



Persistence of the actual hydrological state and weather conditions in streamflow prediction

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DROUGHT- CH product platform for drought early recognition

How long before a drought actually occurs can it be predicted?

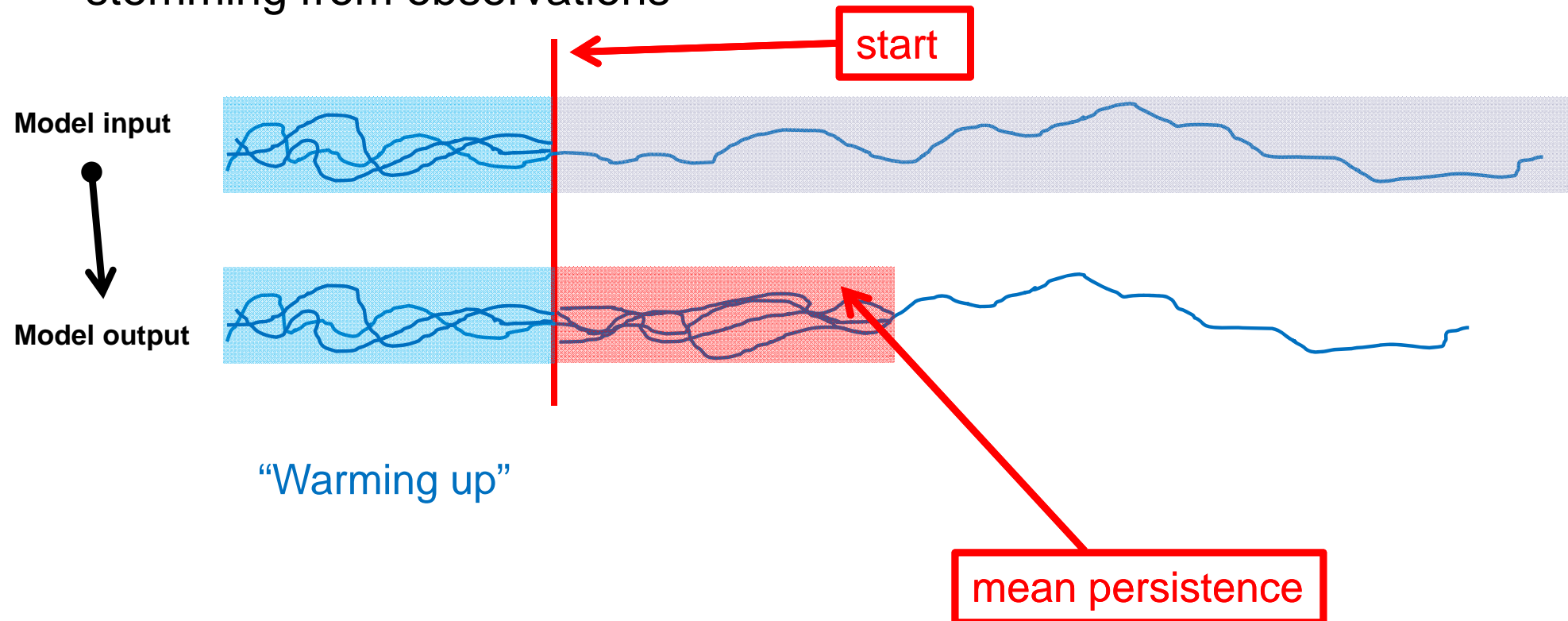
How useful are common conceptual hydrological models for drought early recognition?

METHOD



Simulation of streamflow with the HBV model (HBV light 2010)

Starting with **different antecedent** weather and streamflow **conditions** and one possible "seasonal forecast" both stemming from observations





Calibration

Monte-Carlo Simulation (1000000 runs)
using a period of 28 years (1981-2008)

Log Nash-Sutcliffe $1 - \frac{\sum (\ln Q_{obs} - \ln Q_{sim})^2}{\sum (\ln Q_{obs} - \overline{\ln Q_{obs}})^2}$

→ 100 parameter sets for each catchment

Simulation

Simulation of 365 days x 28 (28 antecedent conditions)

