

Climate change impacts on extreme rainfalls, discharges and **floods** in **Mediterranean** mesoscale **catchments**

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*Aude river in
Carcassonne
Nov 1999, AFP*

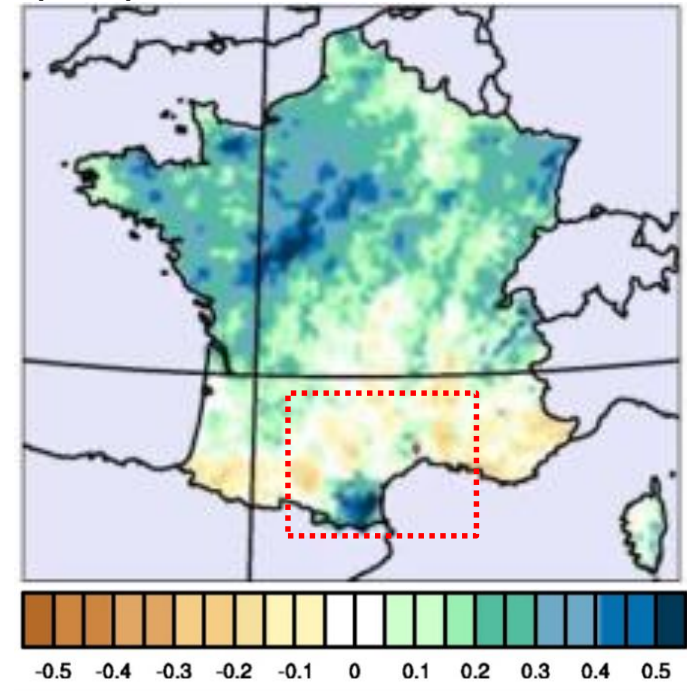
- *35 deaths*
- *200 000 inhabitants affected*
- *3.5 Billion Francs*

How does **climate change** will **localy** affect **flash floods**?

- Introduction
- Tools and issues
- Futurisation method
- Results
- Conclusions

- *Mediterranean is ... a hotspot ... when you look at extreme seasonal precipitation.*
Diffenbaugh and Giorgi, 2012

RCP8.5 99th Precipitation Change (SON) Harader, 2015



Tools and issues : Precipitation and soil moisture

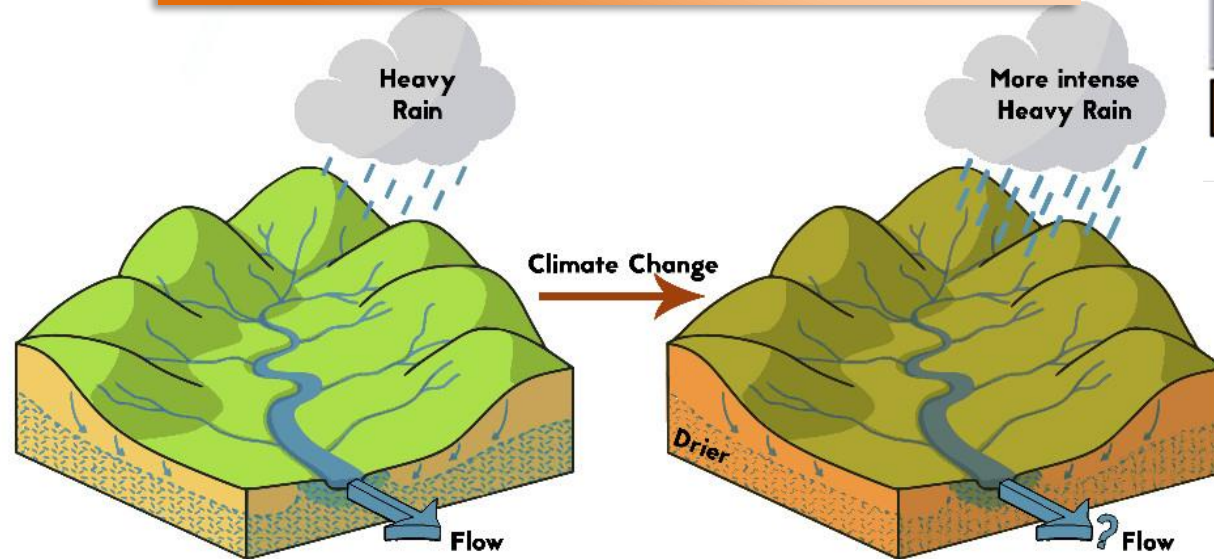
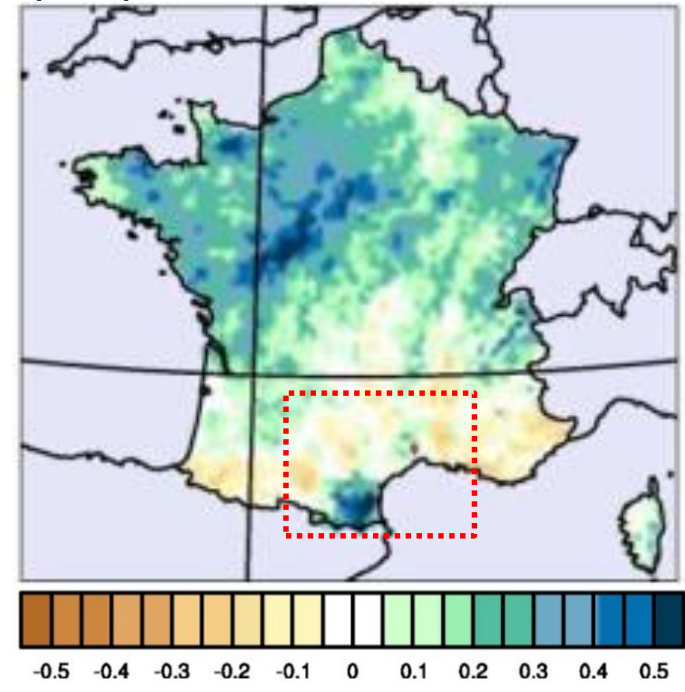
- *Mediterranean is ... a hotspot ... when you look at extreme seasonal precipitation.*

