

Climate Change Impacts on the Distribution of Total Annual Rivers' Runoff in Latvia



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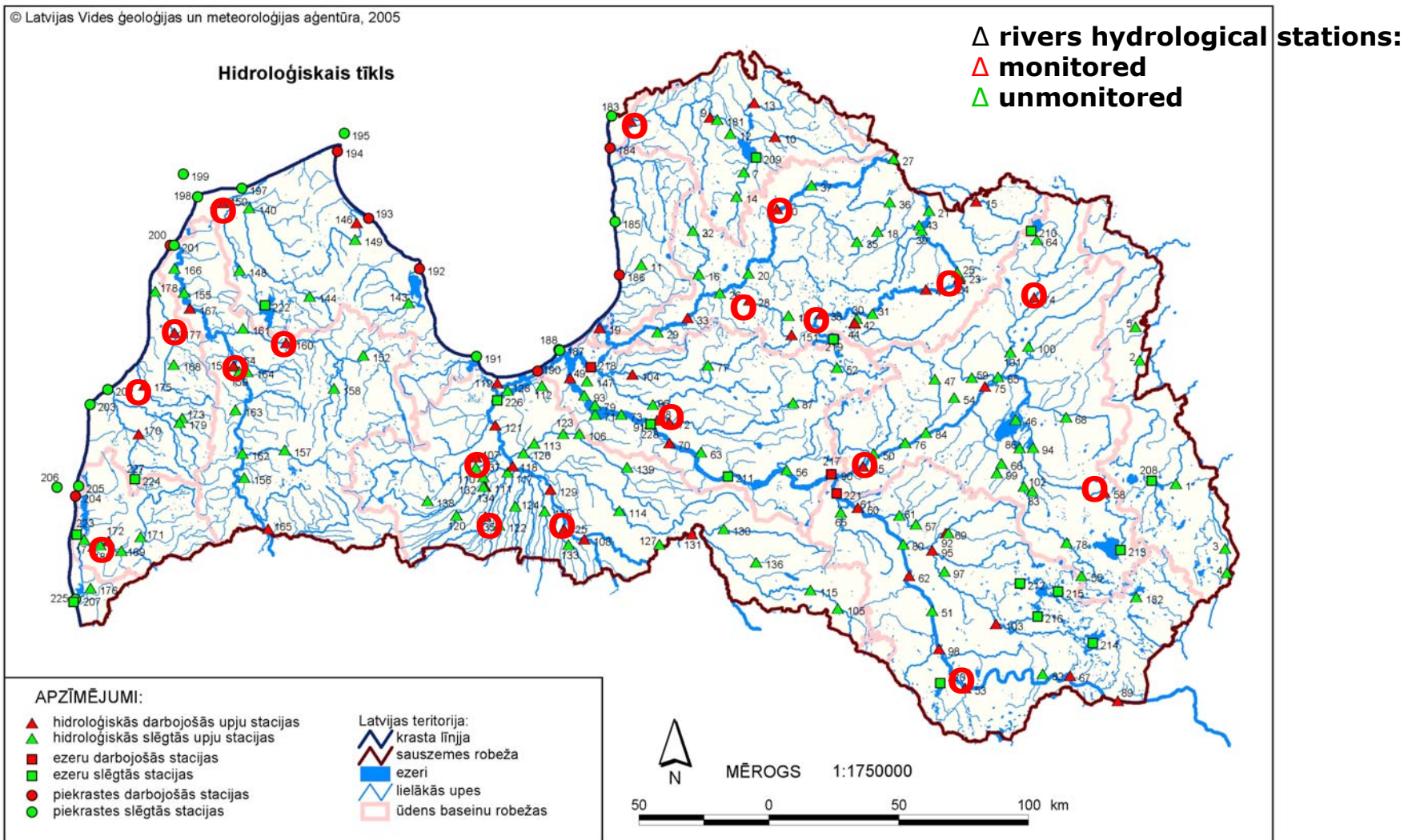
The aim of the study

- was to analyse the climate change impacts on the total annual rivers' runoff distribution (winter and spring seasons) in Latvia to cover different river basins from 1951 to 2005