Start of simulations in spring, summer, fall and winter

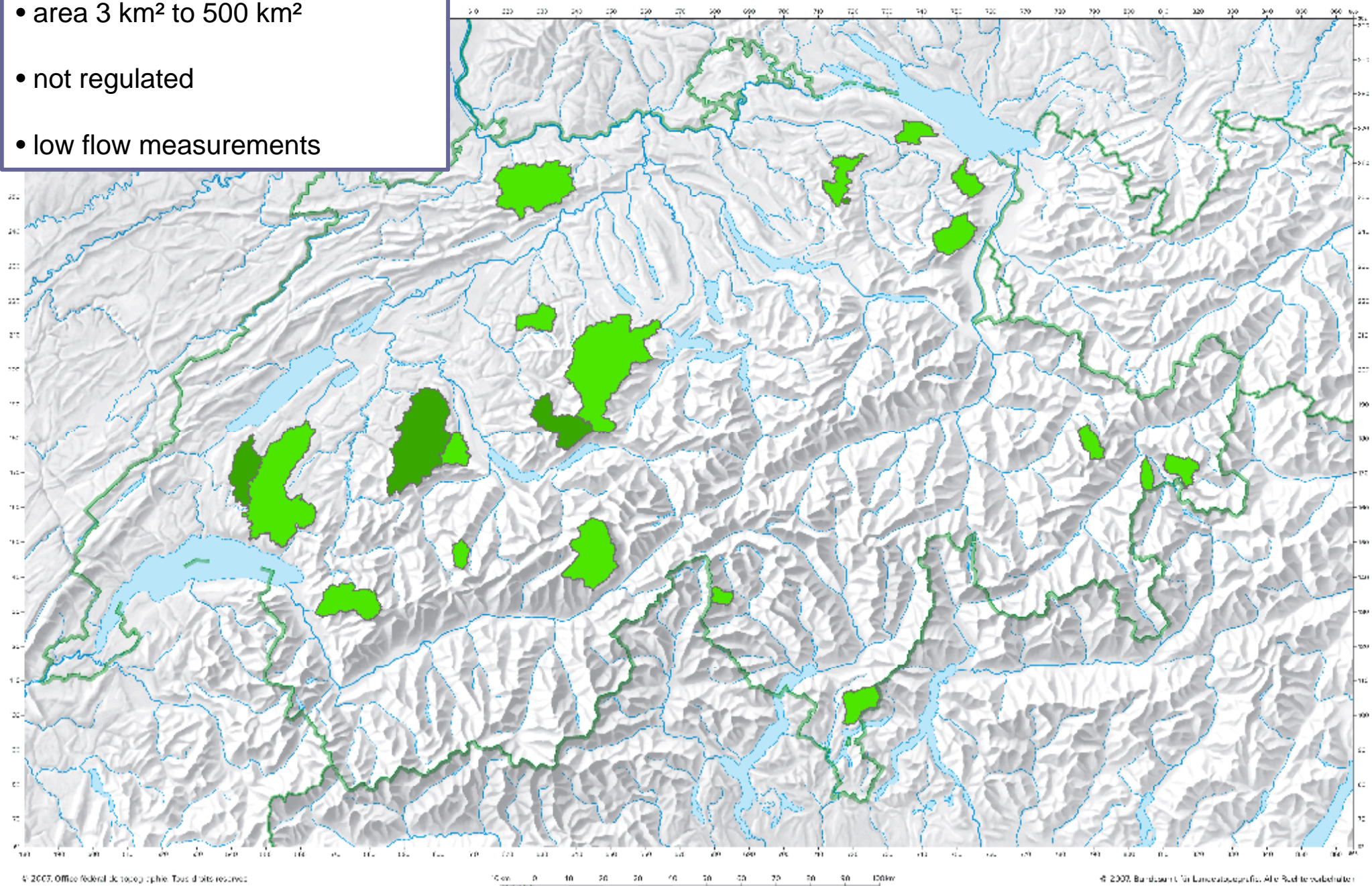
Analysis

Estimation mean persistence for all seasons and all catchments

CATCHMENTS

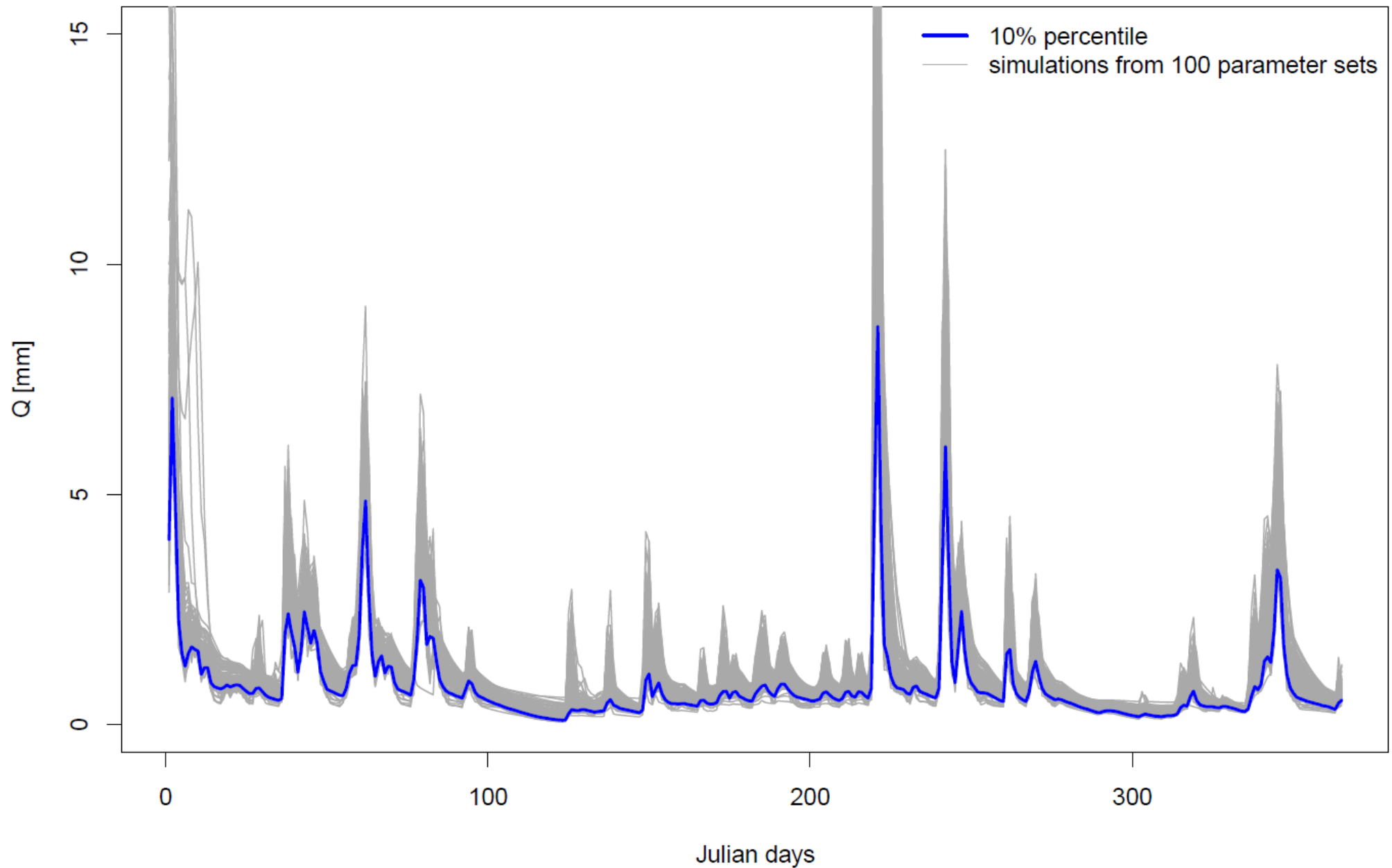


- area 3 km² to 500 km²
- not regulated
- low flow measurements

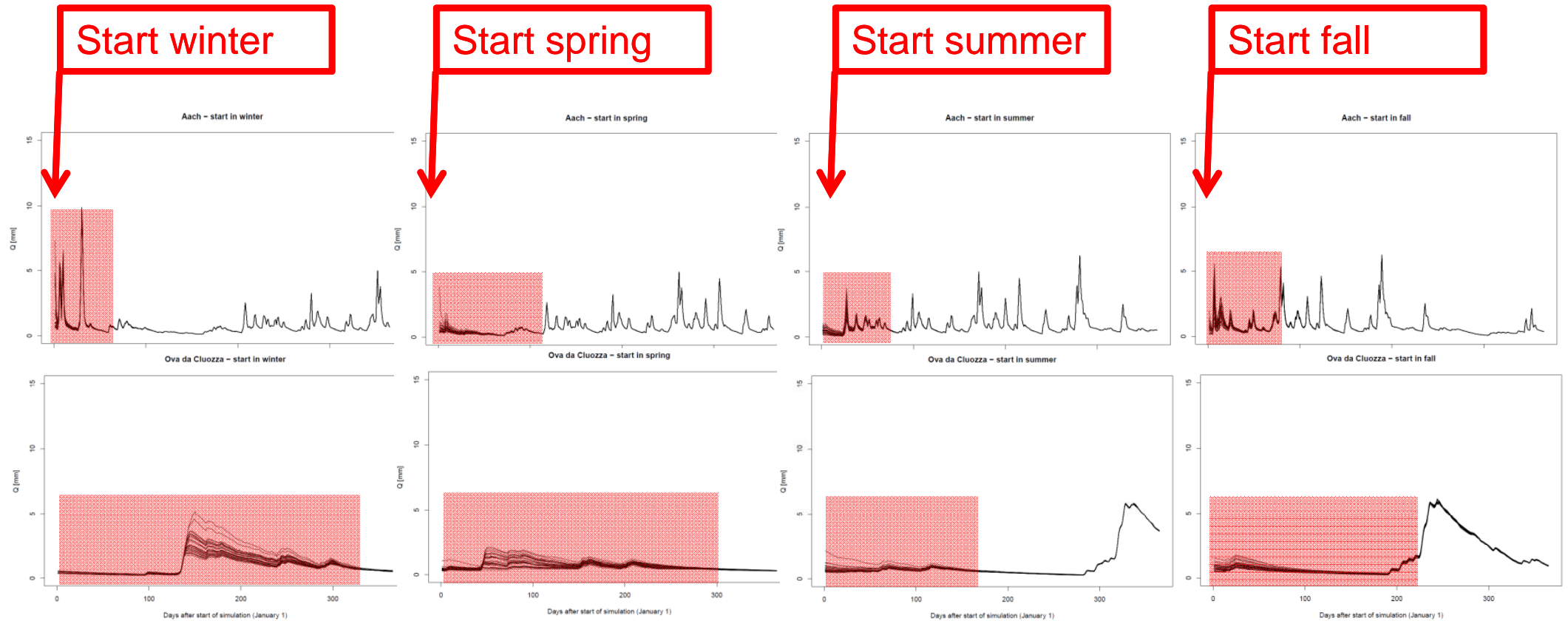


METHOD

10% percentile as representative for the simulations from 100 parameter sets



MODEL OUTPUT



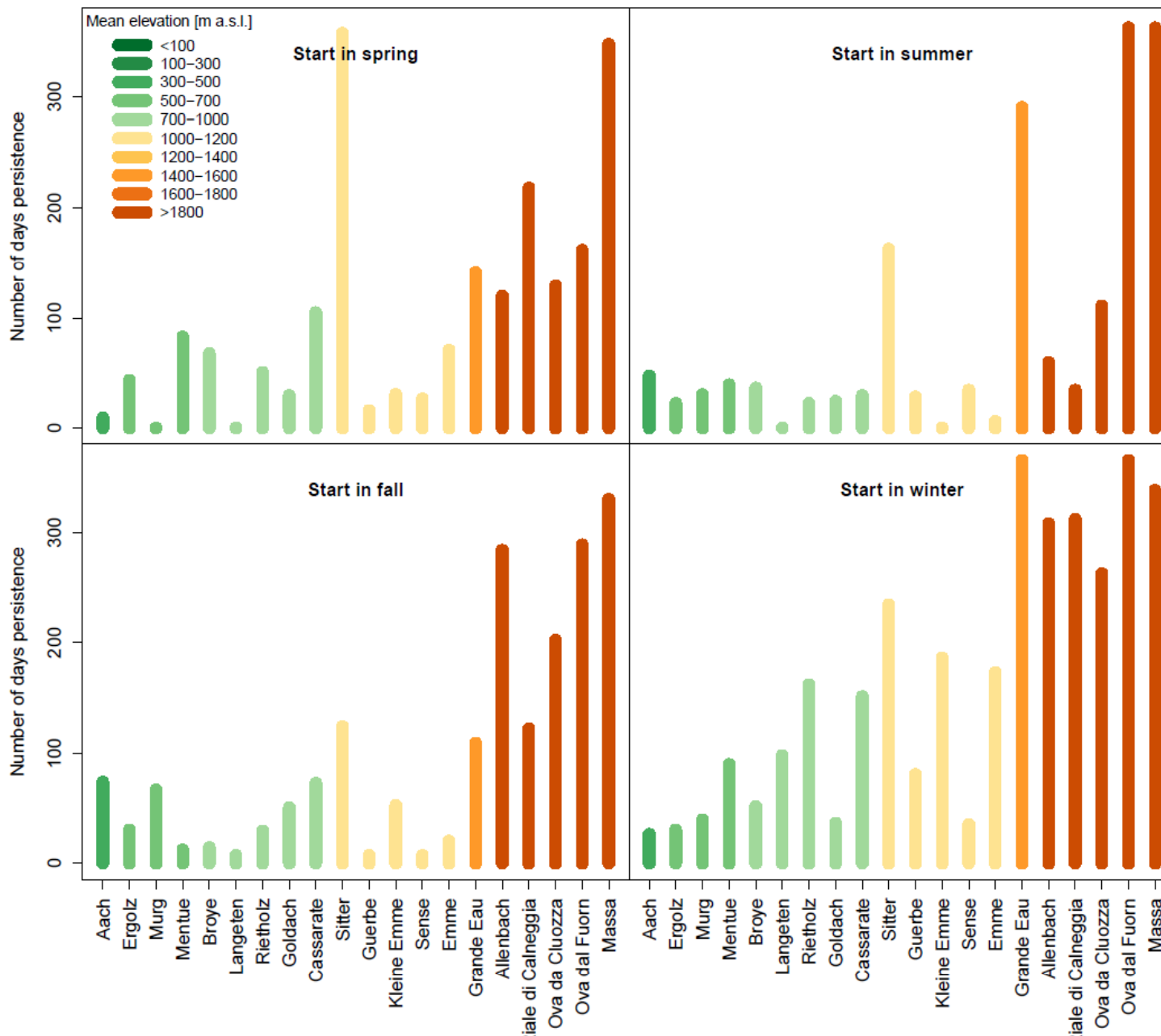
January 1

April 1

July 1

October 1

PERSISTENCE DURING THE SEASONS



1) General

Different persistence for each catchment

Longer for catchments with higher elevation

2) Seasonal

Difference between the seasons → influence of the weather (model parameters the same)
in winter longer persistence

