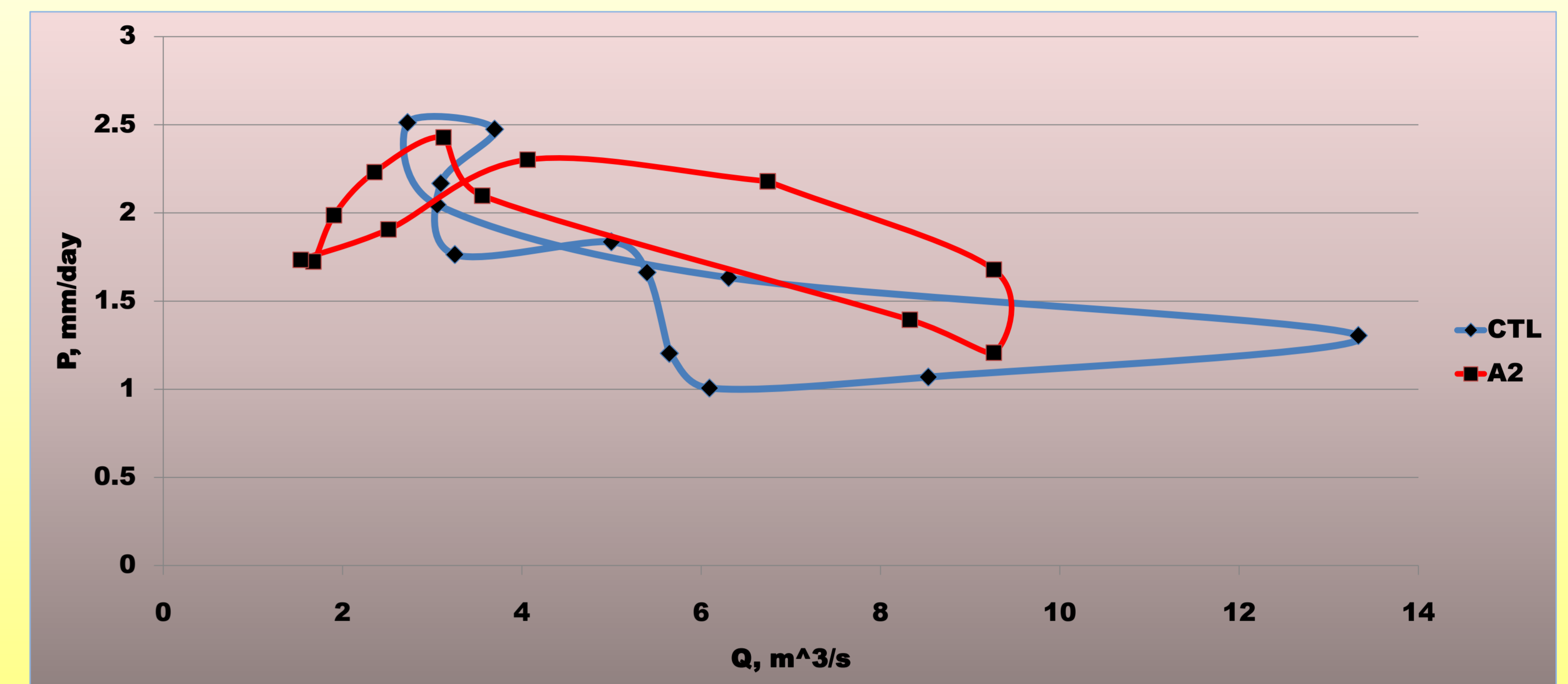