Hydrological monitoring network in 2005

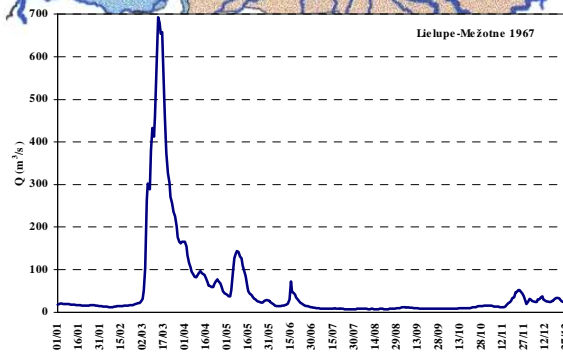
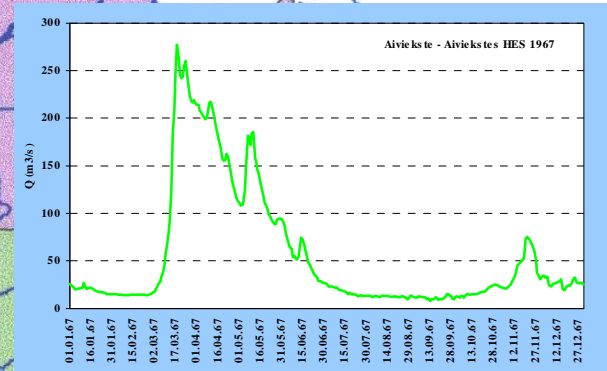
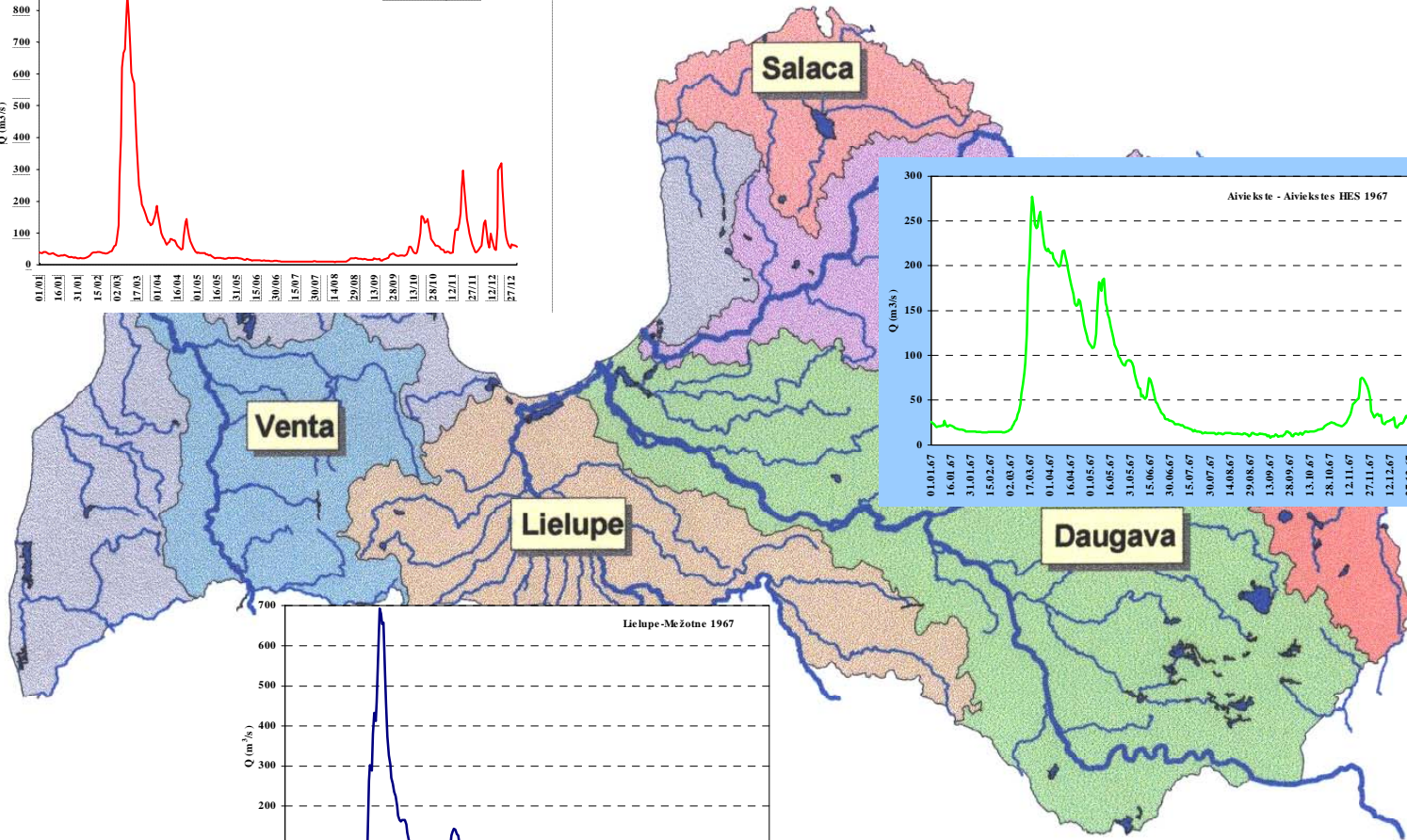
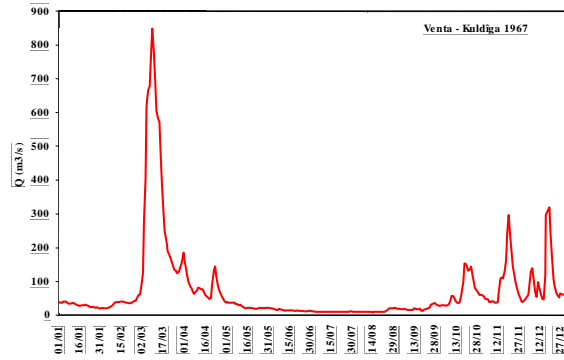
(Latvian Environment, Geology and Metrology agency)