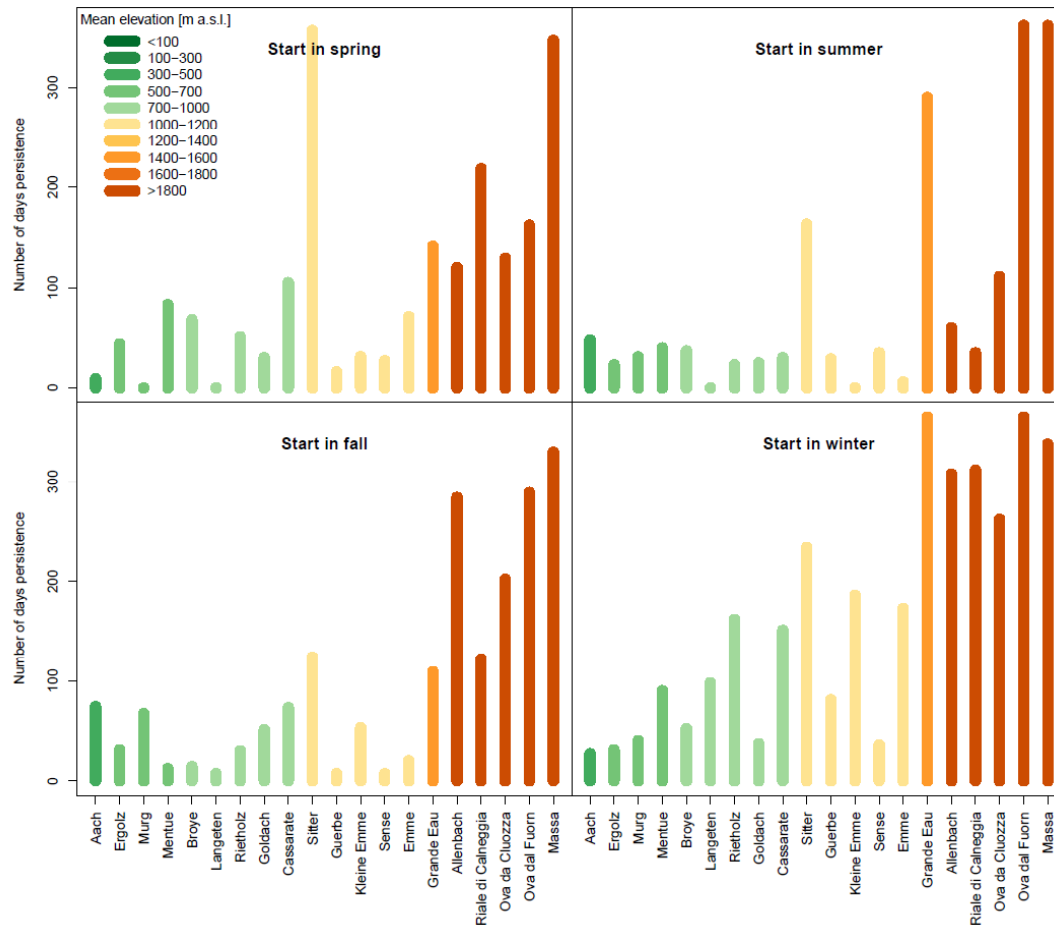
e.g. start in summer and start in spring → influence of snow

What would happen if the seasonal forecast is very dry?

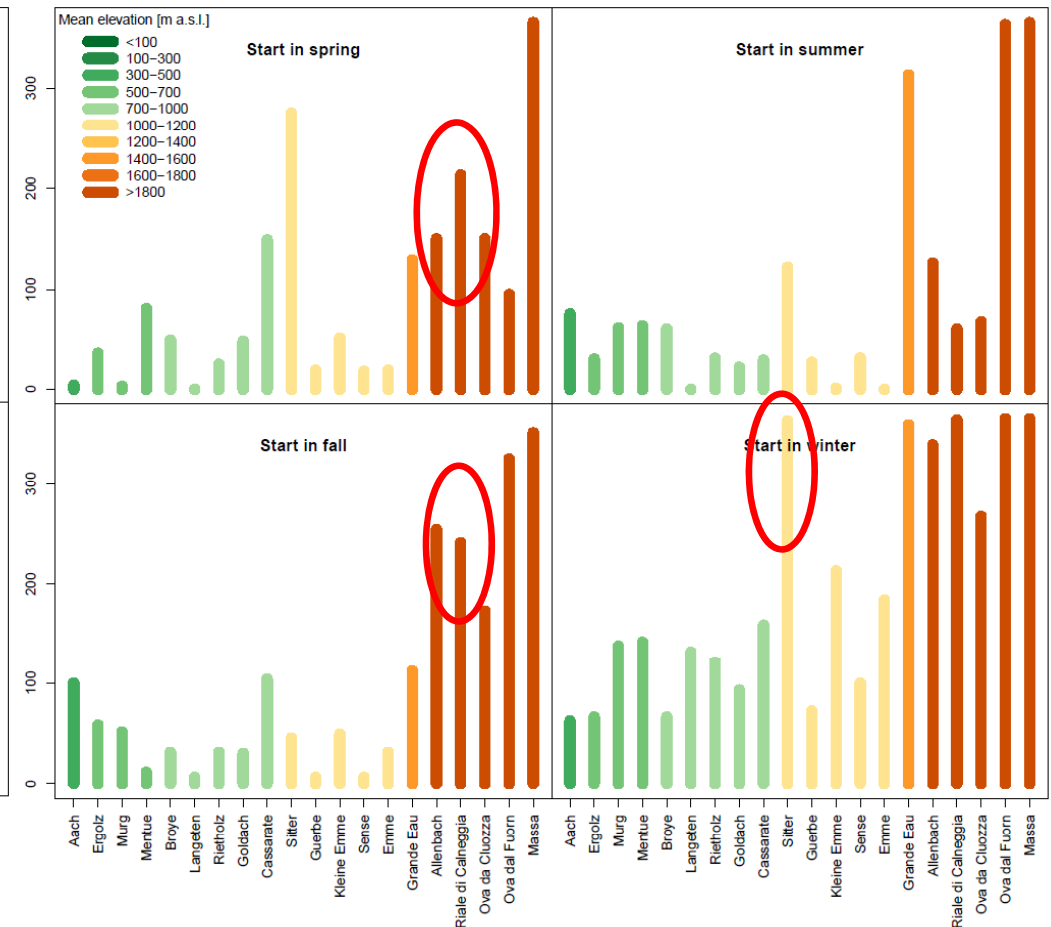
PERSISTENCE DRY SEASONAL FORECAST



Normal year (1982)

