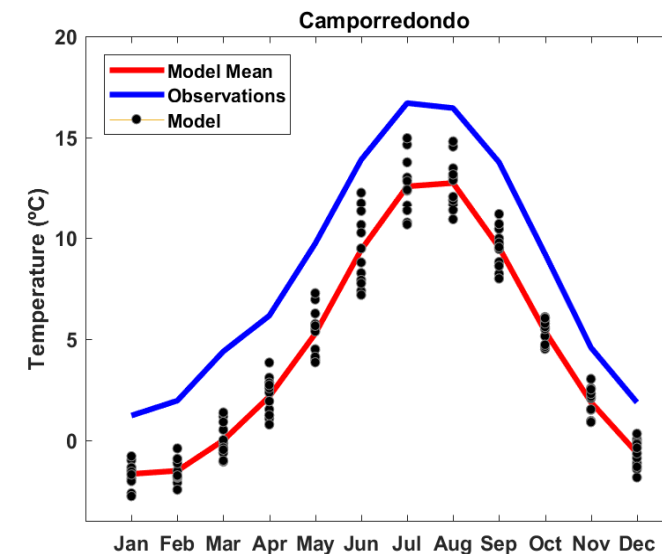
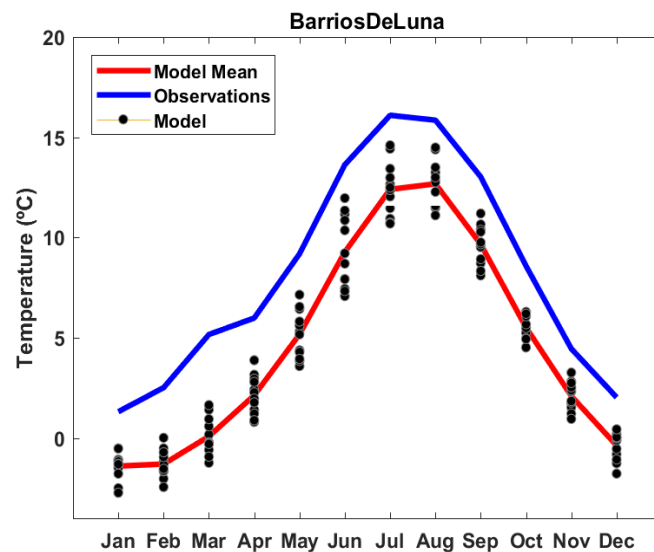
- In Spain, there are two sources of climate change projections: AEMET (national scale) and EURO-CORDEX (European scale).
- AEMET projections fail to adequately characterize extreme events (Garijo et al., 2018). In this study the EURO-CORDEX climate projections have been used.
- The climate change projections of 12 regional models from the EURO-CORDEX programme have been used in this study.



- **The temperature and precipitation series of the climate models in the control period show an important difference with the data observed in the same period in the study catchments.**
- **The data series of the climate projections in the future period have been corrected using the best bias correction methodology identified in Soriano et al. (2019).**
- **Flow and precipitation quantiles have been estimated using the generalized extreme value distribution (GEV) function, adjusting their parameters using the L-moment method.**