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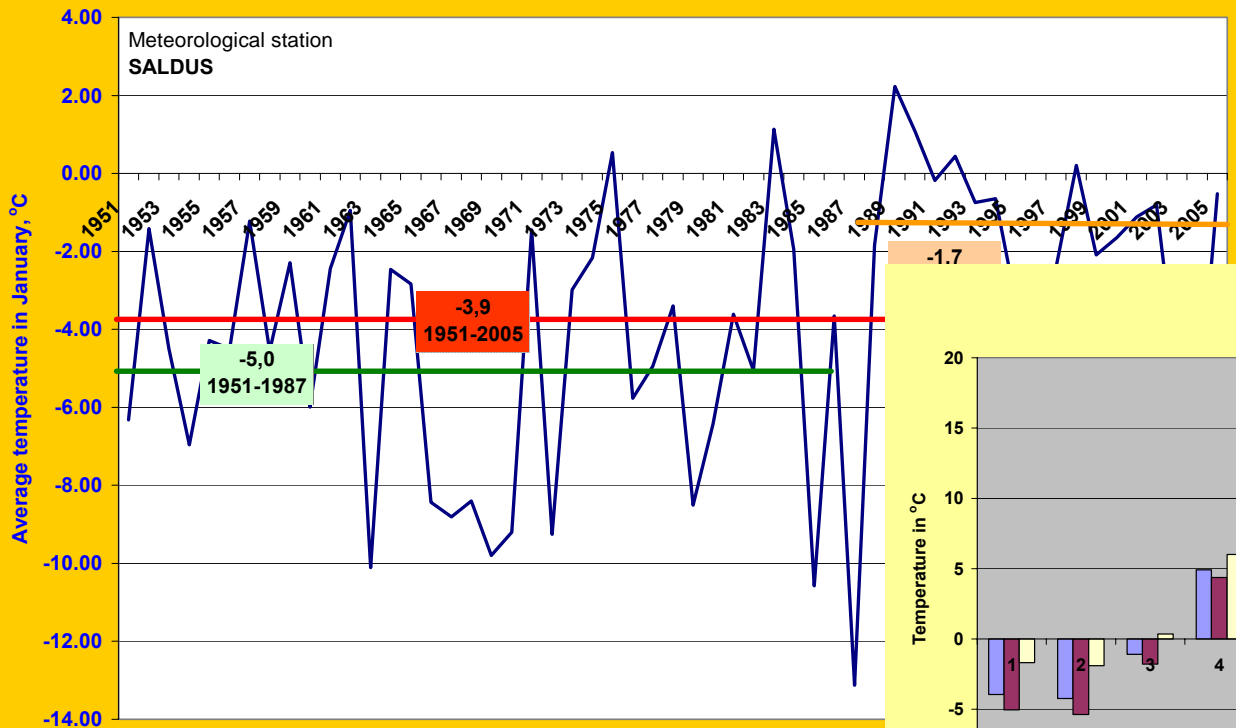


The rivers have typical hydrograph: two main discharge peaks during the spring snowmelt and in the late autumn during rainfall, and low river discharge in winter and summer