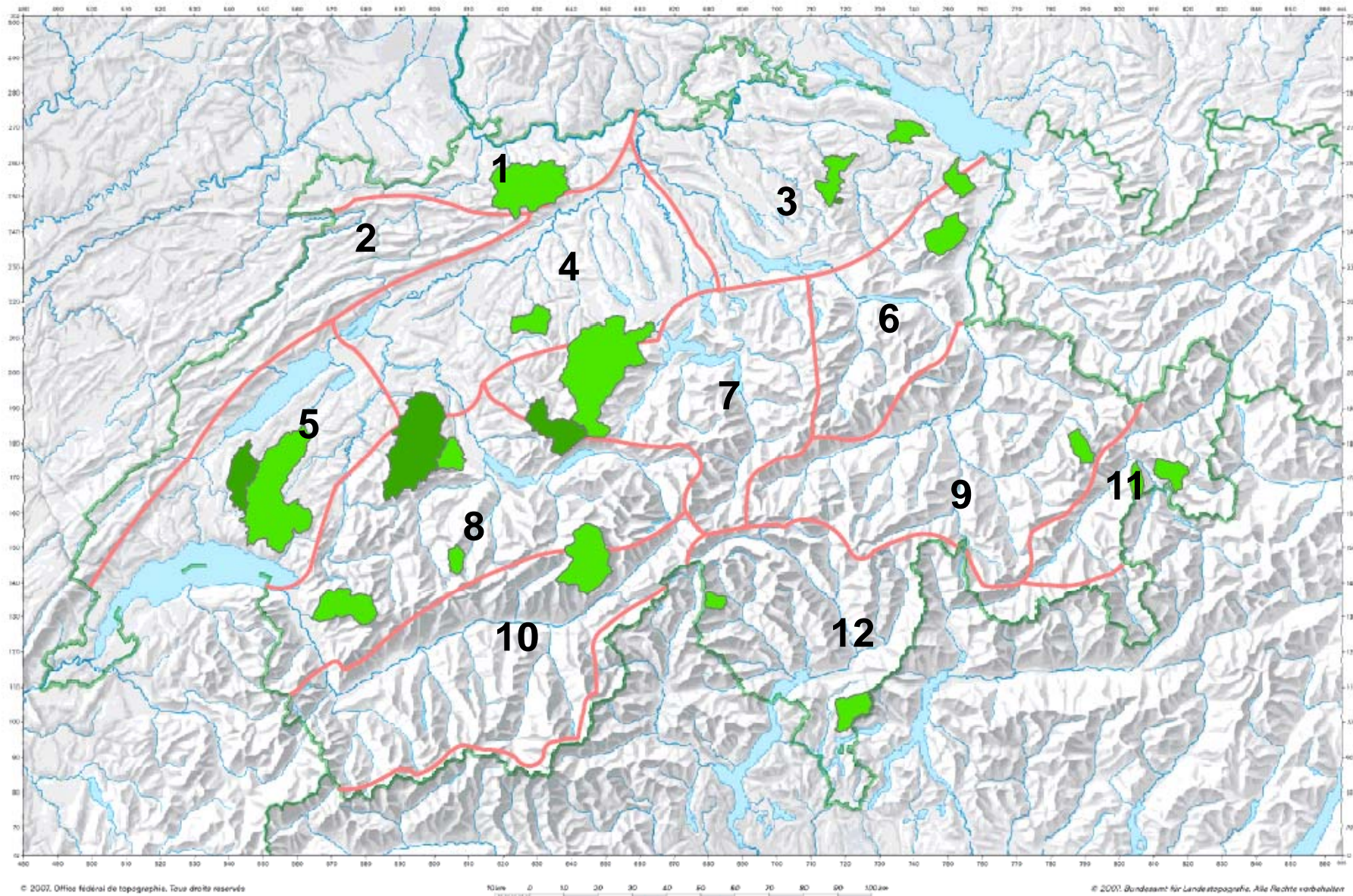


Dry year (2003)

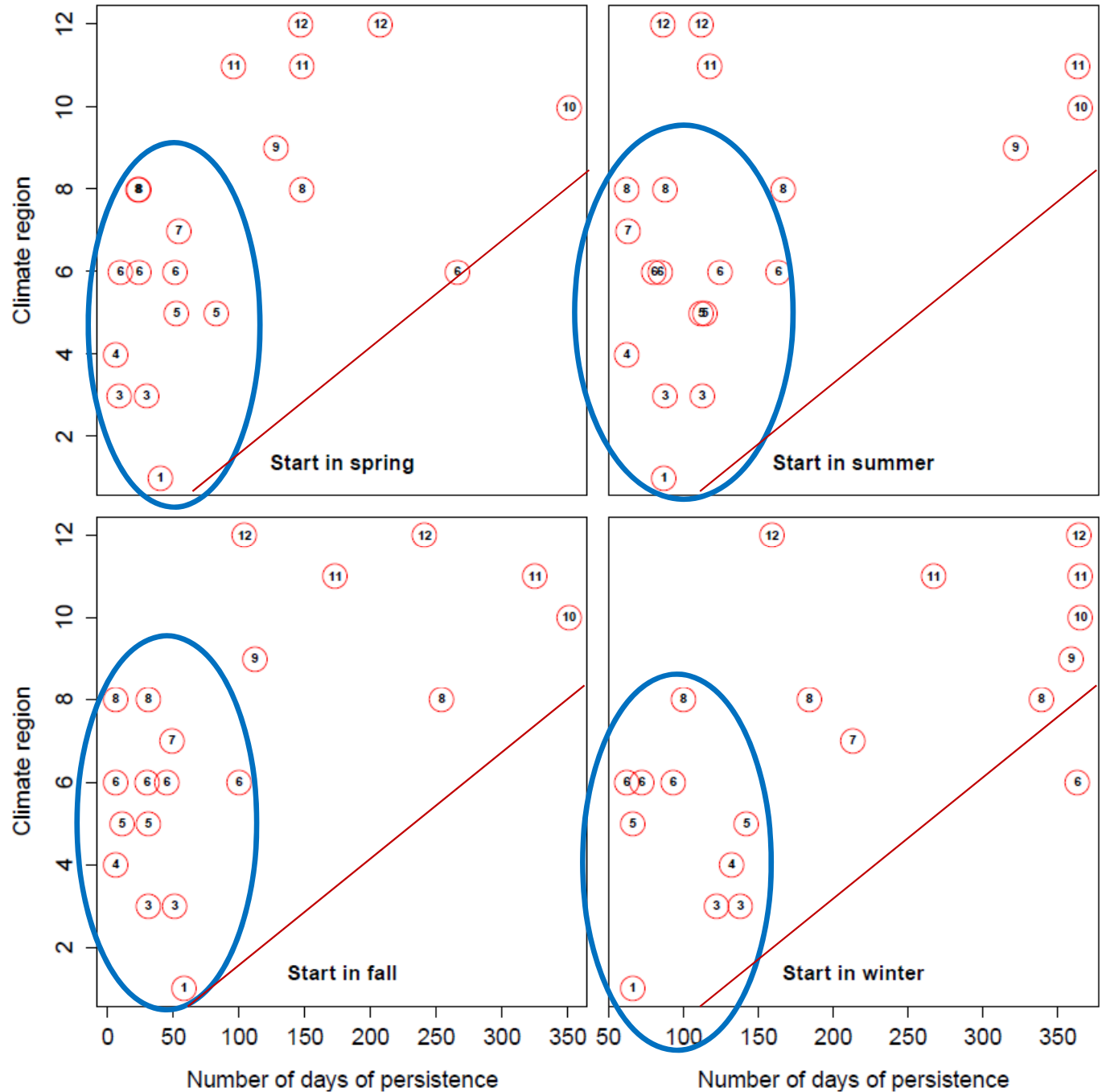
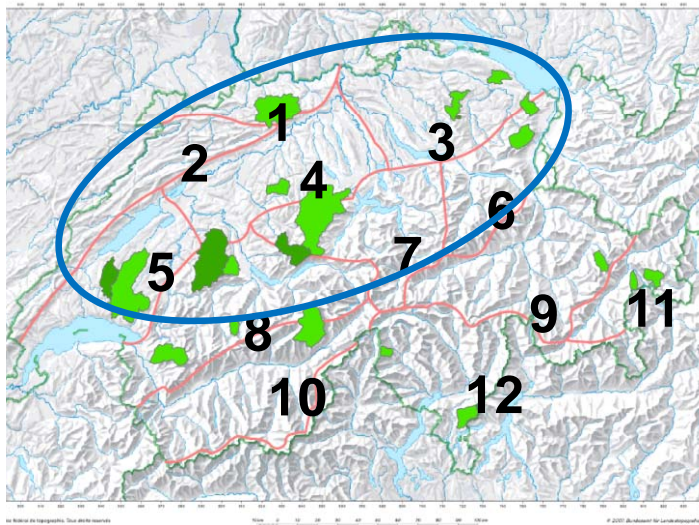


→ Most of the catchments show no significant change in persistence having a different (dry) seasonal forecast