Diffenbaugh and Giorgi, 2012

The water-holding capacity of soil will affect possible changes in soil moisture deficits

IPCC, 2013

RCP8.5 99th Precipitation Change (SON) Harader, 2015

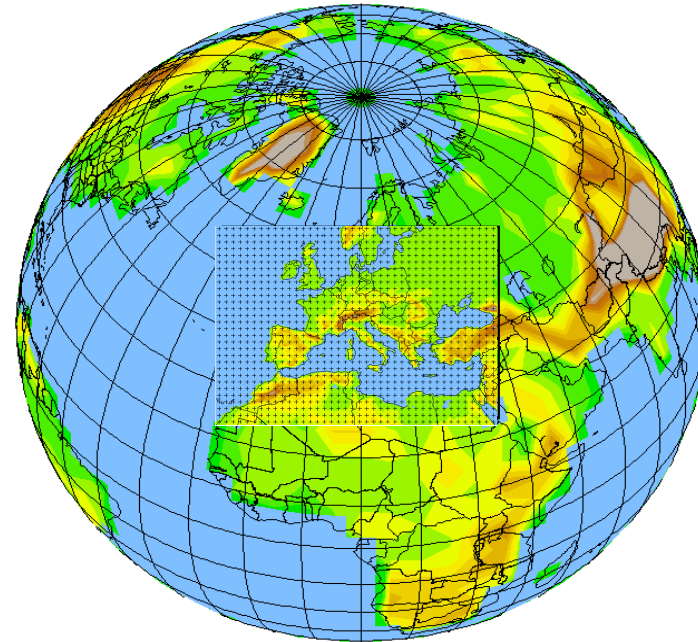


Tools and issues : Climate Models

General Climate Model (GCM)
100-300 km

Dynamic Downscaling

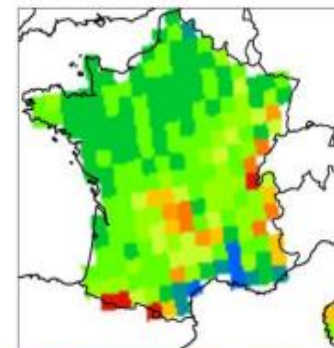
Regional Climate Model
(RCM) 12 km
CORDEX Giorgi *et al.* (2009)



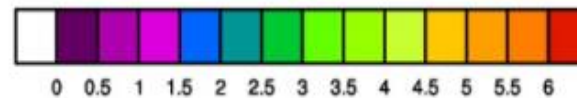
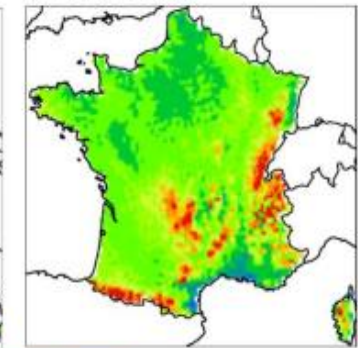
CNRM-CM5 1.4°



Aladin 50 km



Aladin 12 km



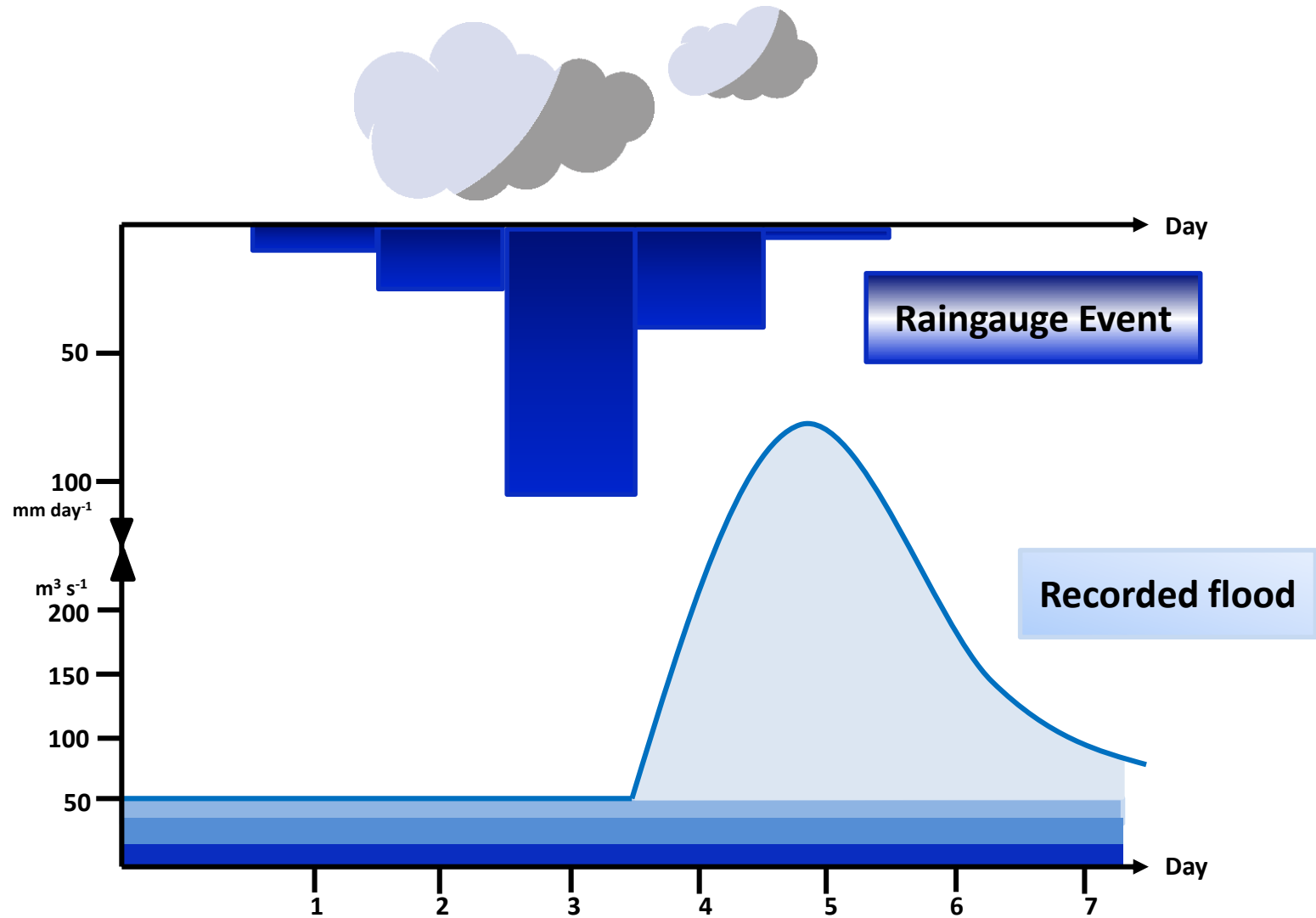
Climate models are **biased** and not appropriate for **forecasting** precipitation.

