Climate change and it's impacts in Latvia

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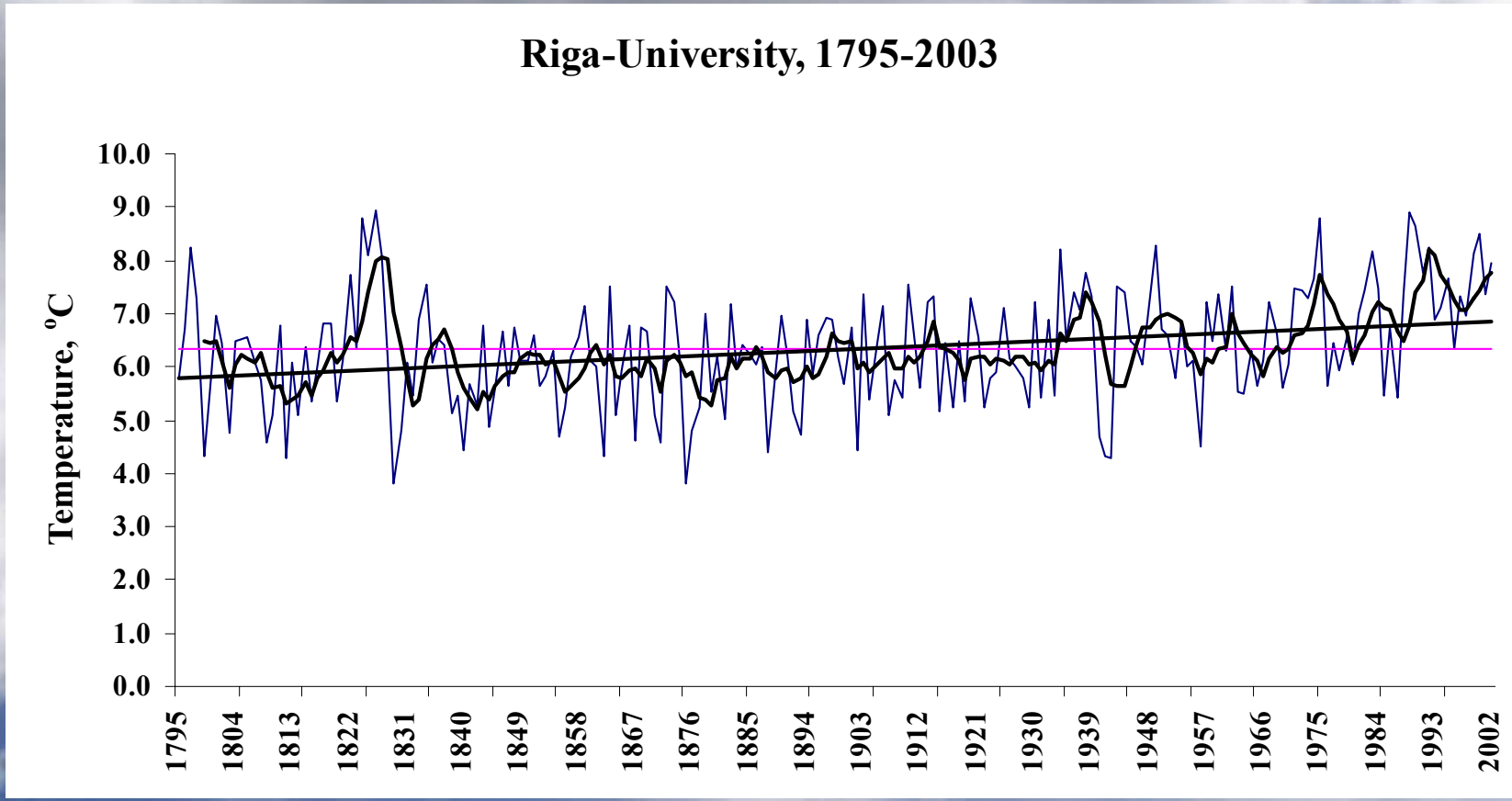
Parameters used to ilustrate climate variability and changes in Latvia:

- temperature;
- precipitation;
- snow cover;
- atmospheric circulations;
- changes of vegetation;

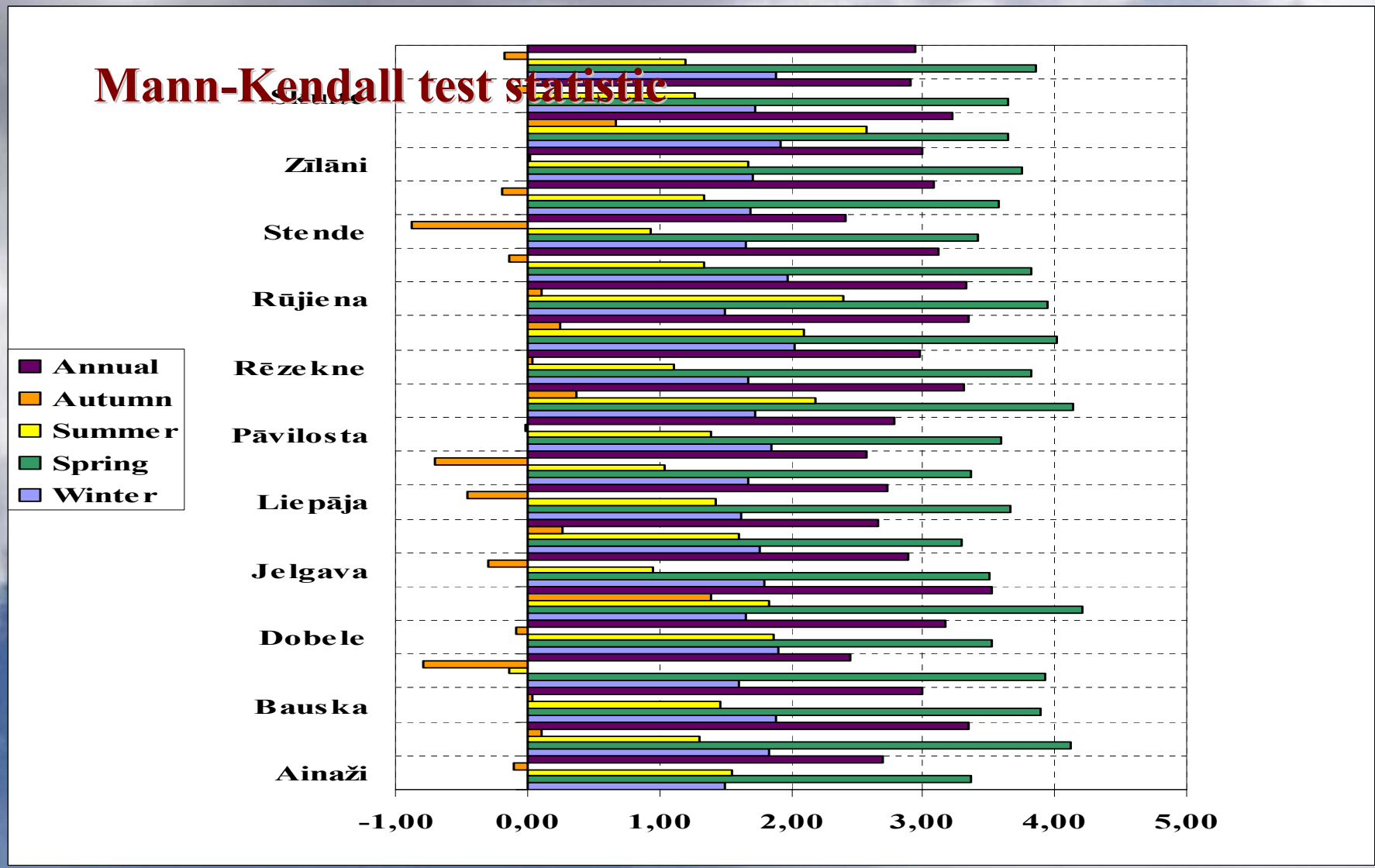
- river runoff changes;
- ice regime changes;
- coastal processes.