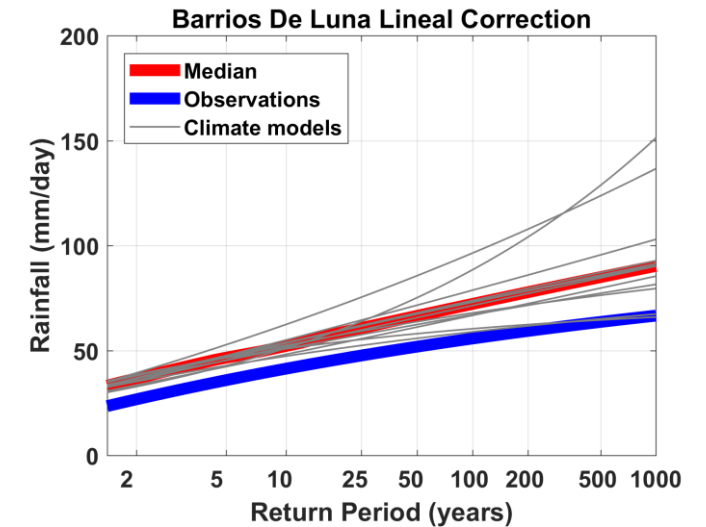
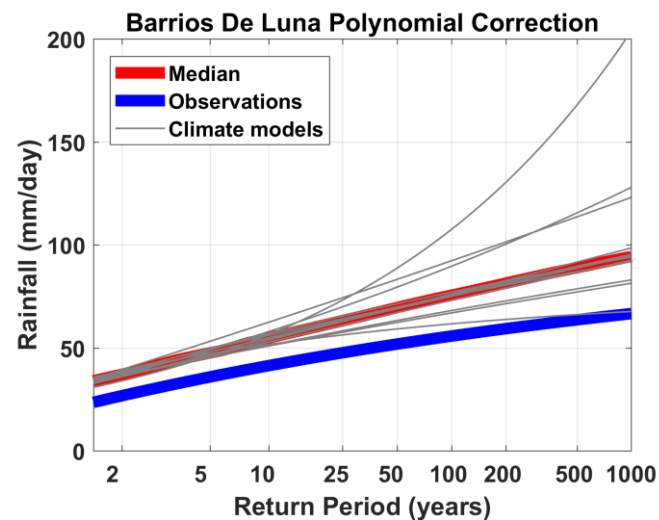
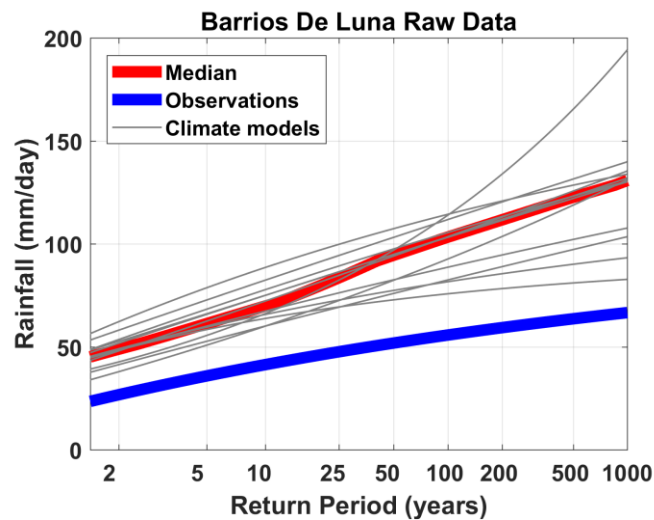
Bias Correction- Temperature

- Temperatures are significantly lower than observations.
- The monthly difference between climate model and observations has been used to correct the bias