Ex: rainfall on November 4th 2063

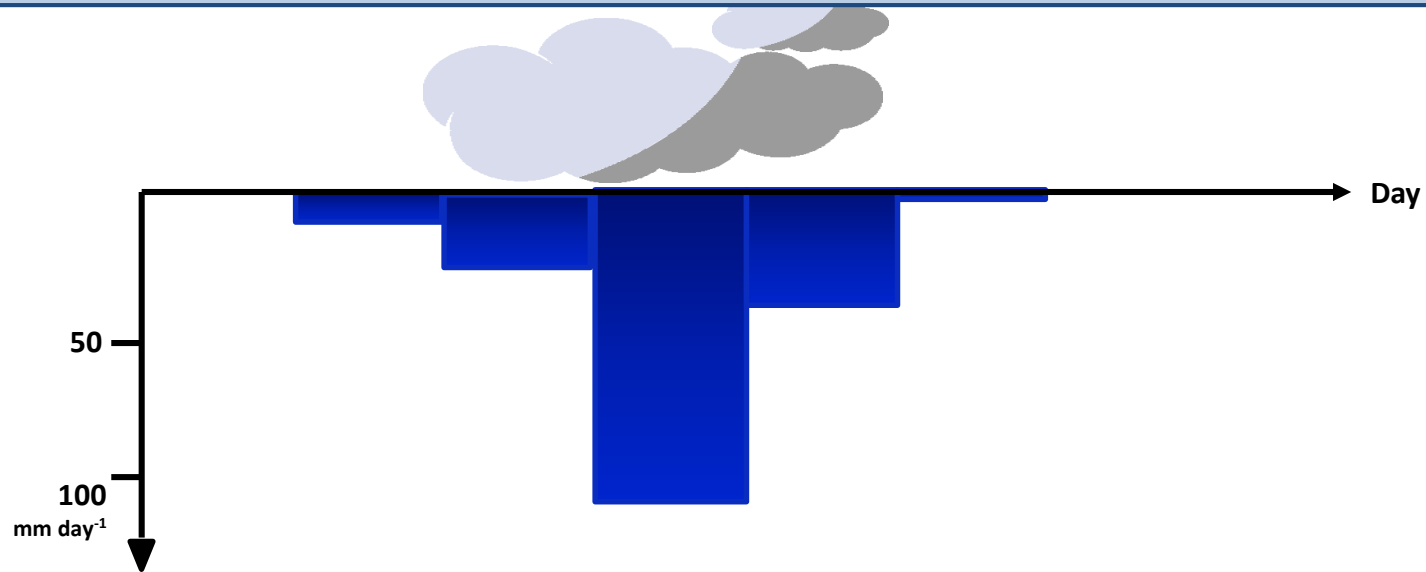
Climate models are **appropriate** to study **statistical changes** in precipitation.

Ex: Intensity of precipitation events of 10 year return period are going to increase 10% in 2050.