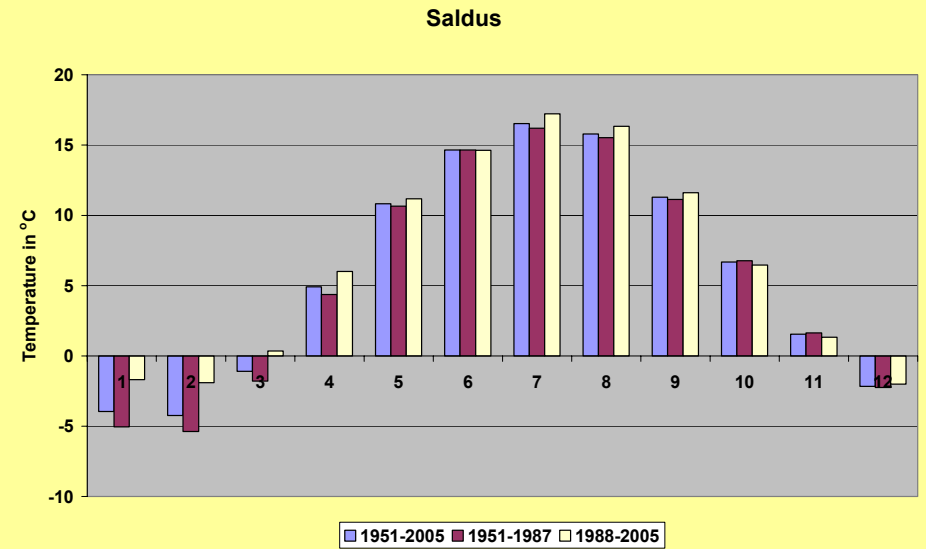


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- Data source - Latvian Environment, Geology and Metrology agency

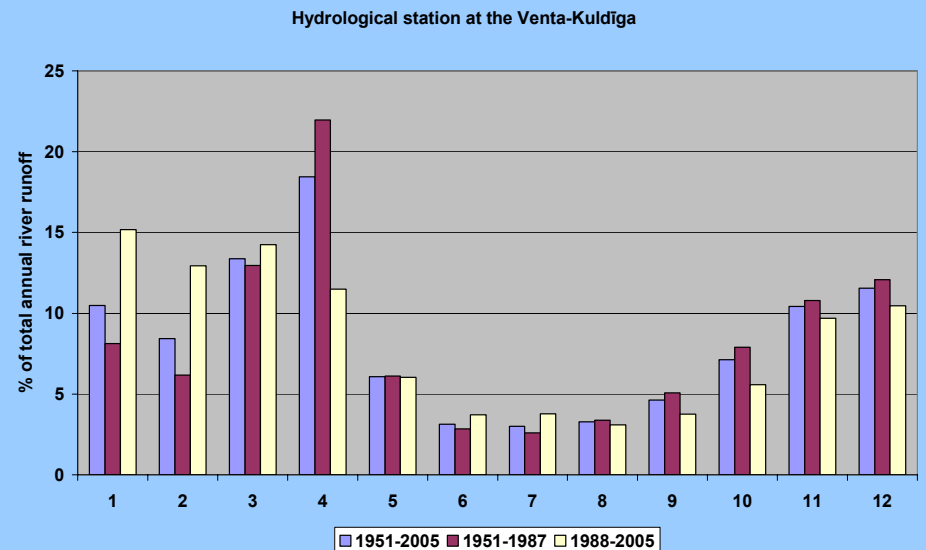
 - For the analysis of long-term trends and the distribution of total annual river runoff by months, seasons and three study periods:
 - 1951–2005 (all study period)
 - 1951–1987 (basic period)
 - 1988–2005 (climate change impacts)



Long-term average air temperature of January



Long-term average air temperature and river runoff by three study periods: 1951-2005, 1951-1987, 1988-2005