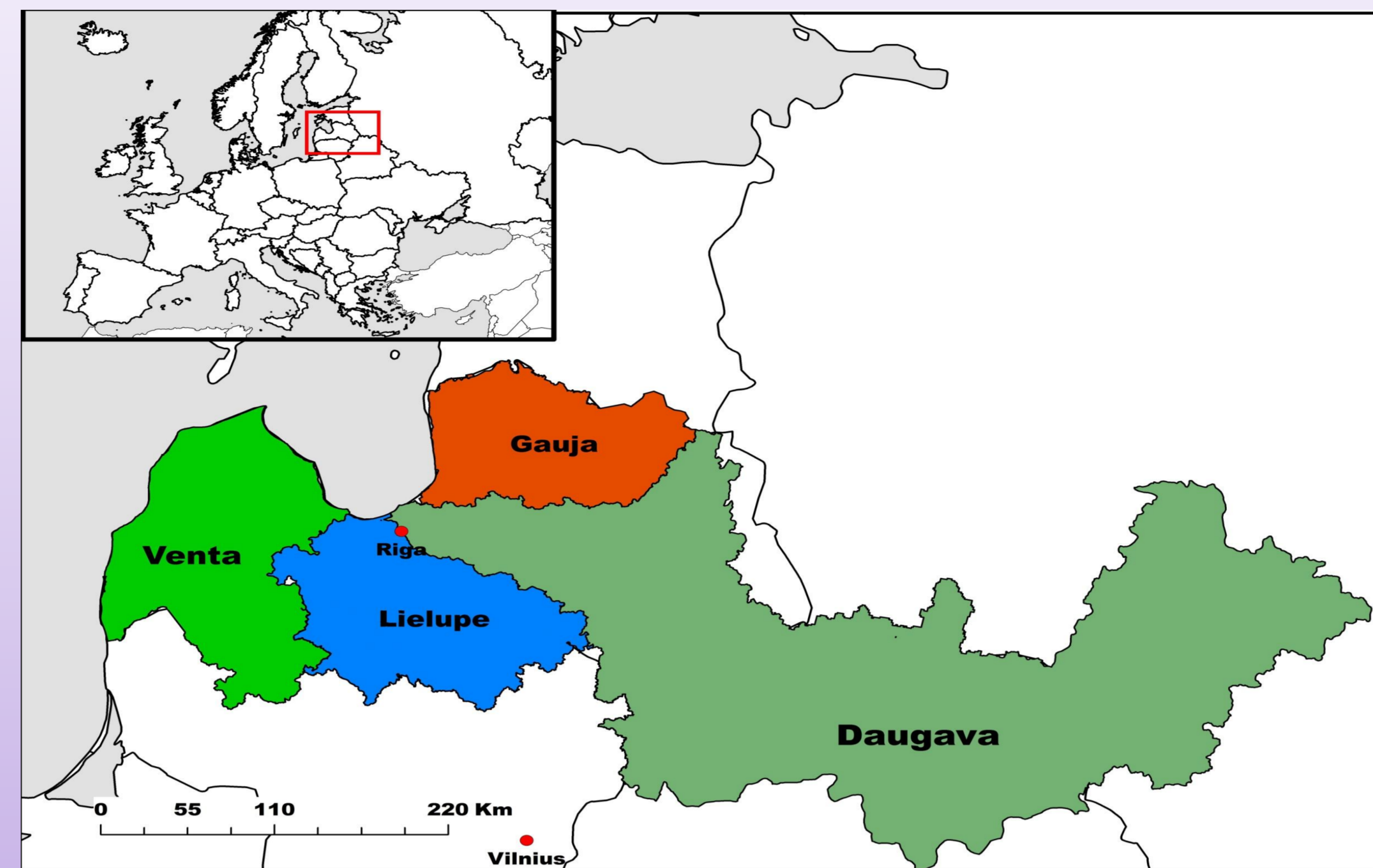