Observed data: Nov 1999 in Aude watershed (France)

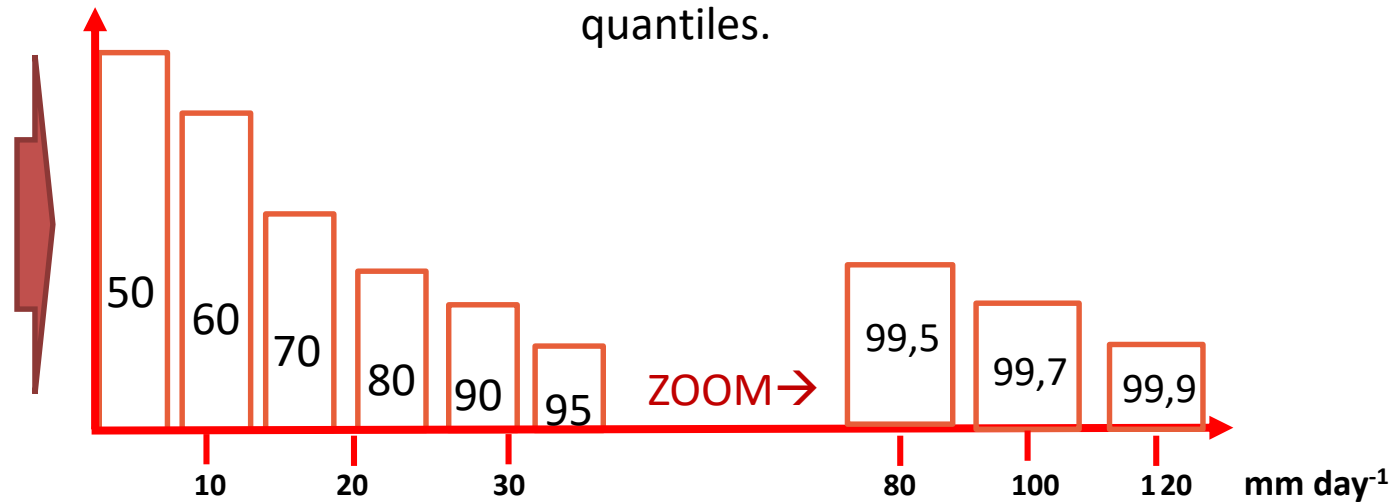


Futurisation method

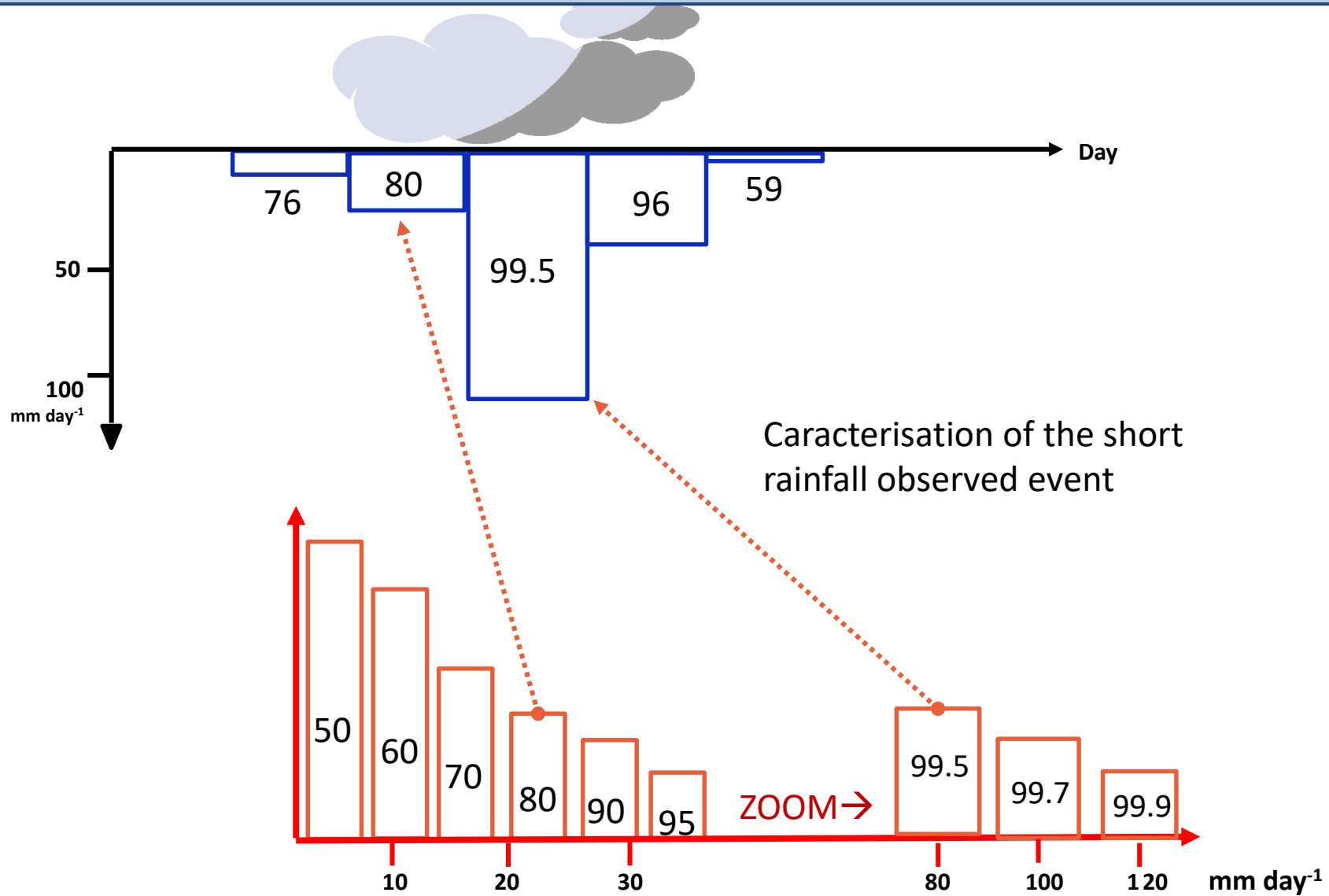


30 year of daily precipitation to define quantiles.