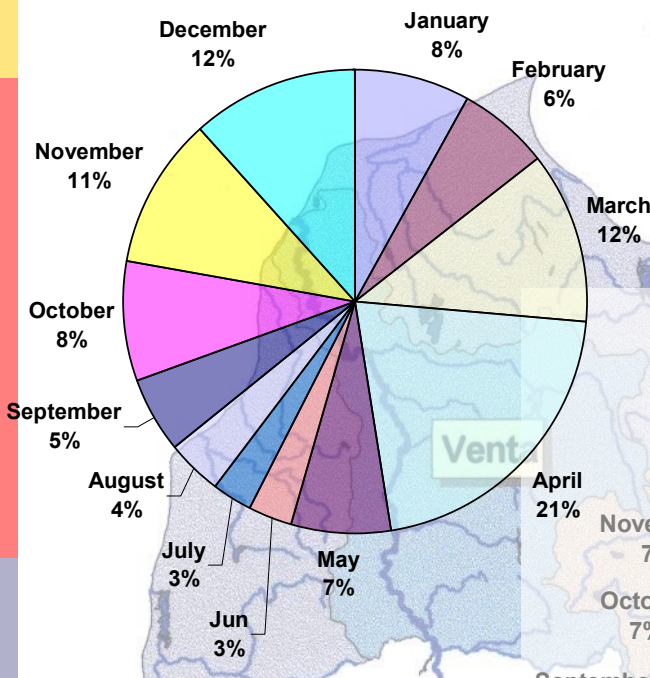


The distribution of total annual river runoff in %, 1951-1987

winter 15-30%
spring 35-55%
summer 7-15%
autumn 15-25%

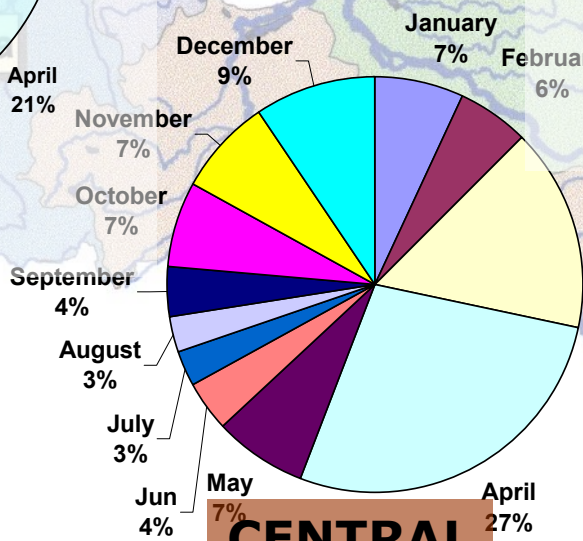
Amata-Melturi

Abava-Renda



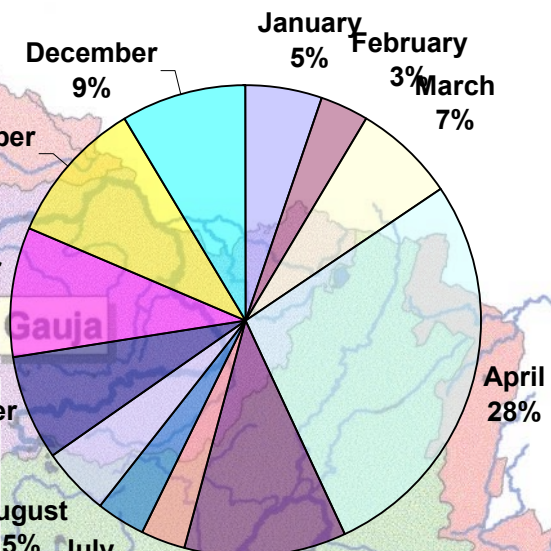
WESTERN PART

Svete-Ūziņi



CENTRAL PART

Salaca



EASTERN PART

Vent

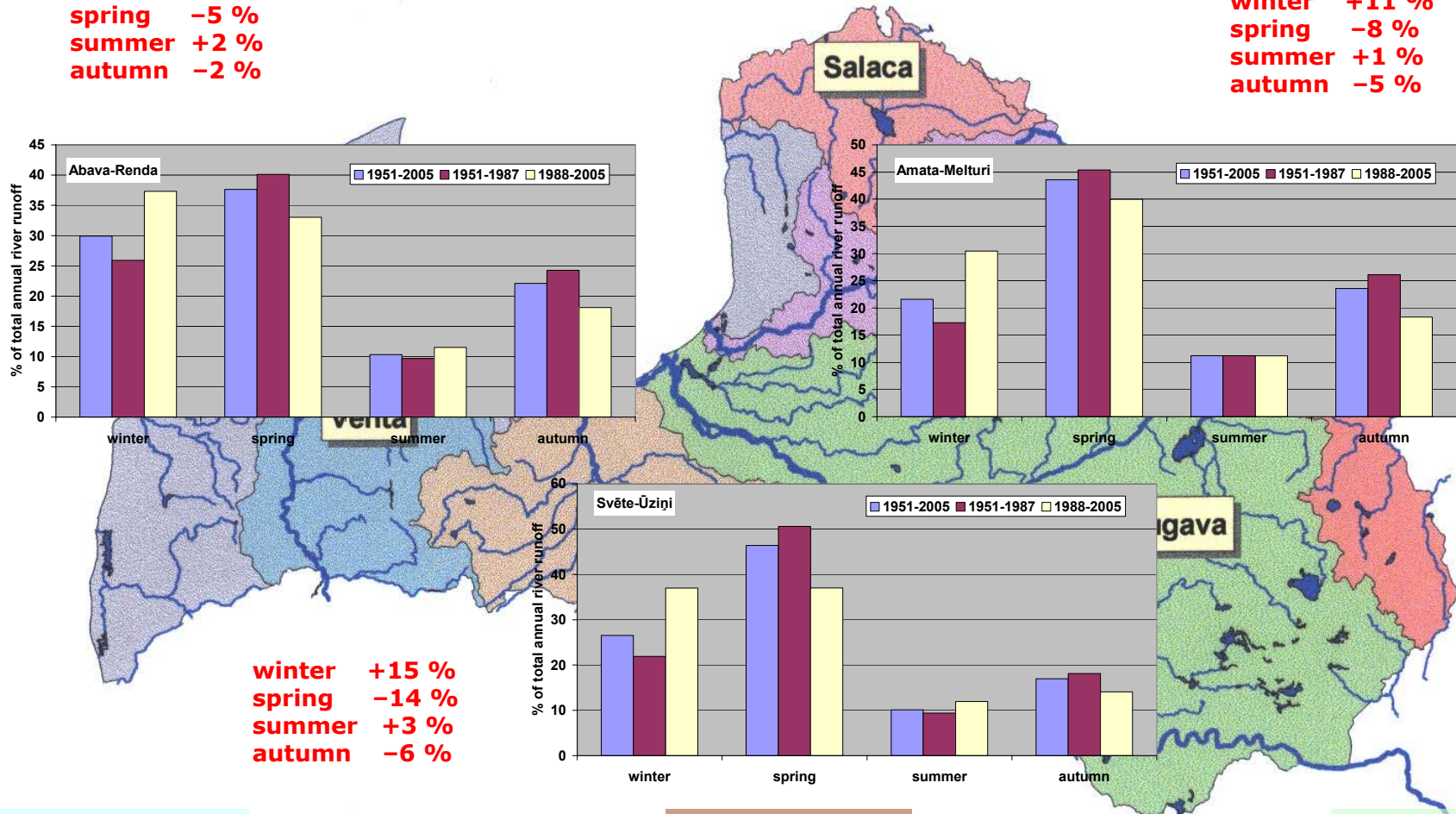
Daugava

Gauja

The distribution of total annual river runoff by seasons in % in 1988-2005 to compare with 1951-1987