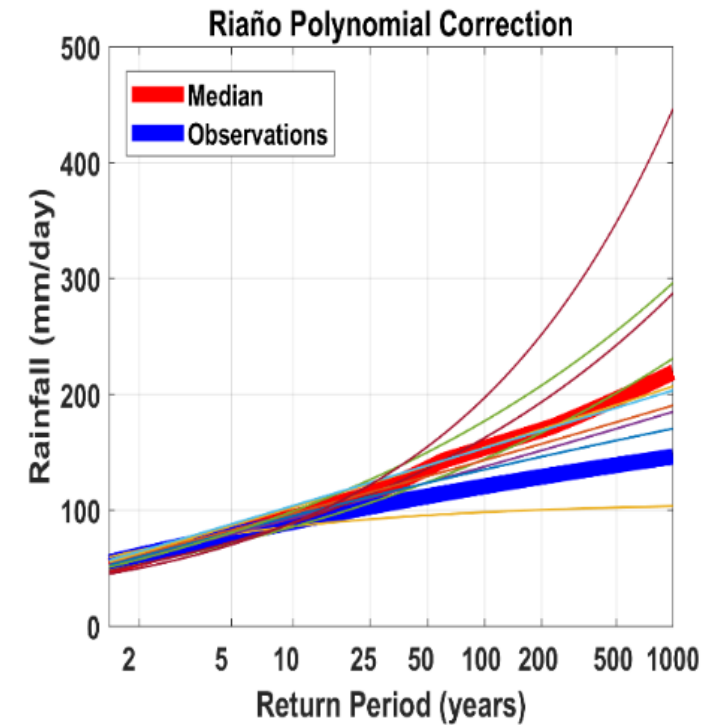
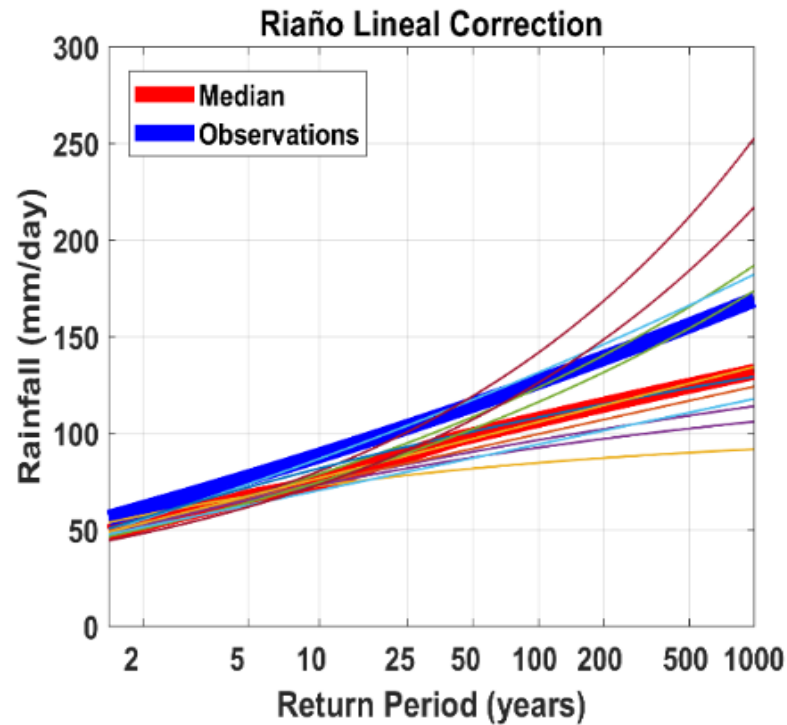
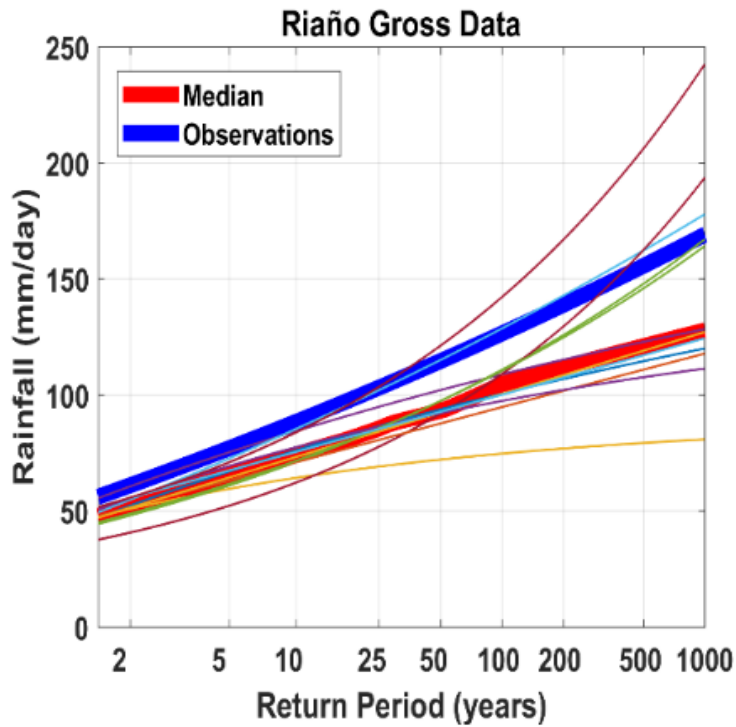


Bias Correction- Precipitation

- The best bias correction technique is polynomial quantile mapping.
- After bias correction, errors in the raw data are reduced.