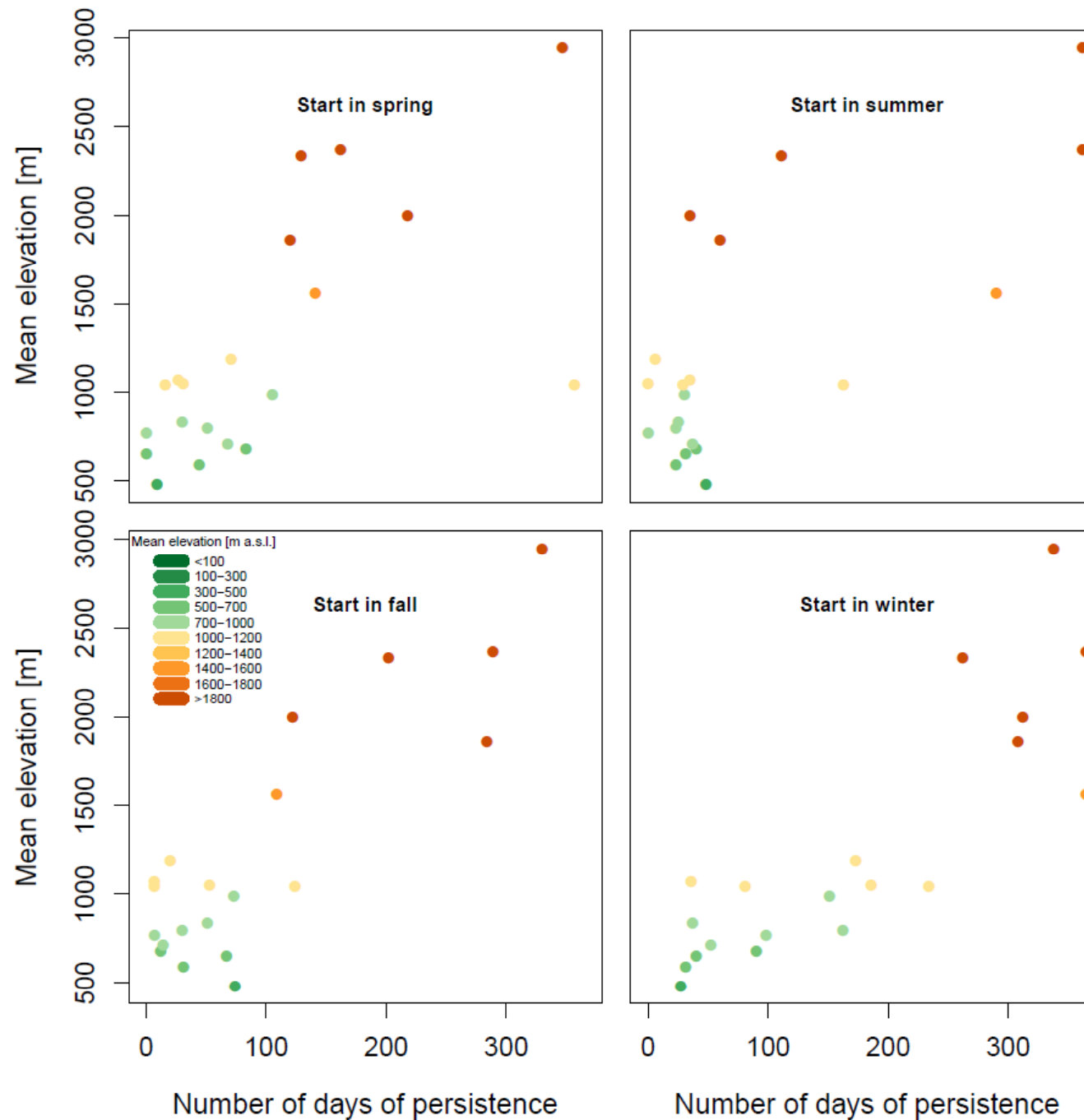
PERSISTENCE - CLIMATE REGION



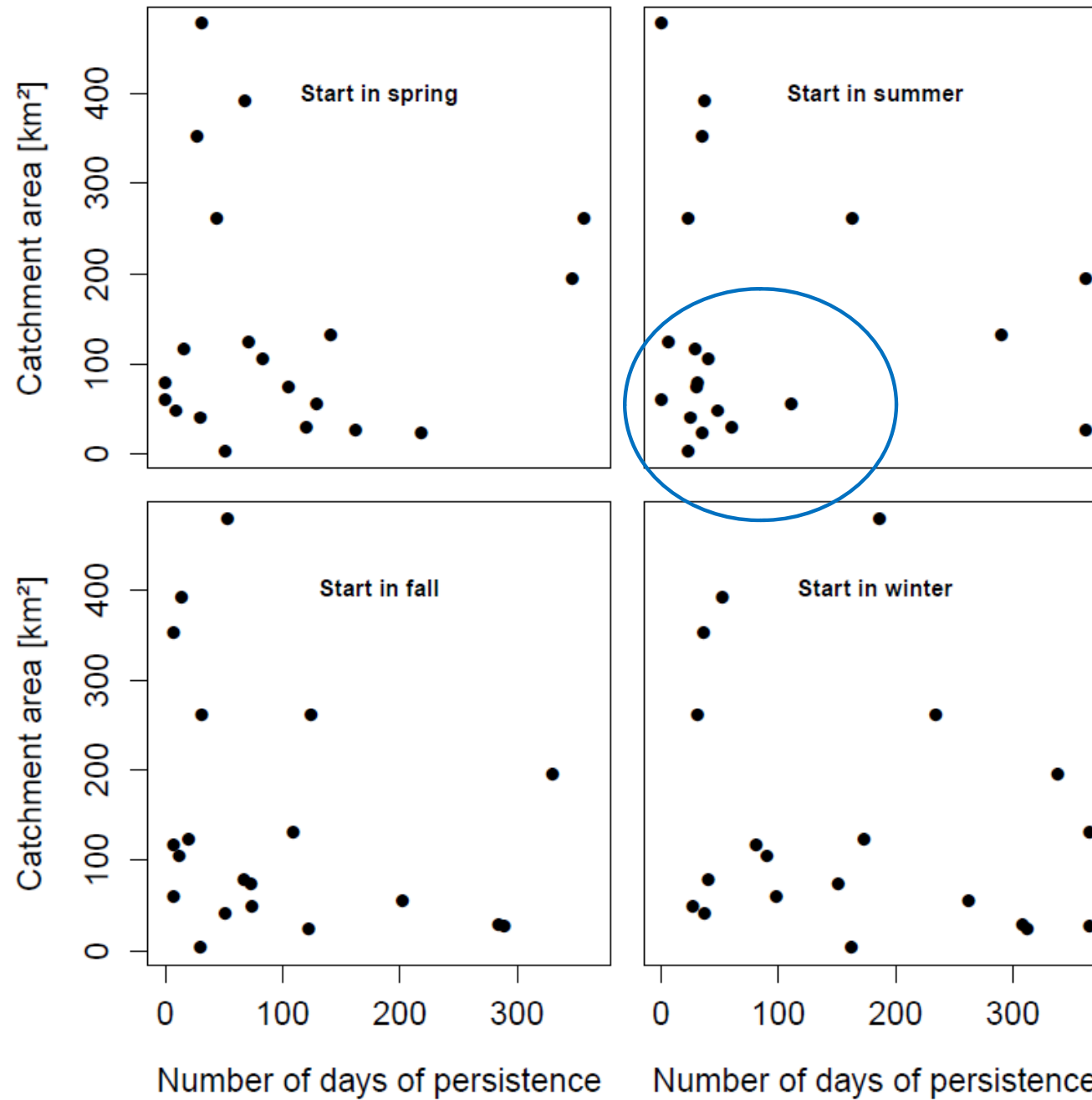
PERSISTENCE - CLIMATE REGION



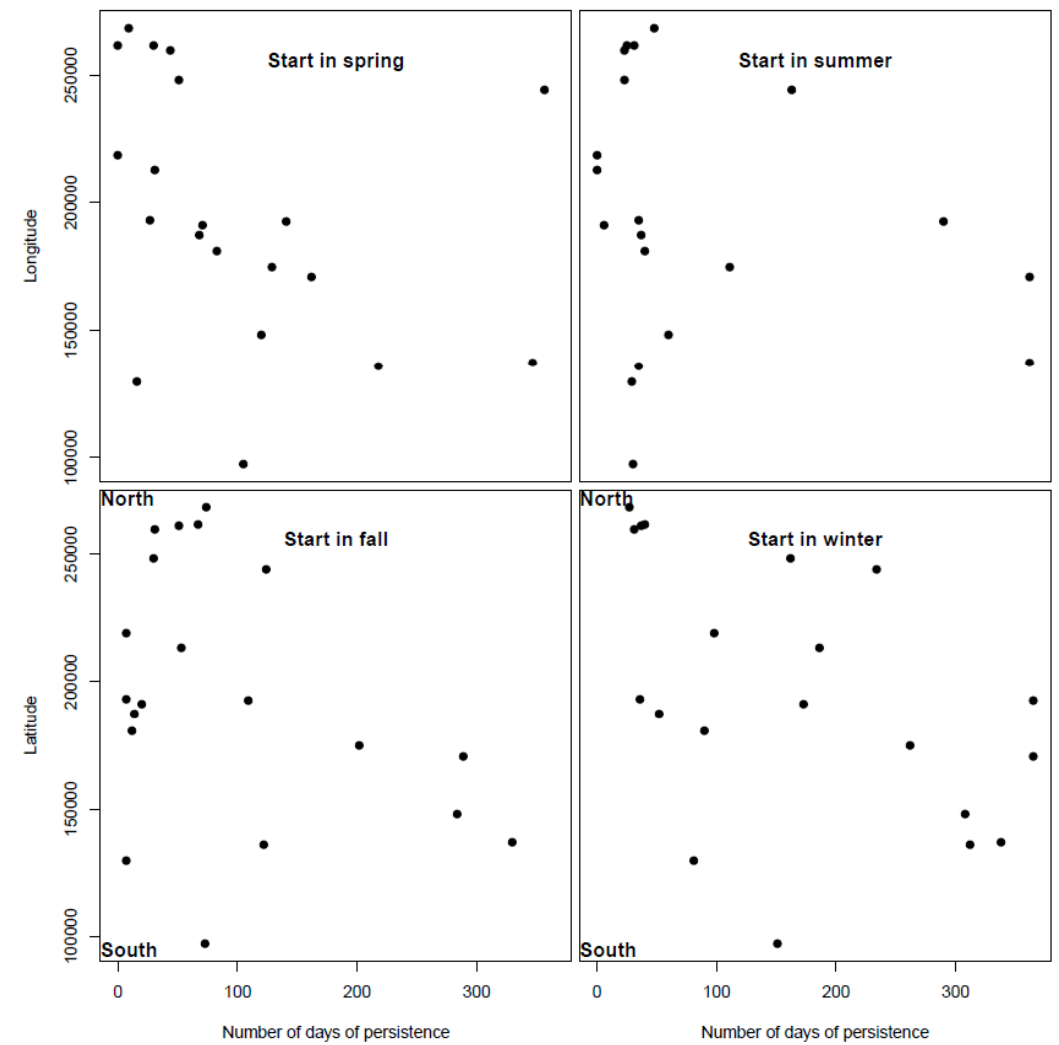
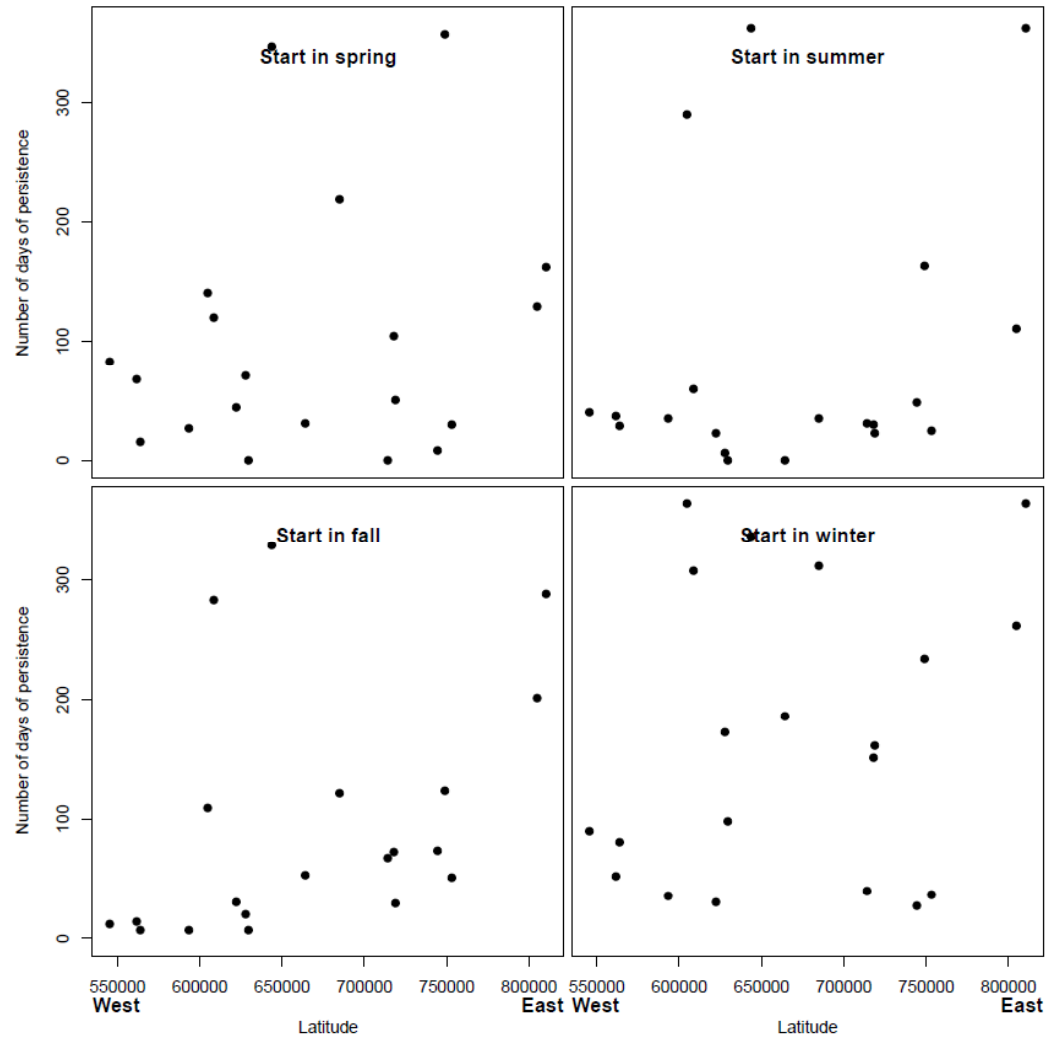
PERSISTENCE – CATCHMENT MEAN ELEVATION



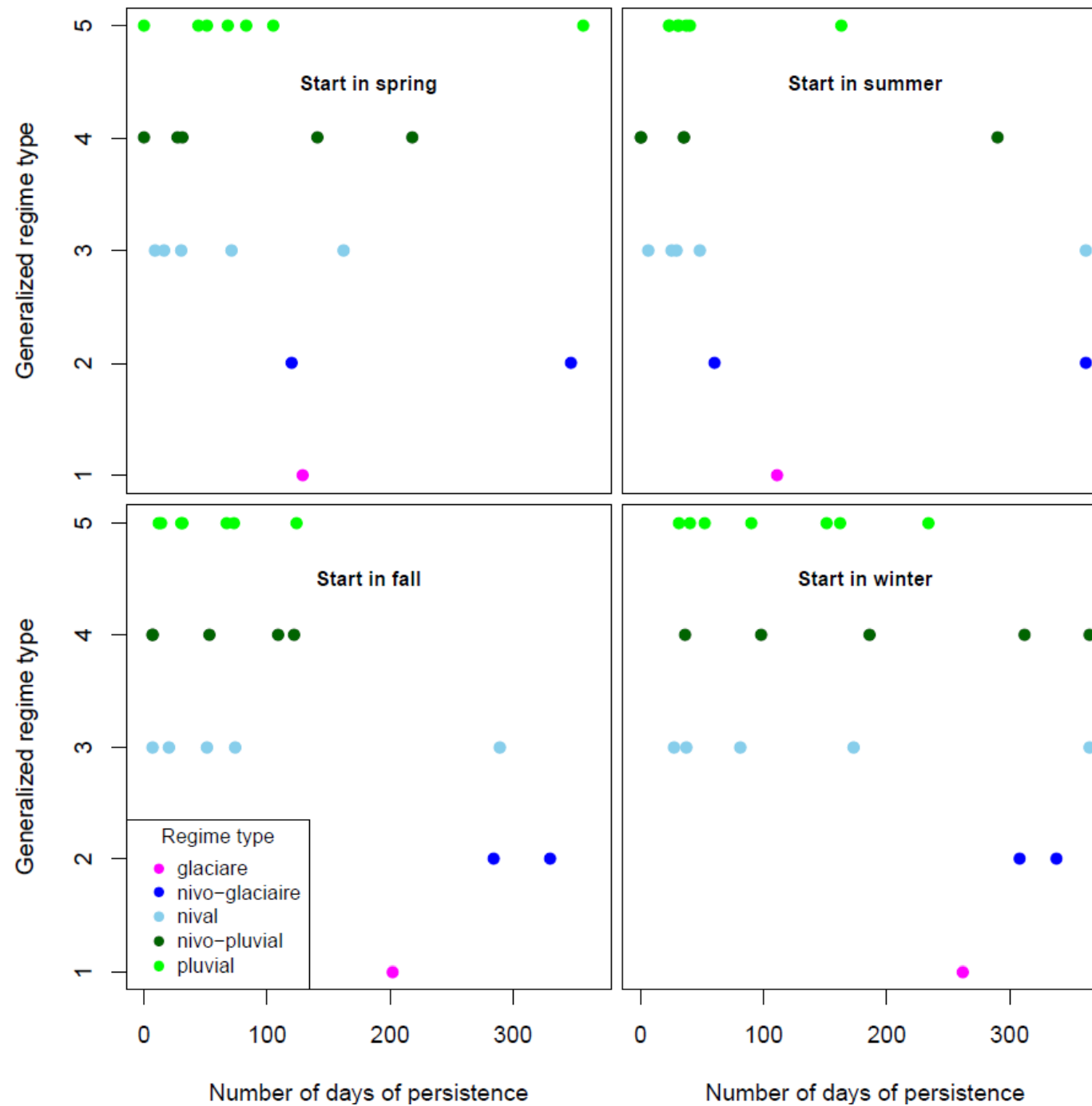
PERSISTENCE – CATCHMENT AREA



PERSISTENCE – LONGITUDE AND LATITUDE



PERSISTENCE – STREAMFLOW REGIME



FIRST CONCLUSIONS



- varying persistences for the different catchments
- seasonal variation within the catchments
- no significant change in the seasons using another “seasonal forecast”