winter +12 %
spring -5 %
summer +2 %
autumn -2 %

winter +11 %
spring -8 %
summer +1 %
autumn -5 %



winter +15 %
spring -14 %
summer +3 %
autumn -6 %

WESTERN PART

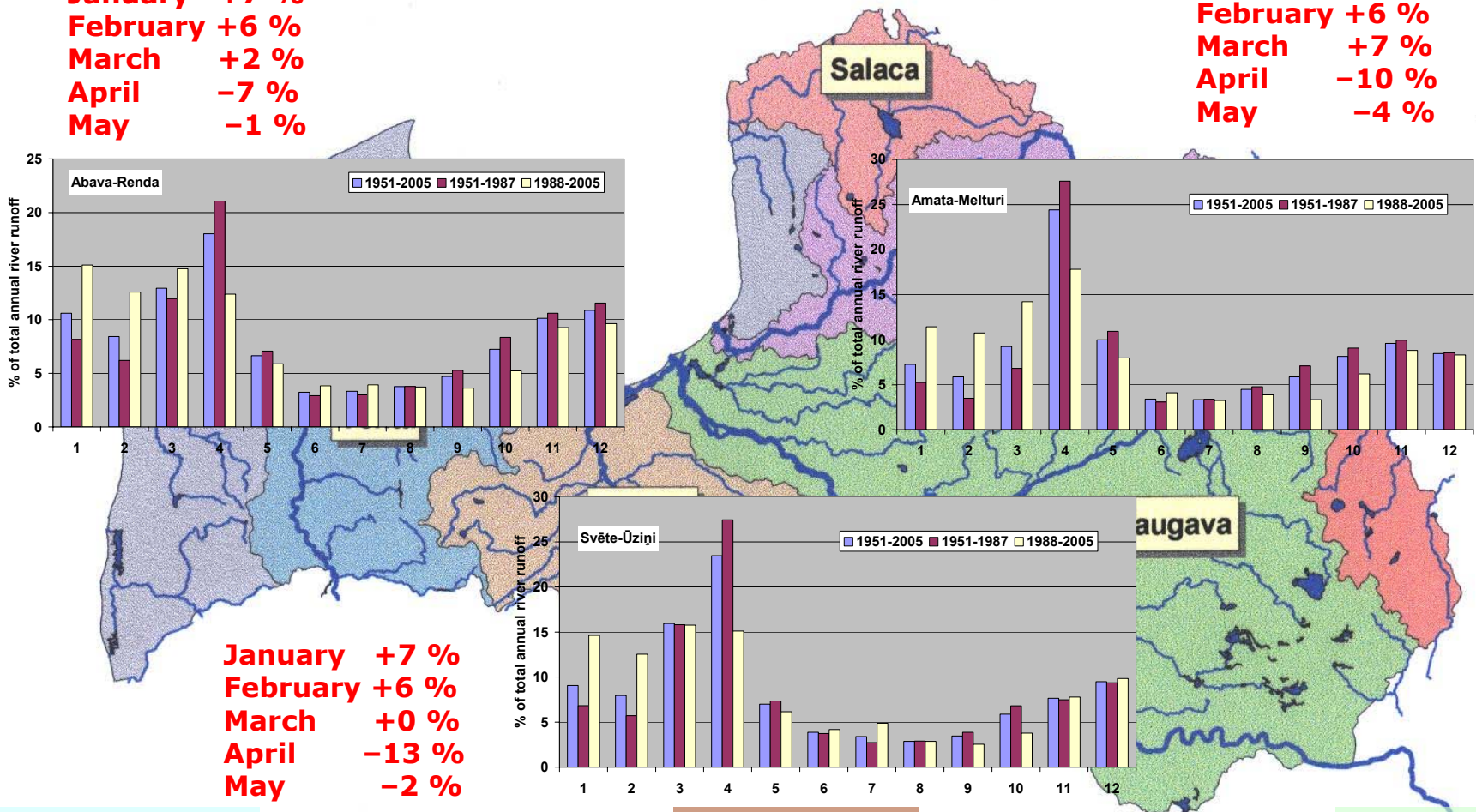
CENTRAL PART

EASTERN PART

The distribution of total annual river runoff by months in % in 1988-2005 to compare with 1951-1987