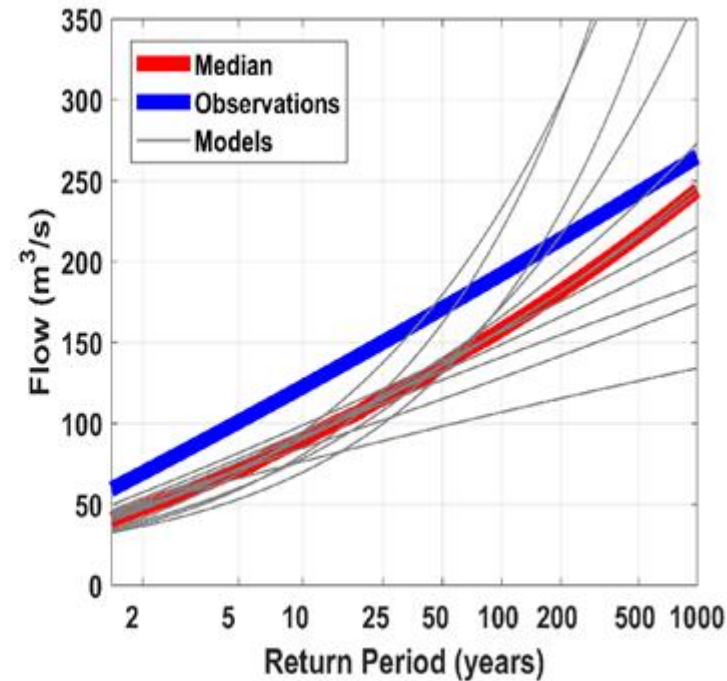
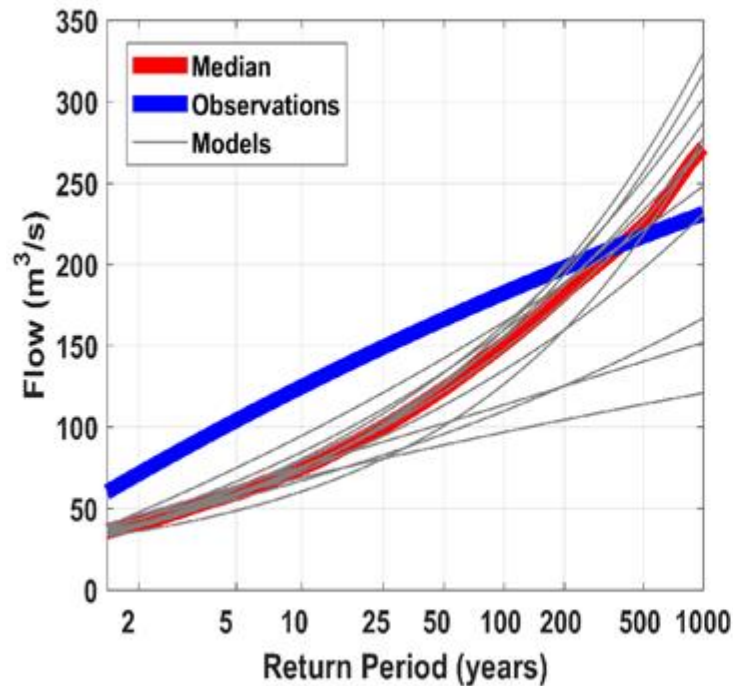
Bias Correction- Precipitation



- **The HBV model has been calibrated with the daily temperature and precipitation series observed in each catchment, using the methodology proposed by Garijo and Mediero (2018).**
- **Climate projections of precipitation and temperature have been corrected by the identified bias correction techniques.**
- **The initial soil moisture in the catchments (V_0) on the day of the occurrence of the annual maximum rainfall has been considered in the modified curve number method.**
- **A histogram of alternate blocks has been considered.**