- no correlation persistence with longitude, latitude or regime type visible
- Small catchments have small persistence in summer (not all)
- link with catchment mean elevation
- climate regions seem to link but too few catchments for statement
- Seasonal comparison lets think about snow as one of the important factors

FURTHER STUDIES / OPEN QUESTIONS



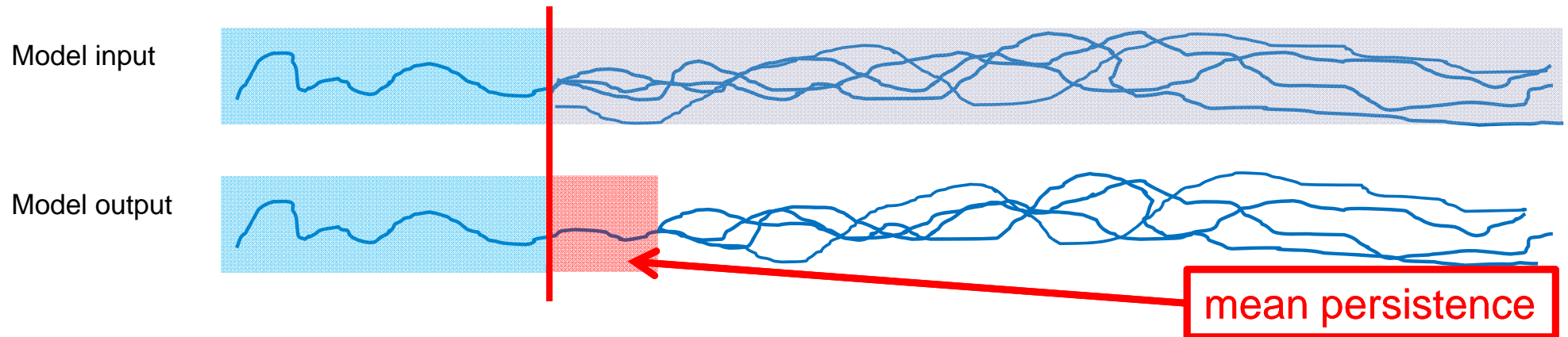
- suggestions for other catchment features that could be used as indicators for the persistence for drought early warning
- further study would be an ANOVA to test for the causes of the seasonal variety
- and...