January +7 %
February +6 %
March +2 %
April -7 %
May -1 %

January +5 %
February +6 %
March +7 %
April -10 %
May -4 %



WESTERN PART

CENTRAL PART

EASTERN PART

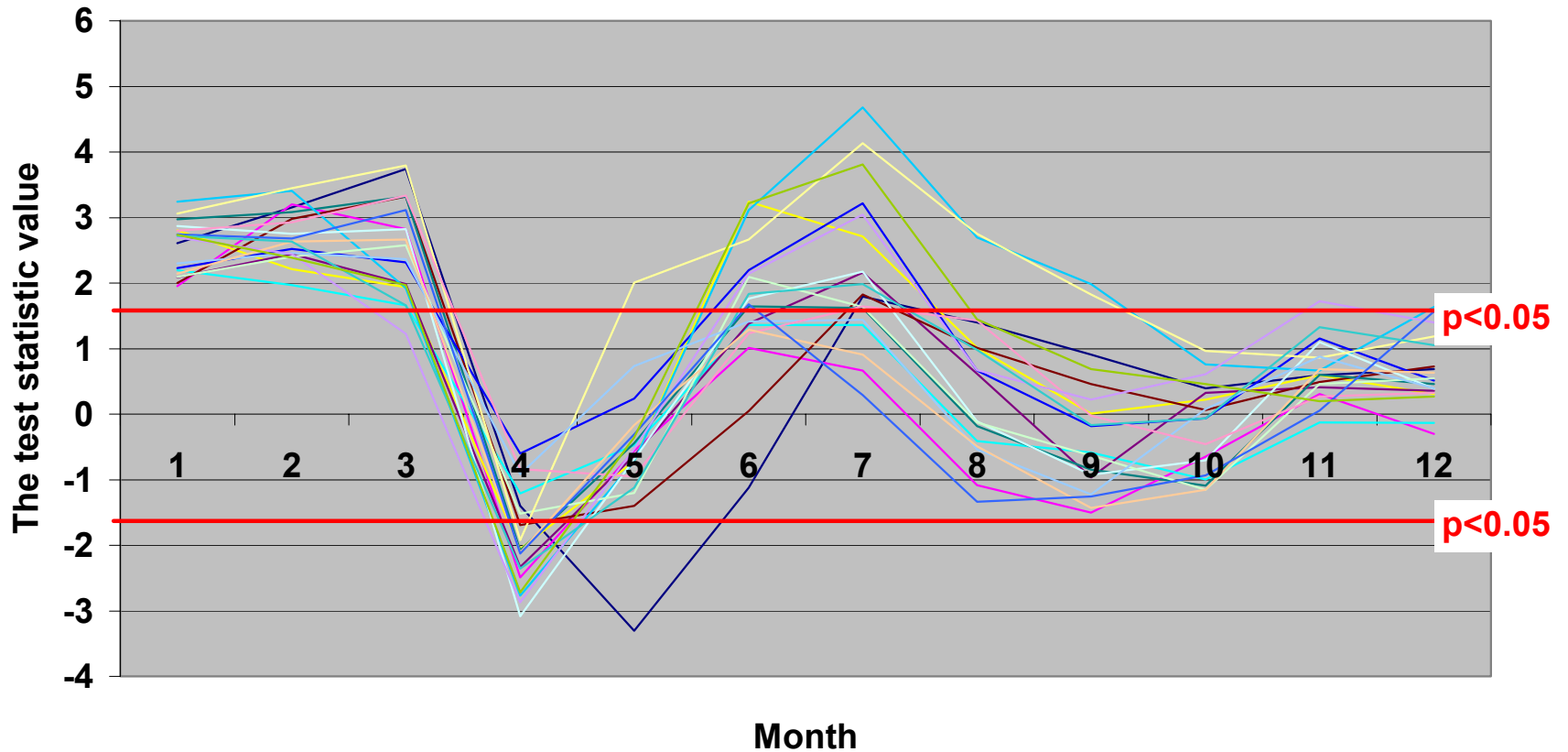
The results of Mann-Kendall test for the long-term data series of monthly river discharges, 1951-2005