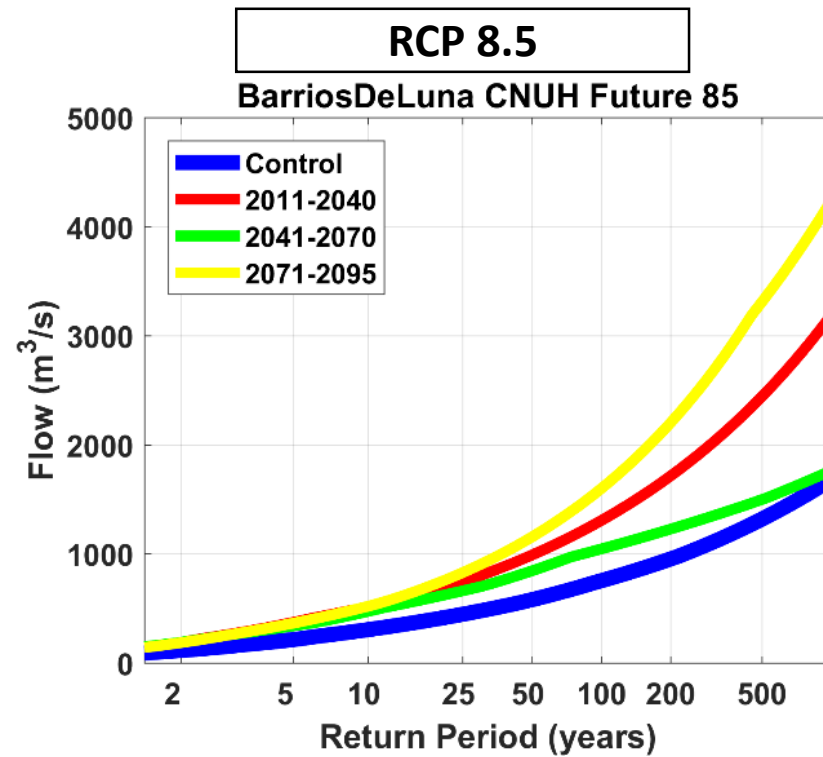
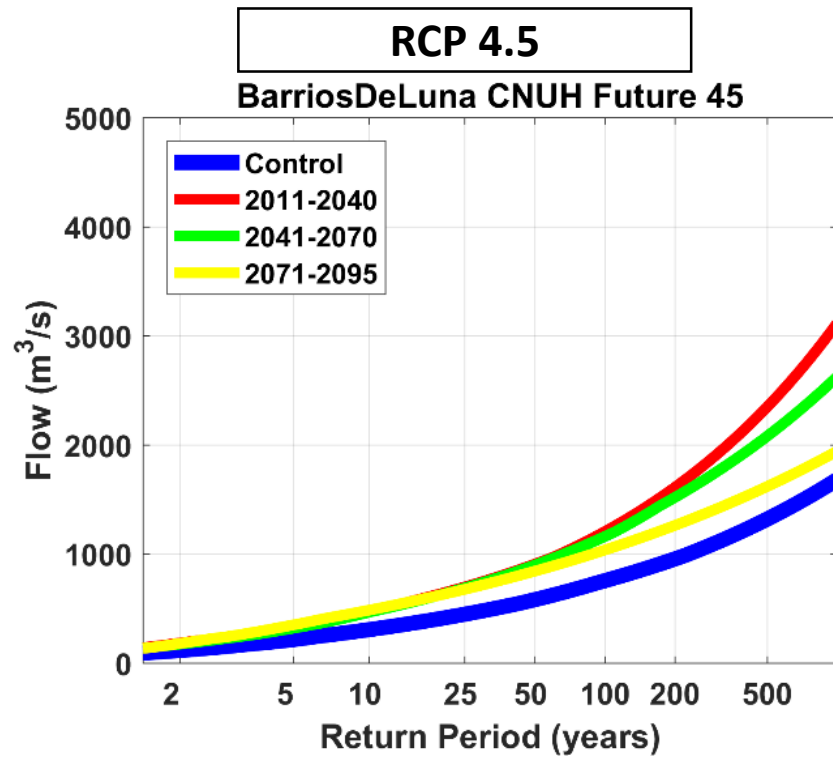
Frequency curves in the control period.

- The model has been calibrated in each catchment using the control period (1970-2005).