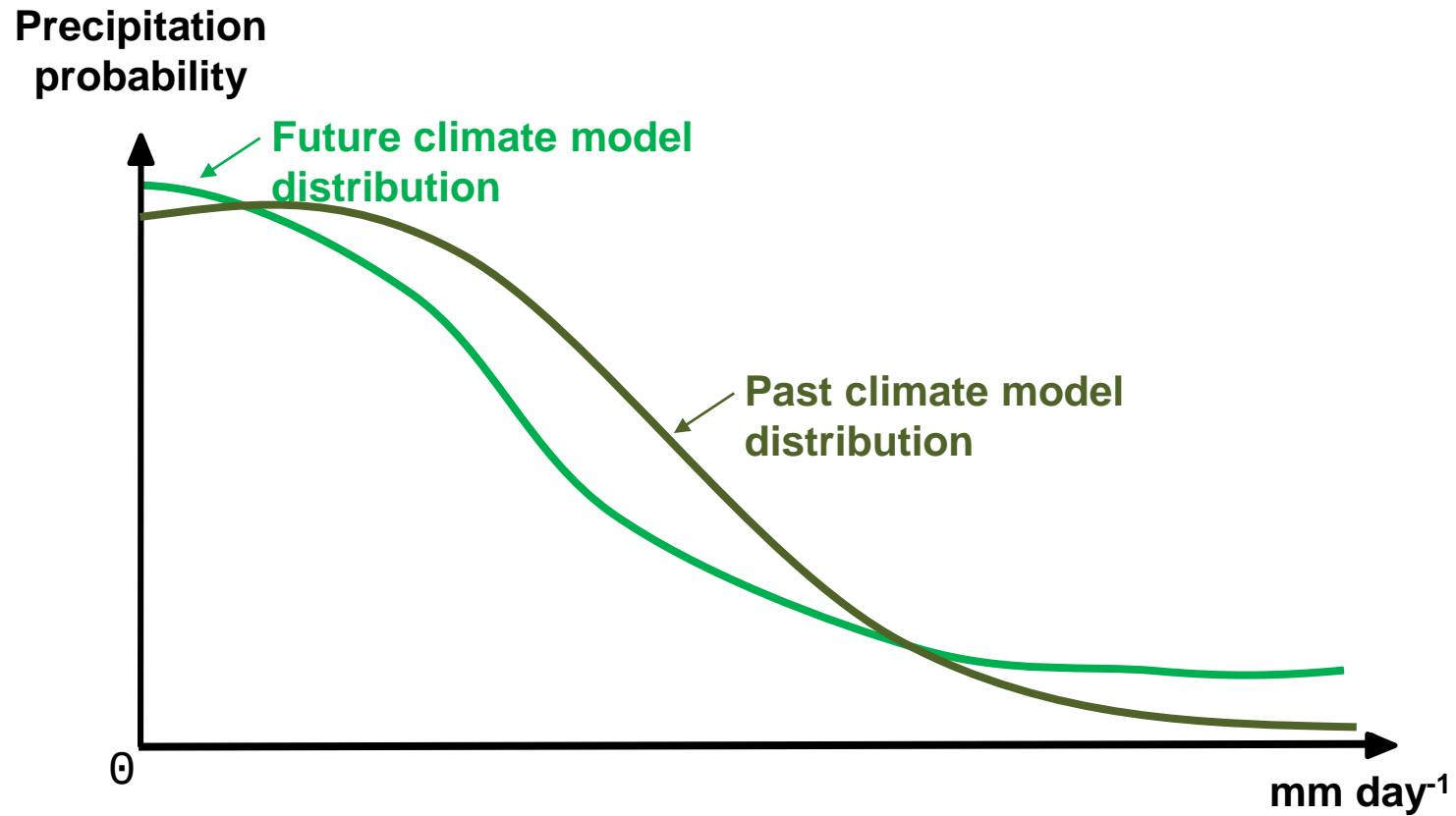
SAFRAN
Durand *et al.* (1993)
Quintana-Segui *et al.* (2008)