1. Introduction

The main goal of our study is to forecast possible changes in the discharge patterns in Latvian river drainage basin. In our study we used a modified Regional climate model (RCM) data based on SMHI RCAO forced by HadAM3H (which were modified comparing RCMs data with the observations in the reference period) and Mike Basin with a conceptual hydrological model NAM by DHI Denmark. Using these we simulated the runoff for the climate reference period (1961-1990) and for the future scenarios A2 and B2 (2071-2100).

2. Area of study

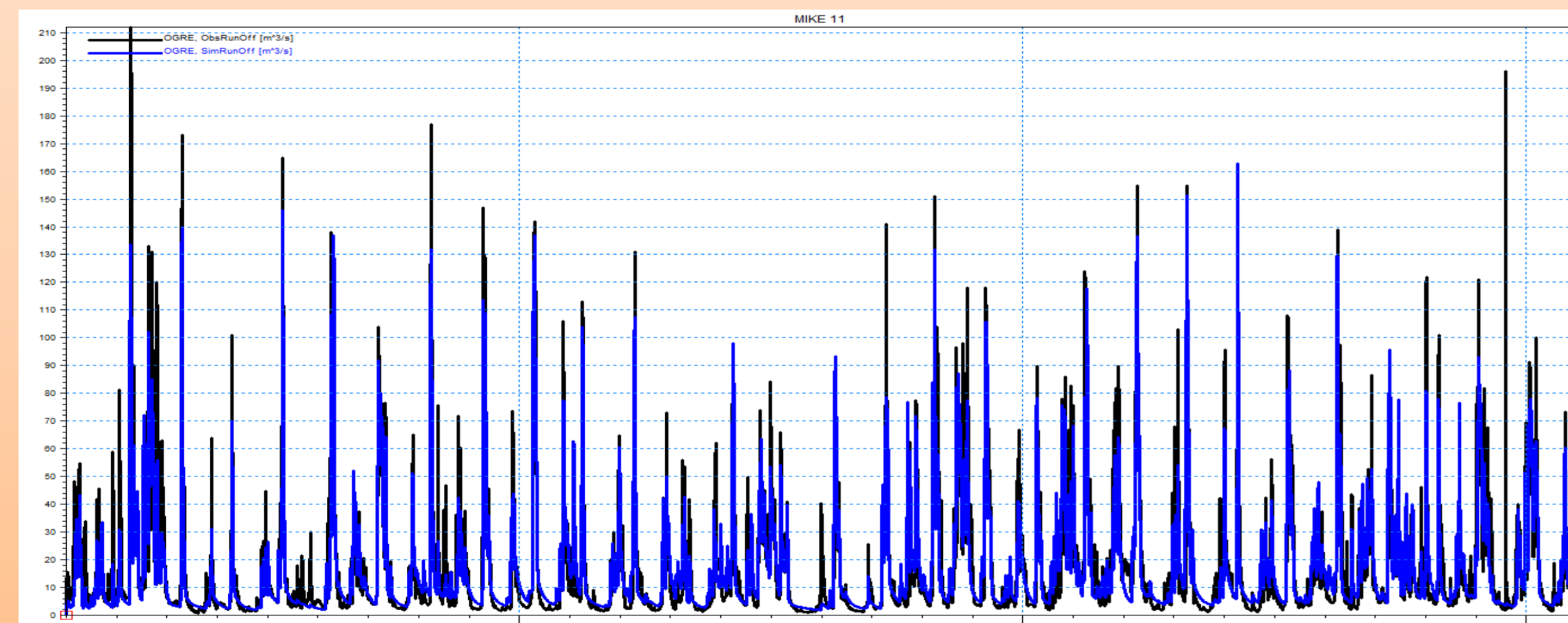
The whole area consists of four river basins (Daugava, Gauja, Lielupe, Venta), which covers 130 thousand sq km, in the territory of Latvia and parts of Lithuania, Estonia, Belarus and Russia.



Annual cycle of precipitation and runoff in the reference period and scenario A2

3. Calibration

Calibration was done using Mike 11 NAM conceptual model in 10 river basins with area aggregating to 24000 sq km. The calibration was made for the reference period (1961-1990), using observation data from meteorological stations in the region. The R2, water balance and seasonal analysis was used to determine the best parameter set, and R2 values from 0.75 to 0.84 were obtained.