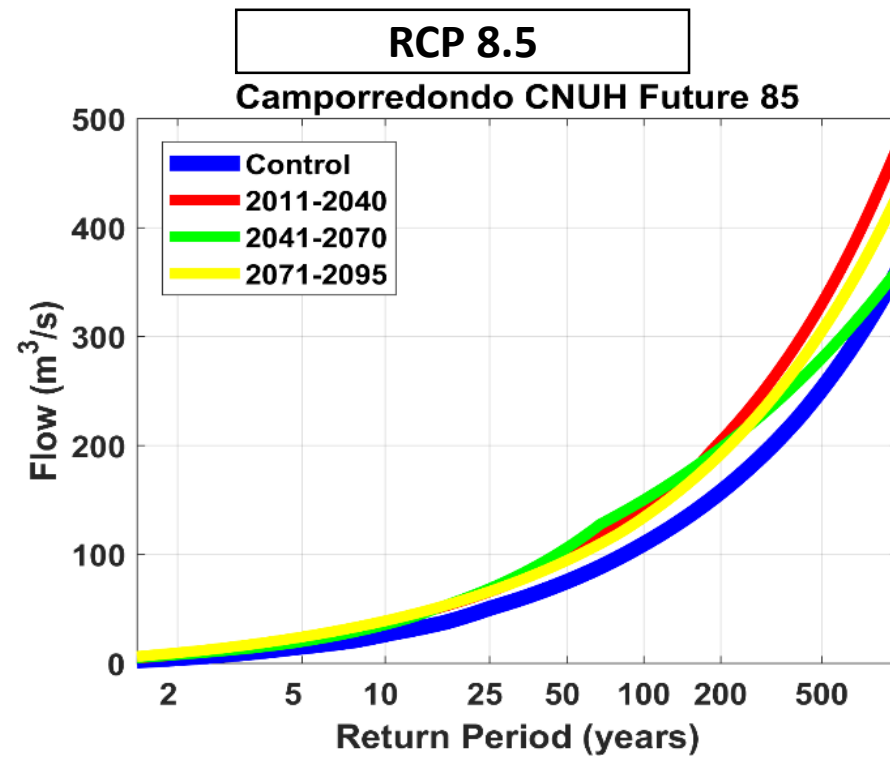
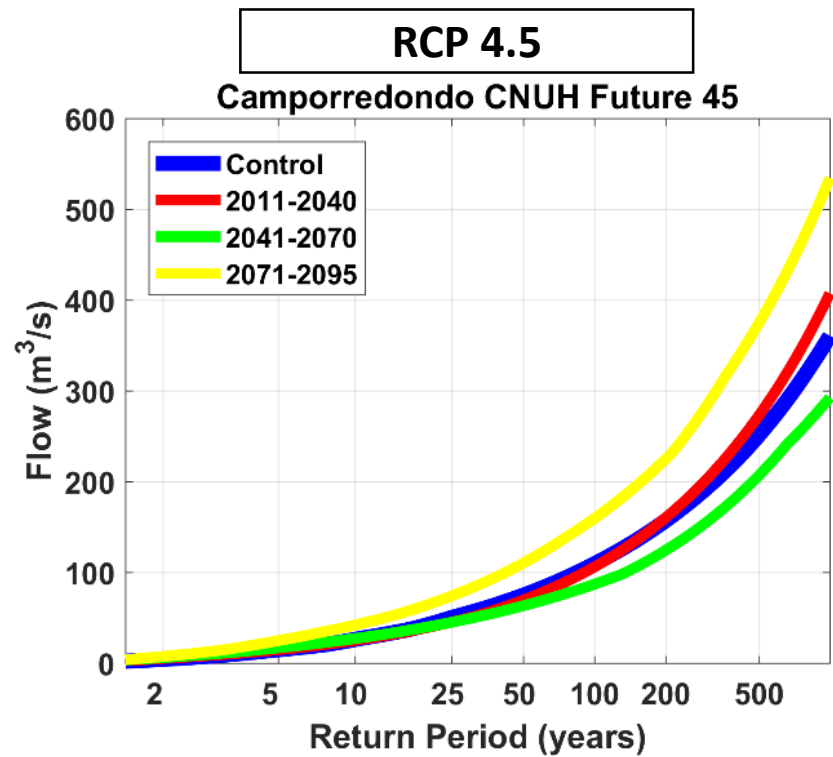
Frequency curves in the future period.

- In Barrios de Luna, the largest flow increases are expected in the future.