(COND/MULTIMK, Libiseller and Grimvall, 2002)

The trend is considered as statistically significant at the 5% level if the test statistic is greater 1.65 or less than -1.65

RIVER HYDROLOGICAL STATION	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
EASTERN PART												
Salaca-Lagaste	2.79	2.93	3.33	-0.83	-0.95	1.23	1.65	1.43	-0.02	-0.46	0.27	0.33
Gauja-Valmiera	2.97	3.09	3.32	-2.08	-0.44	1.65	1.62	-0.18	-0.85	-1.09	0.60	0.46
Amata-Melturi	1.95	3.20	2.82	-2.49	-0.56	1.01	0.66	-1.08	-1.50	-0.65	0.31	-0.30
Tirza-Lejasciems	2.14	2.64	2.66	-2.11	-0.17	1.28	0.91	-0.49	-1.43	-1.15	0.69	0.63
Tulija-Zoseni	2.74	2.68	3.11	-2.13	-0.31	1.68	0.29	-1.34	-1.26	-0.93	0.06	1.57
Daugava-Daugavpils	2.00	2.98	3.32	-1.69	-1.40	0.04	1.82	1.01	0.46	0.07	0.49	0.73
Aiviekste-Aiviekste HES	2.61	3.16	3.74	-1.40	-3.30	-1.13	1.79	1.40	0.91	0.39	0.60	0.69
Rezekne-Griskani	3.06	3.45	3.80	-1.92	2.01	2.66	4.13	2.75	1.82	0.97	0.86	1.18
Pededze-Litene	2.10	2.40	2.58	-1.52	-1.20	2.10	1.63	-0.12	-0.63	-1.15	0.46	0.54
Ogre-Lielpeci	2.87	2.75	2.82	-3.09	-0.69	1.76	2.17	-0.11	-0.92	-0.70	1.10	0.38
CENTRAL PART												
Lielupe-Mezotne	3.25	3.40	1.92	-2.77	-0.72	3.11	4.68	2.69	1.98	0.76	0.66	1.63
Svete-Uzini	2.69	2.45	1.23	-2.87	-0.53	2.14	3.04	0.68	0.22	0.61	1.72	1.40
Berze-Balozi	2.20	1.97	1.66	-1.21	-0.47	1.36	1.36	-0.41	-0.59	-0.99	-0.12	-0.14
WESTERN PART												
Venta-Kuldiga	2.74	2.39	1.97	-2.72	-0.36	3.22	3.81	1.44	0.69	0.46	0.20	0.27
Abava-Renda	2.81	2.21	1.94	-2.05	-0.72	3.25	2.72	1.01	0.01	0.23	0.60	0.31
Irbe-Vicaki	2.23	2.52	2.32	-0.60	0.24	2.20	3.22	0.66	-0.18	-0.07	1.15	0.52
Barta-Dukupji	2.08	2.45	1.98	-2.33	-0.63	1.39	2.16	0.62	-0.97	0.33	0.41	0.36
Uzava-Teraude	2.72	2.64	1.66	-2.36	-1.13	1.84	1.98	0.98	-0.17	-0.07	1.33	1.05
Riva-Pieviki	2.30	2.45	2.36	-0.92	0.74	1.41	1.44	-0.54	-1.23	0.08	0.87	0.40

The results of Mann-Kendall test for the long-term data series of monthly river discharges, 1951-2005
(COND/MULTIMK, Libiseller and Grimvall, 2002)



Conclusions



- ❑ The present results confirm the basic hypothesis that main tendency in runoff changes are following: decreased in spring flood and as opposite - increased in winter for the study period 1951-2005
- ❑ The analysis of results shows regional differences in total annual river runoff distribution among Western, Central and Easter parts of Latvia in the study periods