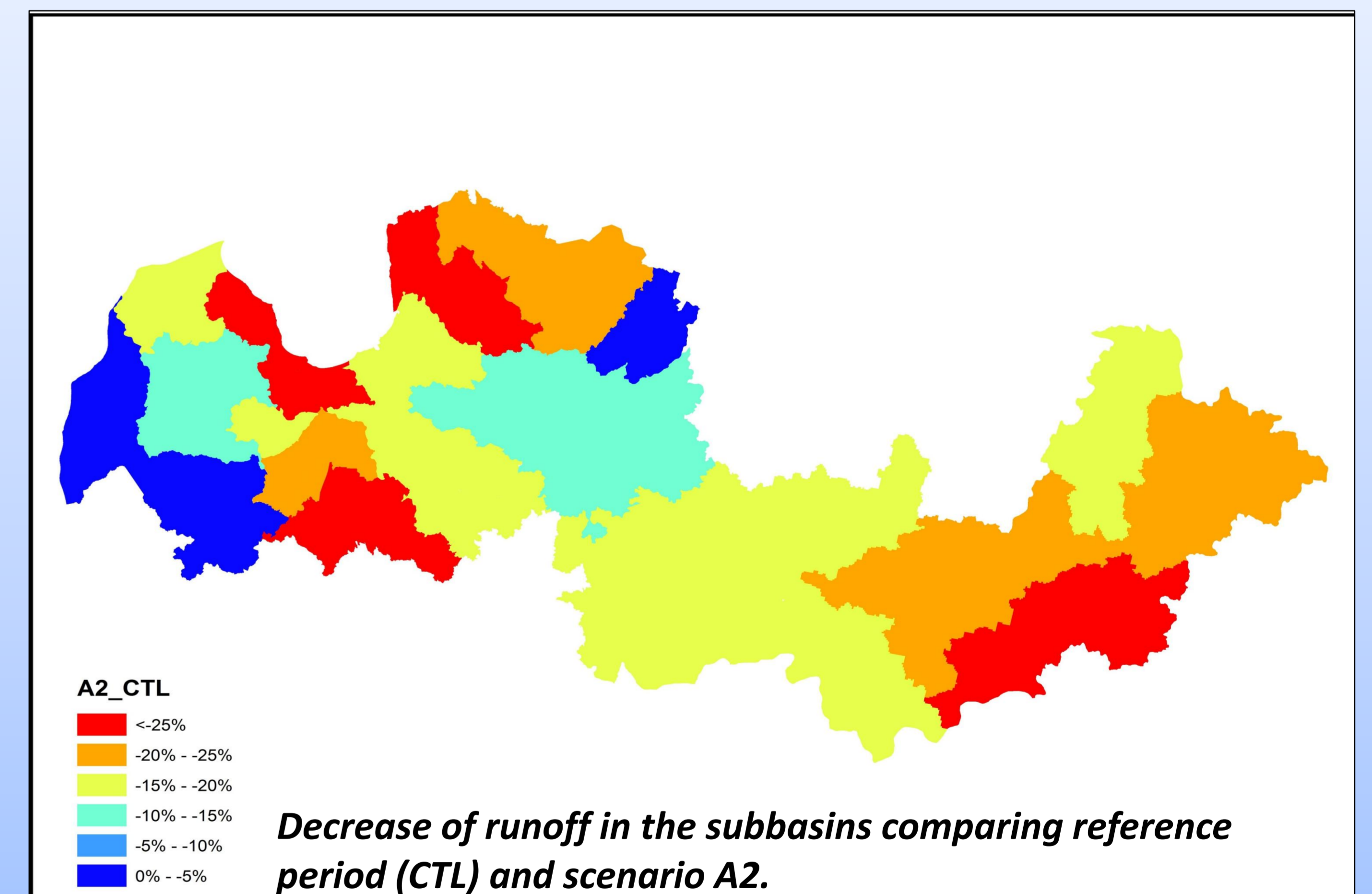


Simulated and observed discharge in Ogre for the reference period (1961-1990)