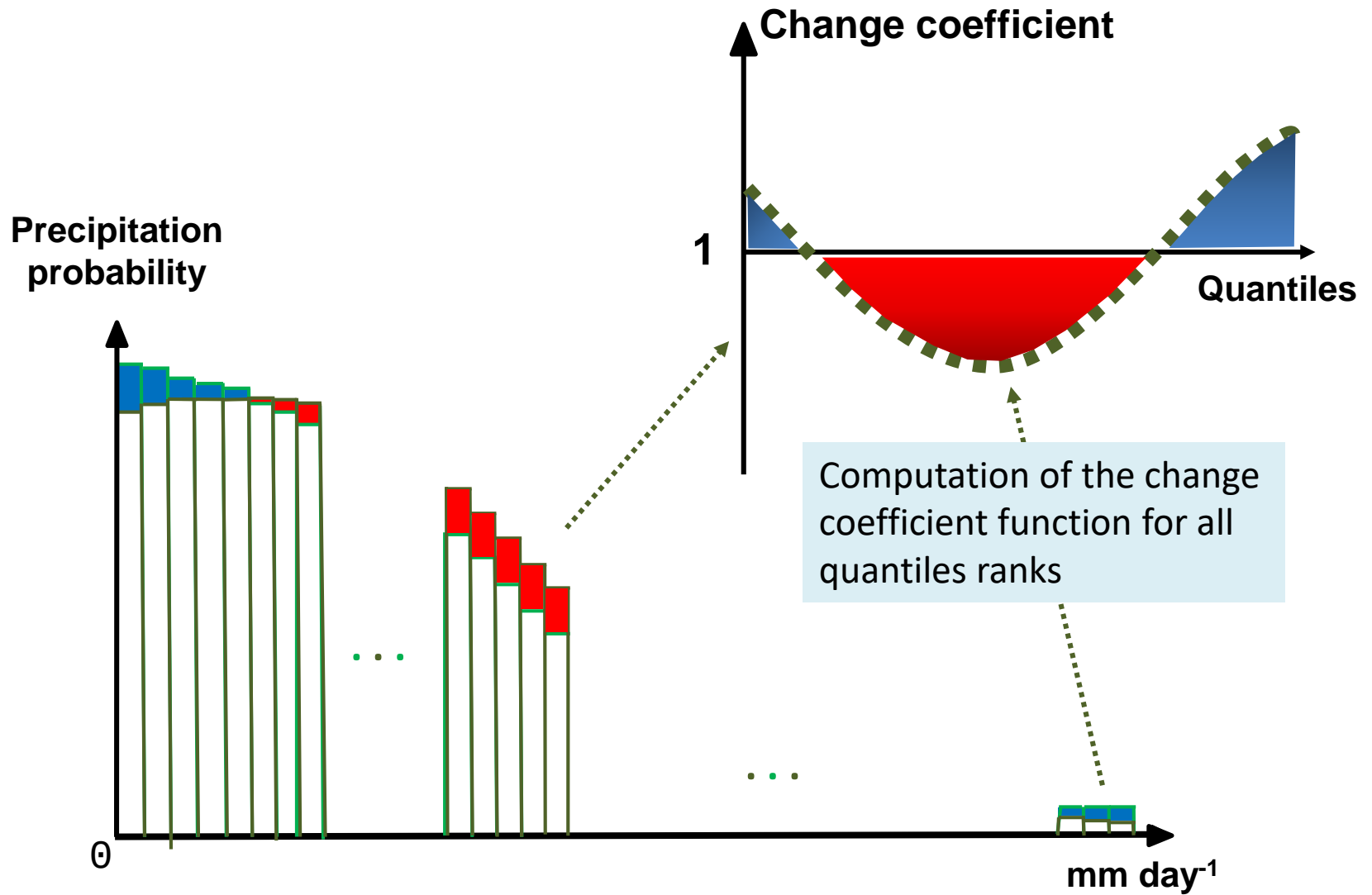


Futurisation method

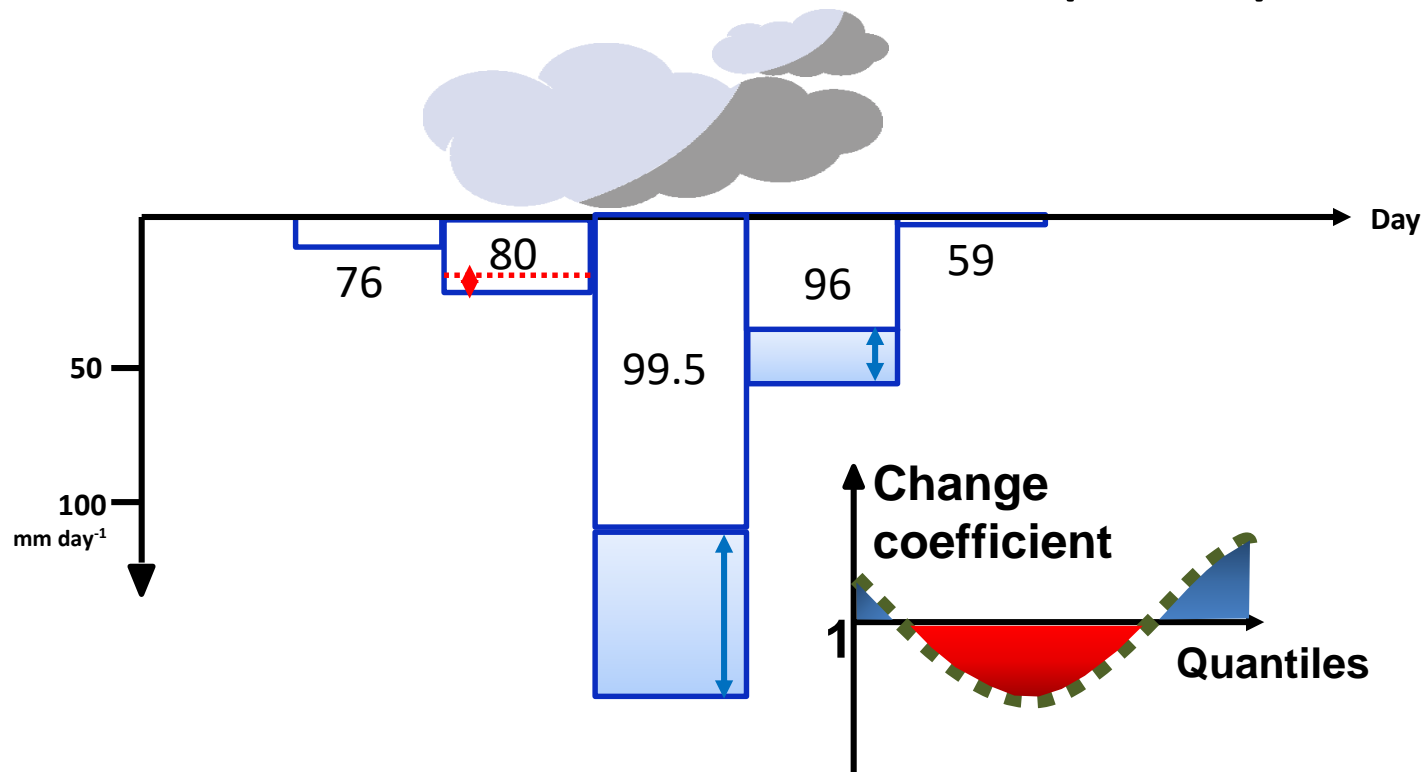


Simulated data from CORDEX regional climate models:

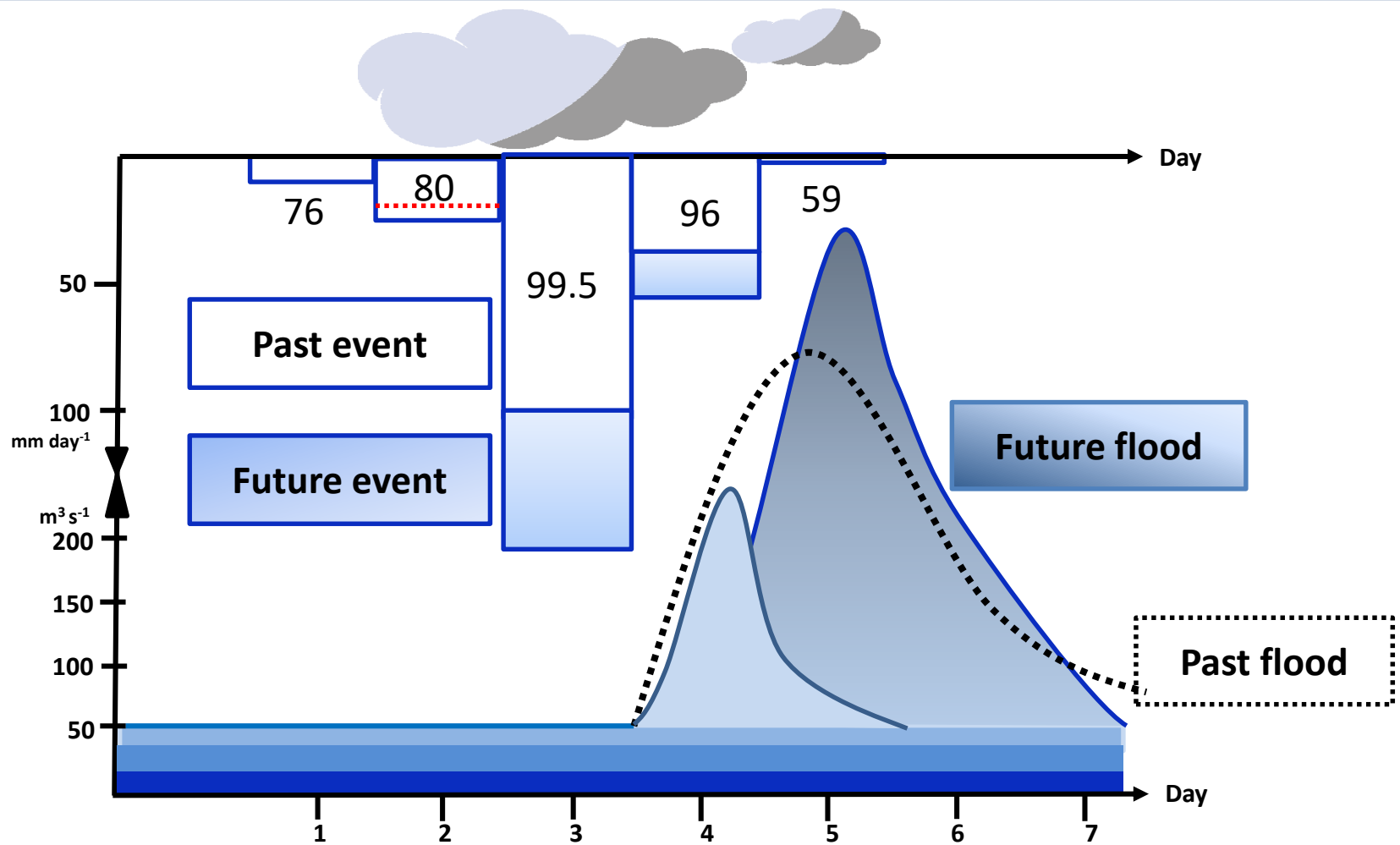




Observed data: Nov 1999 in Aude watershed (France)



Applying quantile-specific change coefficient to the corresponding precipitation event observed in the past period.



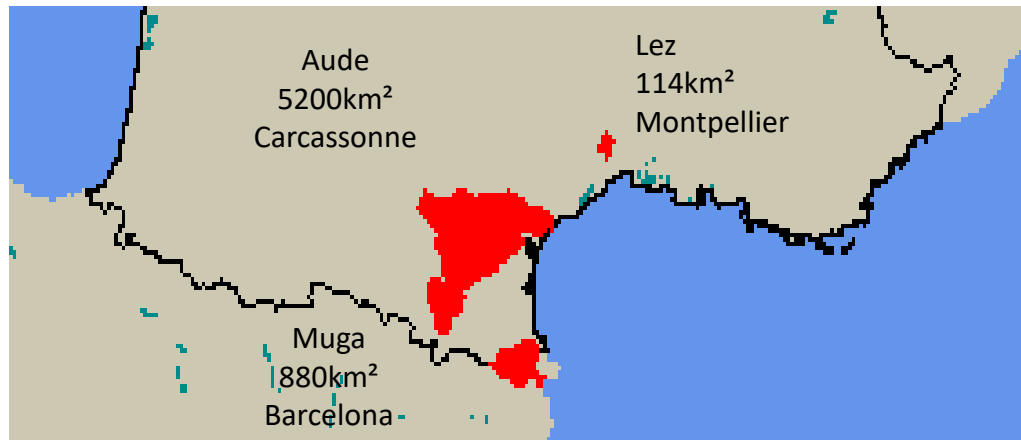
Assessment of flow modification with the future precipitation applied to the hydrological model.