OPEN QUESTIONS/CHALLENGES

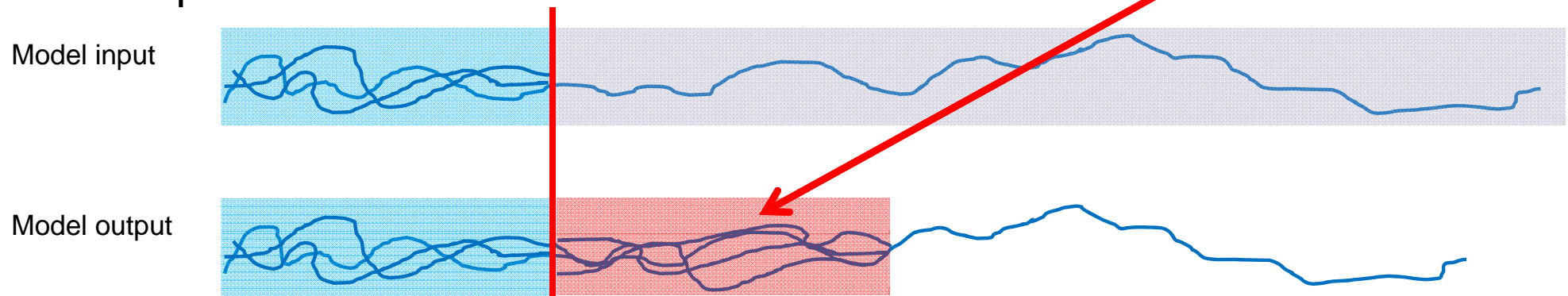


...we have more challenges:

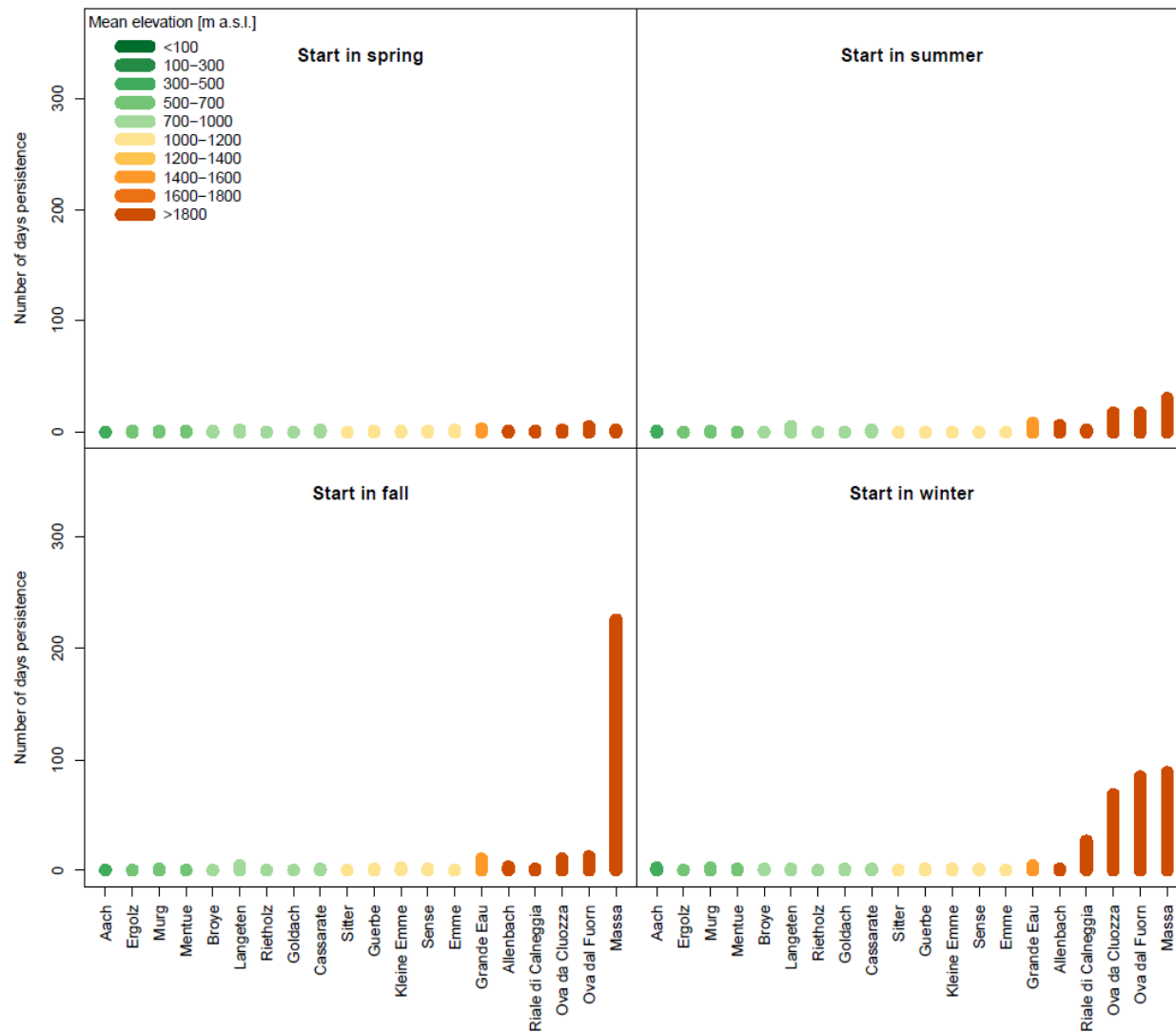
- 1) Starting with same weather and streamflow conditions; different possible "seasonal forecasts" stemming from observations



- 2) Starting with antecedent conditions; same possible "seasonal forecast"



DISCUSSION



Which of the persistences of the two approaches should we consider?

Other techniques to extract the persistence?

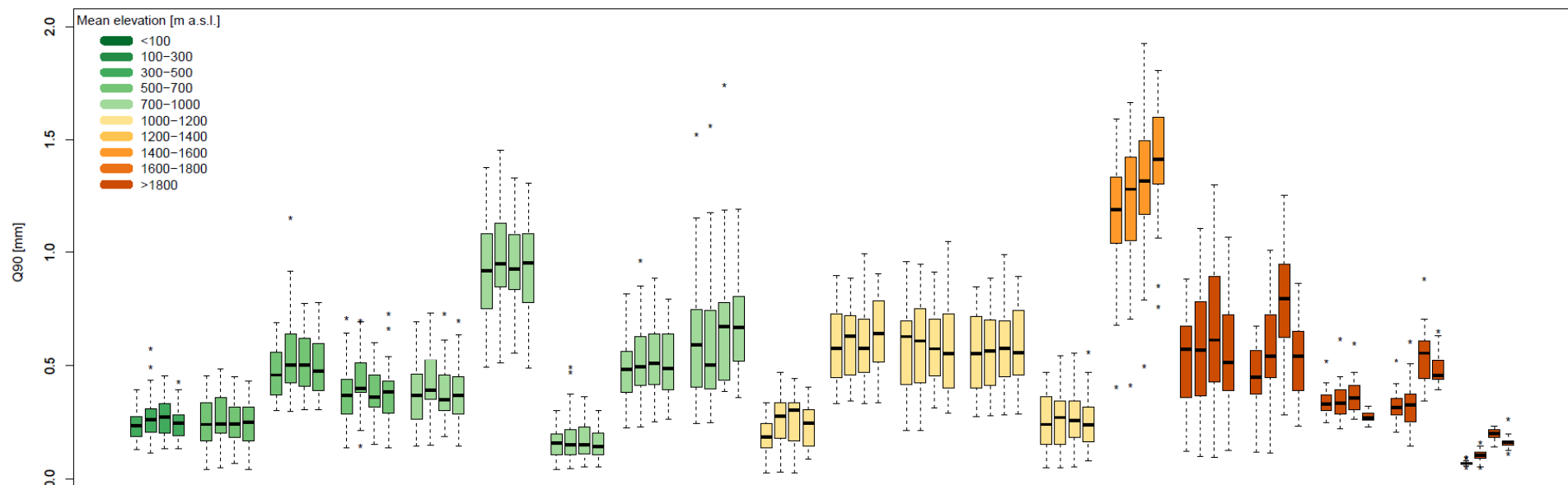


Thanks to Massimiliano Zappa, WSL, Switzerland, who provided the climate input data