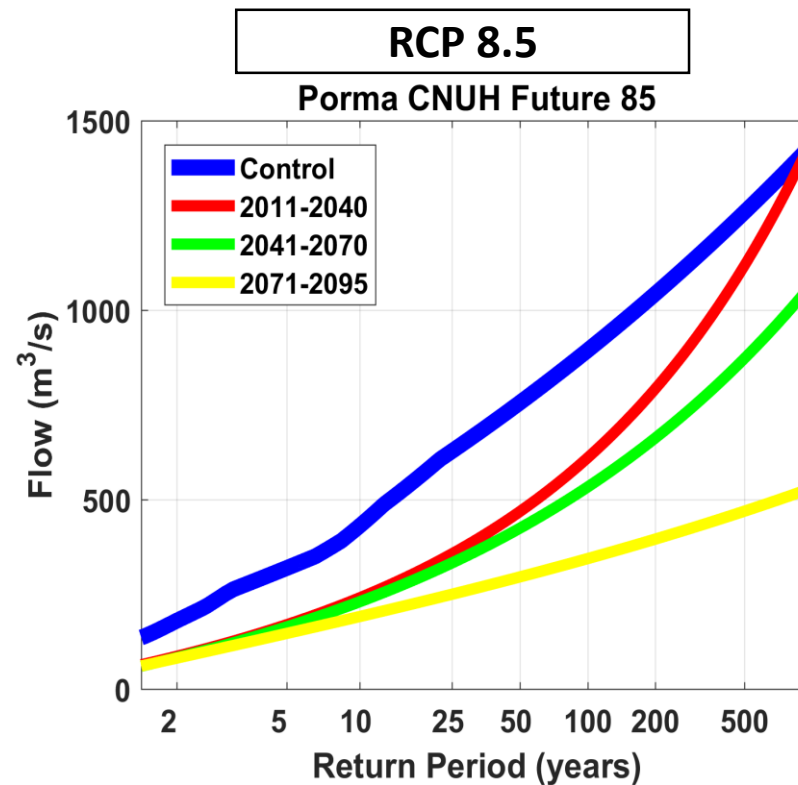
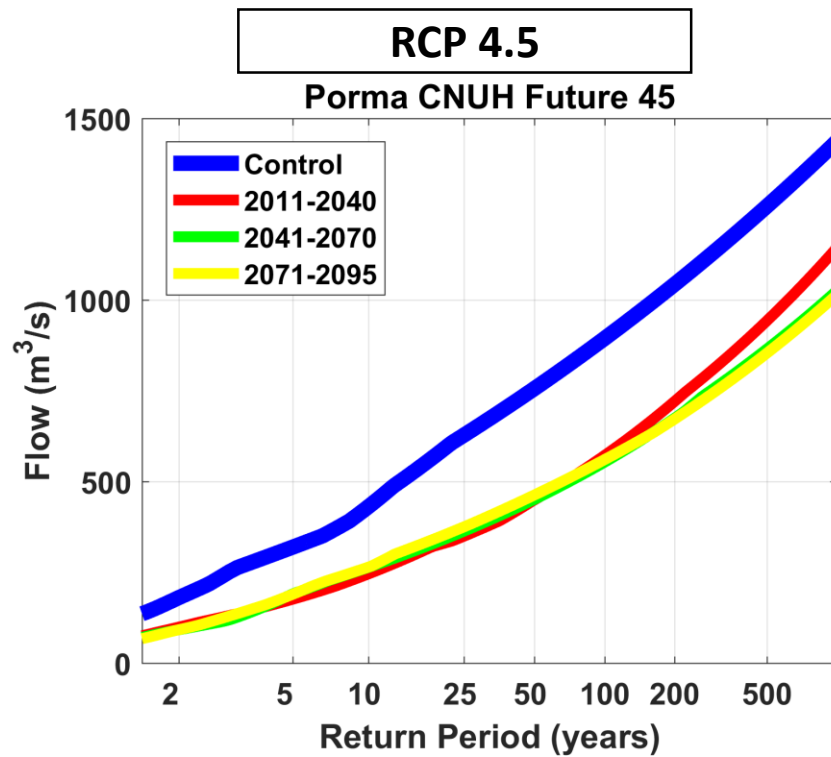
Frequency curves in the future period.

- In Camporredondo, smaller flow increases are expected in the future.