Climate Change: « Comparison of high-resolution Med and Euro-CORDEX simulations (0.11°) with SAFRAN data to forecast future climate changes over Mediterranean catchments »

(Colmet Daage *et al.*, in revision)

- Past simulations : 8 RCMs compared to SAFRAN dataset
- Forecast simulations: change coefficient function between past and future precipitation for the « futurisation method »

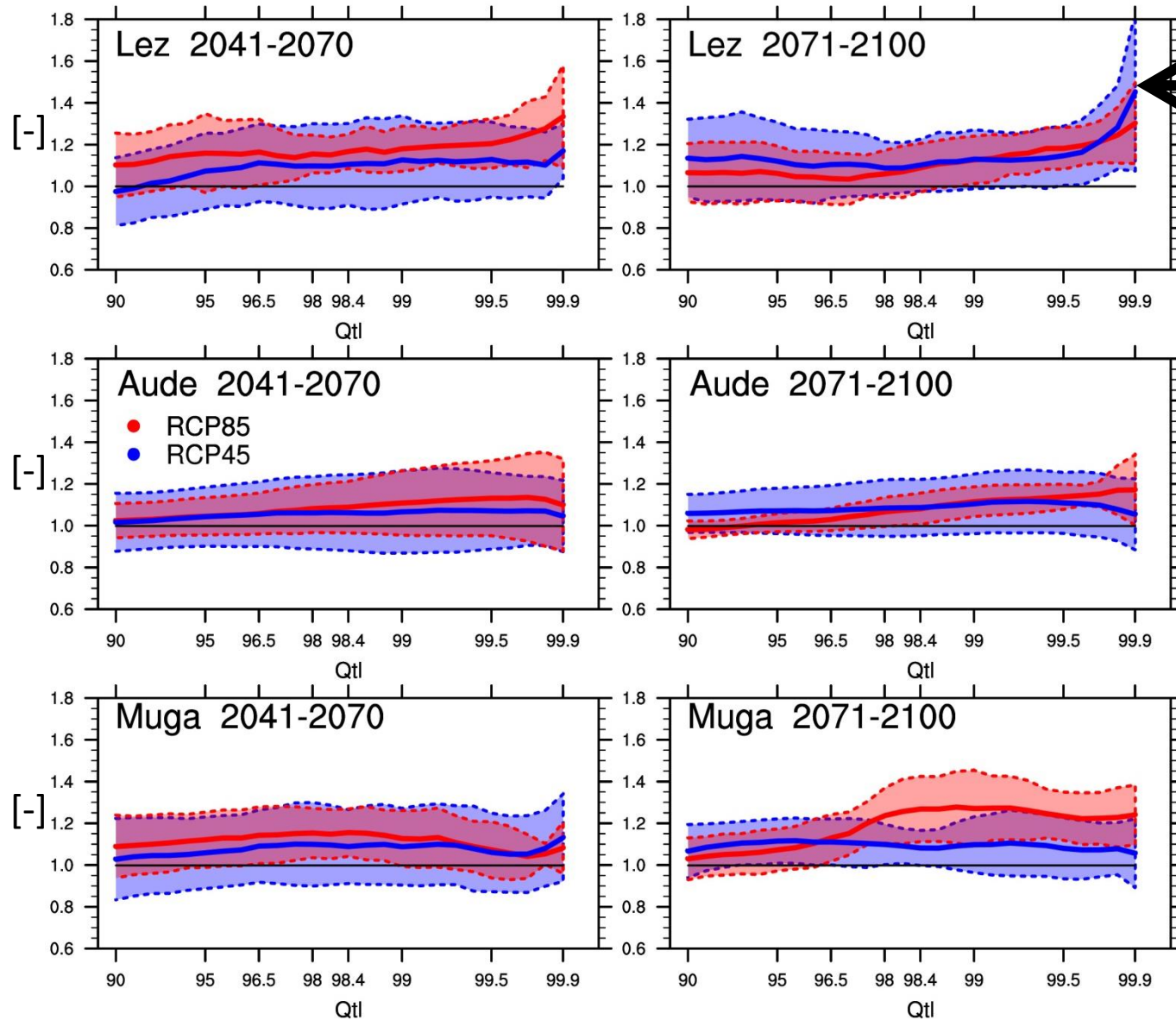
Mediterranean catchments:



Future floods: Hydrological models

- SCS Lag & Route
- TOPKAPI
- HEC-HMS (Raynaud *et al.*, 2016)

Results



120 mm d⁻¹
To
180 mm d⁻¹

- ✘ Rise of extreme precipitation events
- ✘ 2071-2100: spread mostly positive
- ✘ RCP8.5 changes are higher than RCP4.5 changes

Future change: mean precipitation \neq extreme precipitation

« Futurisation » method is adapted

8 RCMs simulate an increase in extreme precipitation for 2071-2100

Outlooks

SAFRAN-ISBA-MODCOU data to assess soil moisture

Tri-hourly time step

Flash Flood assessment



Thank you for your attention.