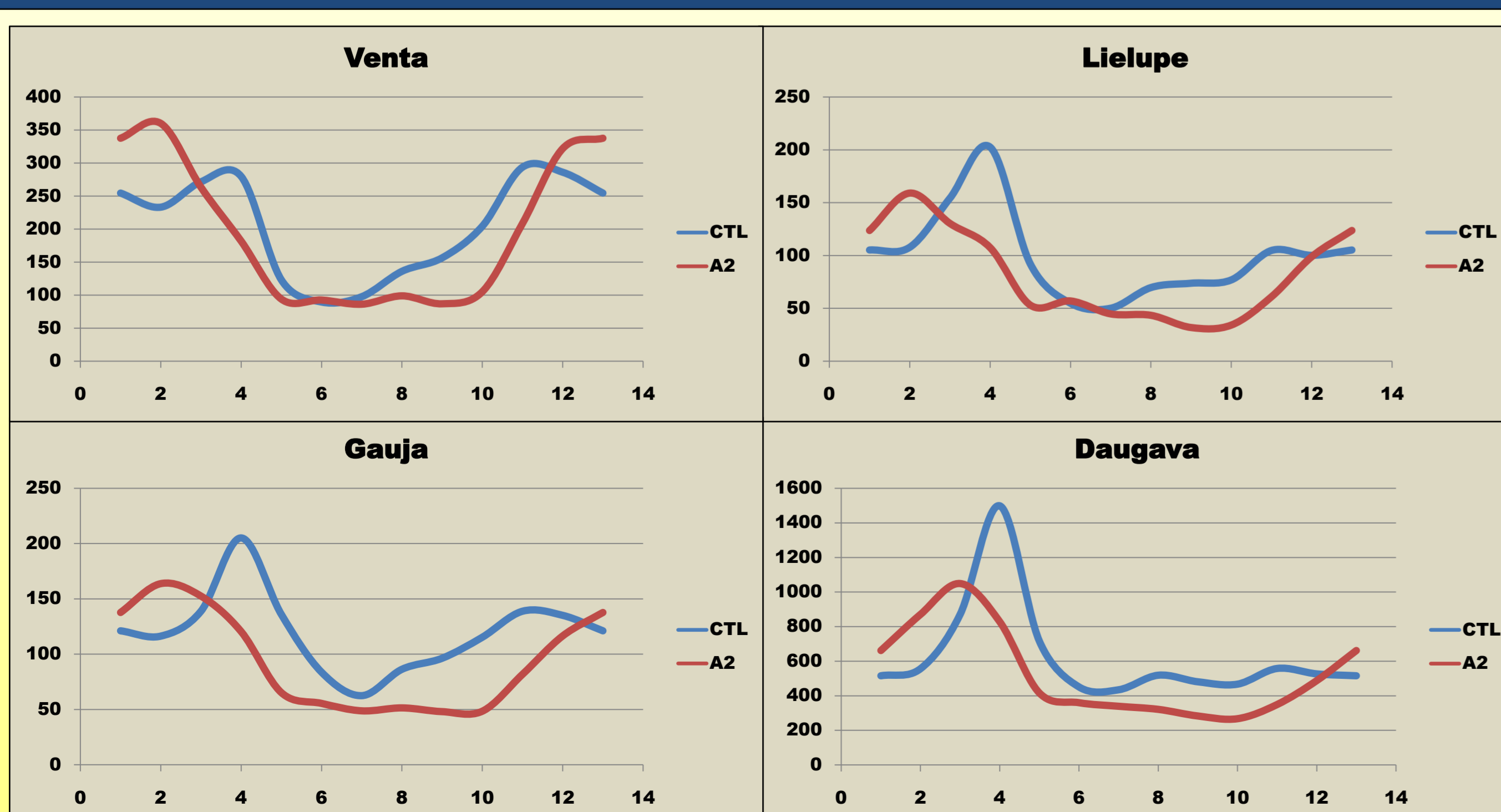
River	Area	R2
Abava	1830	0.804
Aiviekste	7200	0.794
Bārta	1700	0.756
Bērze	904	0.775
Dubna	2060	0.819
Gauja	2230	0.800
Irbe	1920	0.794
Ogre	1660	0.835
Pededze	1670	0.754
Salaca	3220	0.798

5. Analysis

We also created a map which represents, the amplitude of changes in each sub basin, to understand the geographic distribution of future alterations.



Decrease of runoff in the subbasins comparing reference period (CTL) and scenario A2.



Annual discharge (m³/s) patterns in the main river basins in the ref period (CTL) and scenario A2

4. Results

Using the modified RCM data for the reference period (1961-1990; CTL) and for the future scenarios A2 and B2 (2071-2100) we simulated the runoff for each period. Comparison of the acquired time series shows the possible changes in discharge patterns in the future.

River	Change
Venta	-8%
Lielupe	-21%
Daugava	-18%
Gauja	-24%

6. Conclusions

1. The spring floods will be decreased and shifted to an earlier period.
2. There will be a decrease of runoff in the whole Latvian river drainage basin.
3. The winter runoff will become a more significant part of the annual runoff.
4. The summer dry periods will prolong in to the first autumn months.

The qualitative changes can already be noticed in the observations after the reference period (1991-2009), but the quantitative changes, are unnoticeable, which could be explained by the rise of precipitation exceeding expectations.