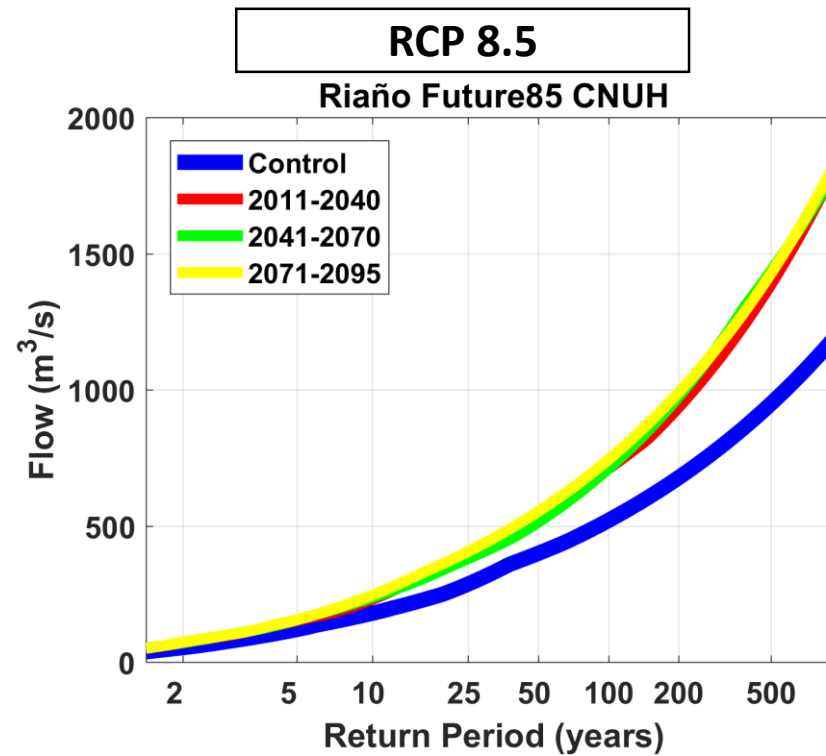
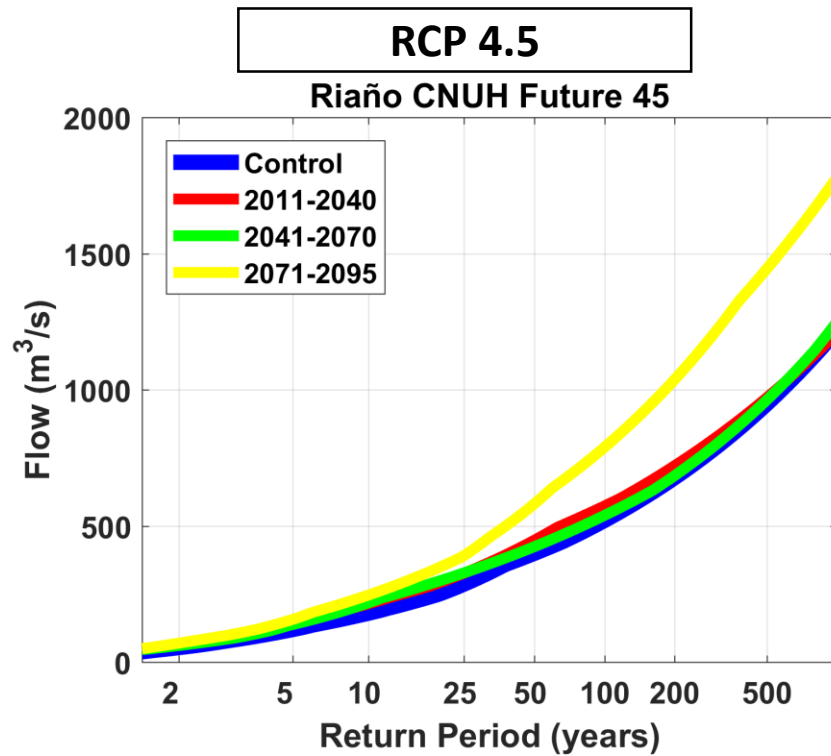
Frequency curves in the future period.

- In Porma, flows are expected to be lower in the future.



Frequency curves in the future period.

- In Riaño, flow increases vary depending on the RCP and period.



- **Bias correction in the precipitation series is more important than in the temperature series, in terms of changes in flow outputs.**
- **The best bias correction technique is quantile mapping with polynomial correction for precipitation and average monthly correction for temperature.**
- **The modified curve number method has been used with the series of annual maximum daily precipitation and the initial soil moisture simulated by the HBV model at the beginning of each event.**

- **A better characterization of the flood hydrograph peak flow has been achieved using the modified curve number method.**
- **Increases in flood quantiles have been observed in three of the four catchments studied.**
- **In general, the period 2071-2095 and RCP 8.5 show the largest increases.**

Thanks for your interest

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