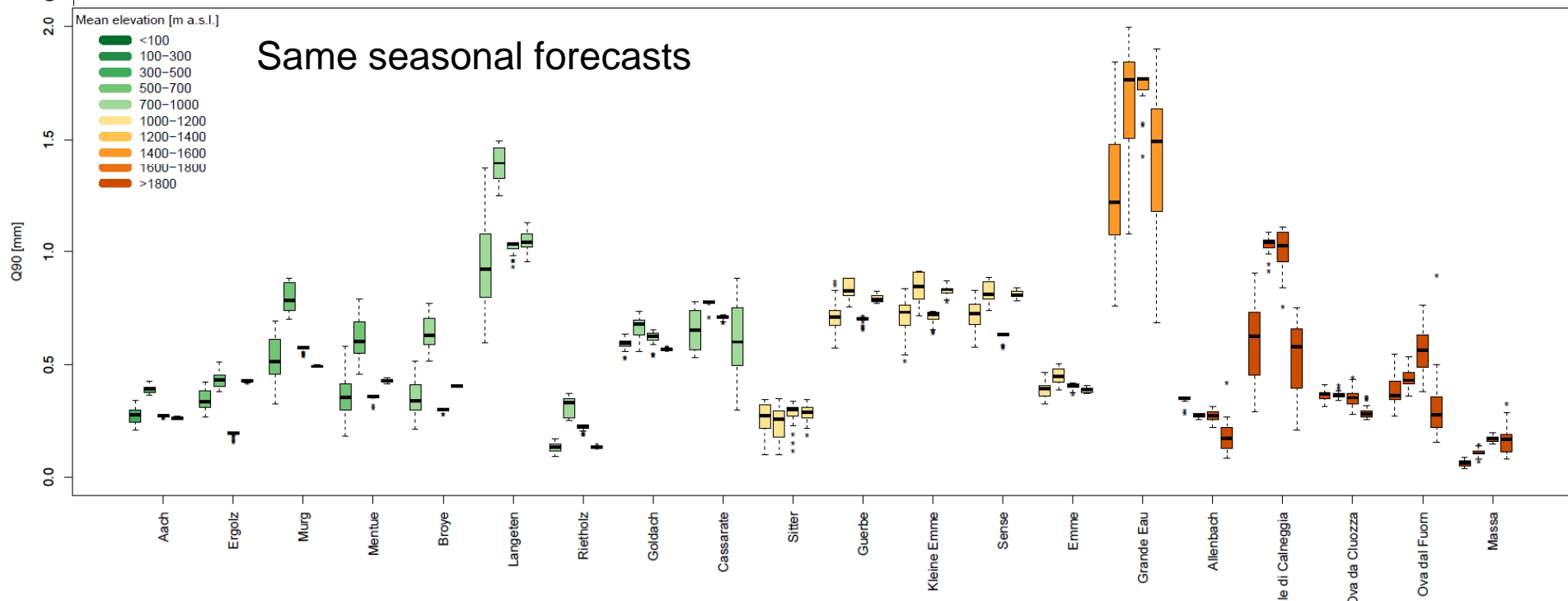
Thanks for listening!

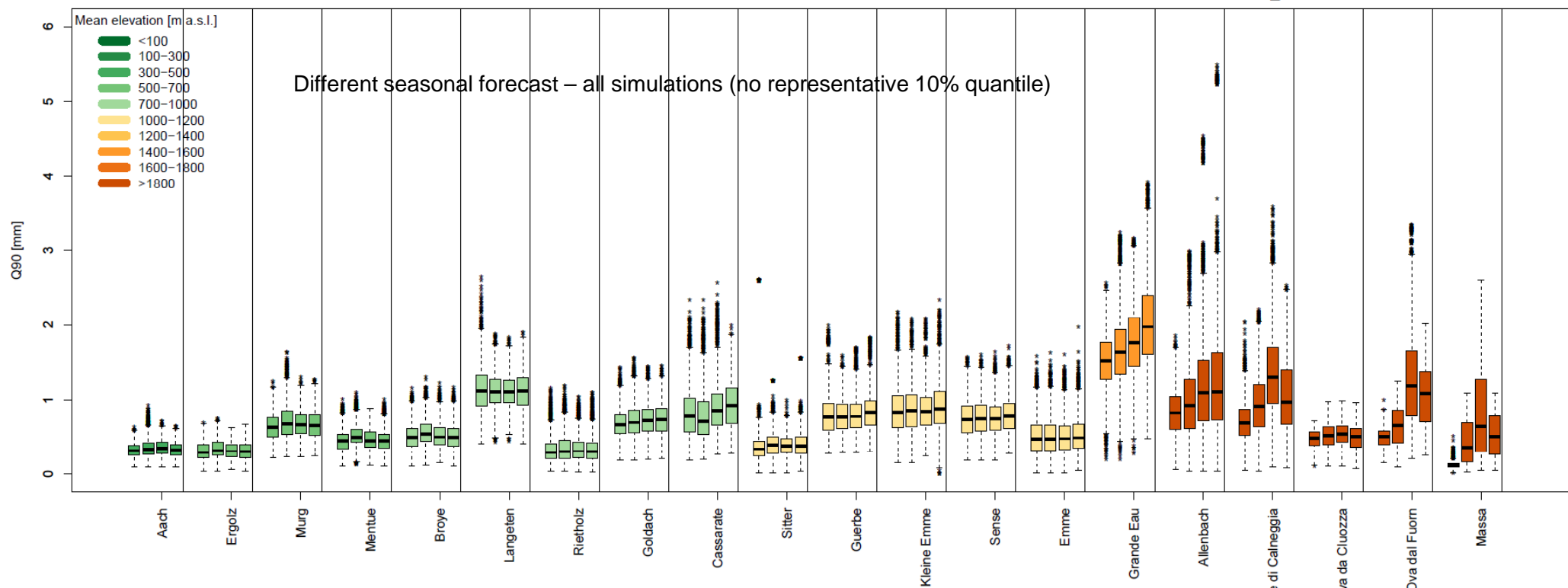
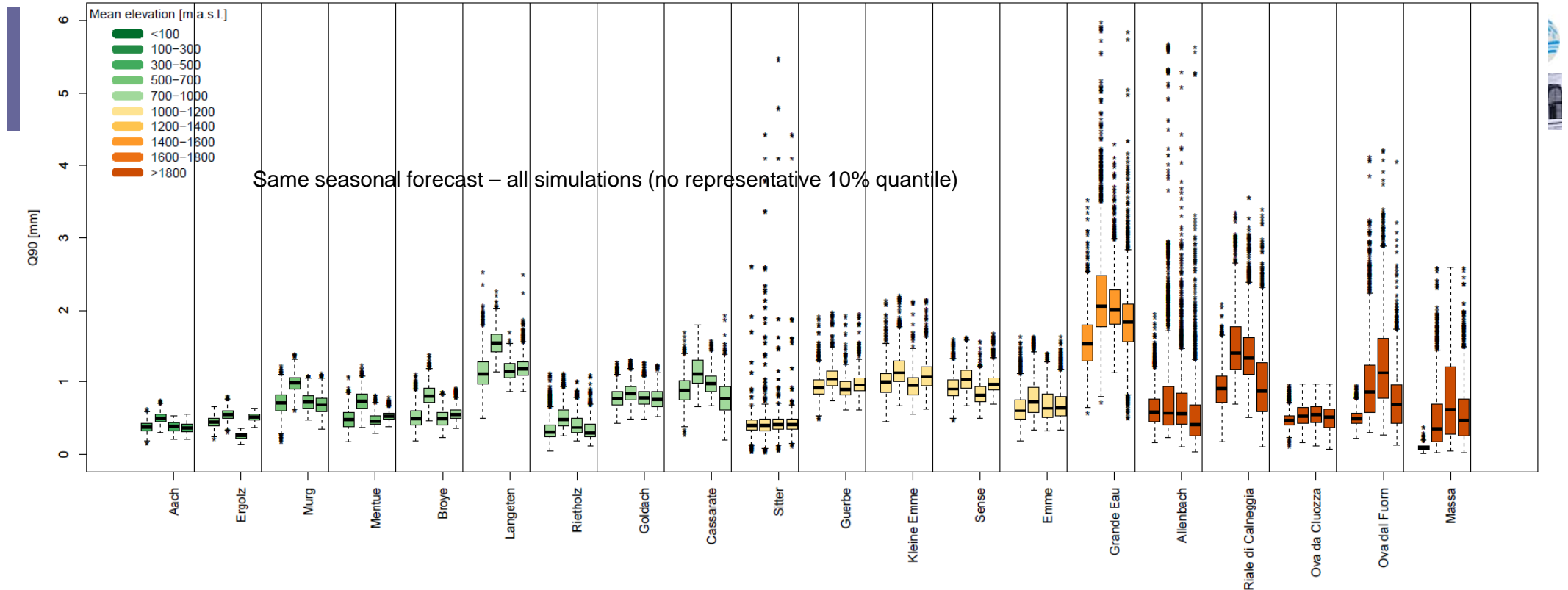


Different seasonal forecasts



Same seasonal forecasts





Aach – start in winter