Long-term variability of annual temperature



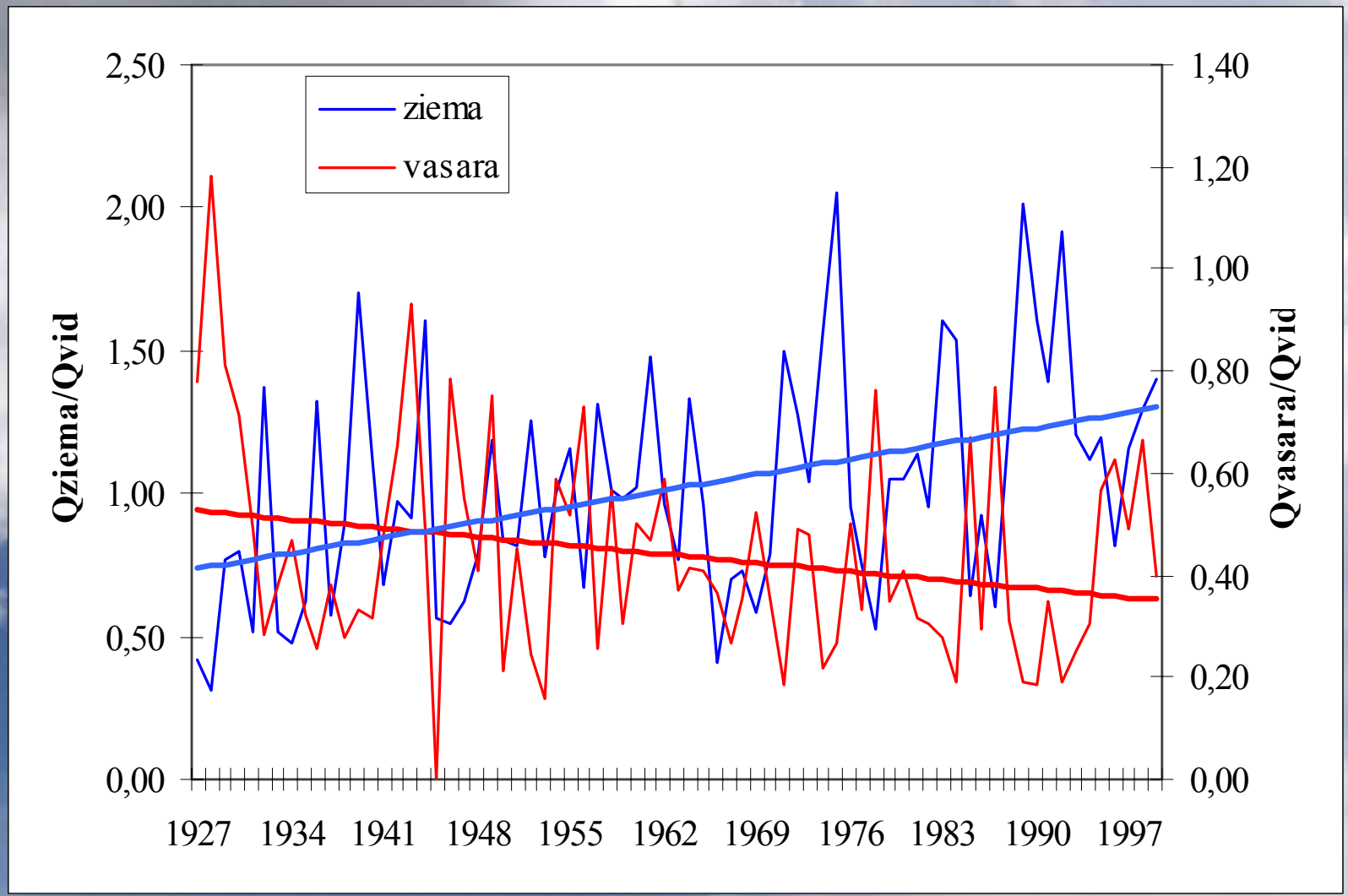
Meteorological station	Period	Test statistics	p-value
Ventspils	1900-2000	1.67	0.048
Mērsrags	1900-2000	2.13	0.02
Liepāja	1900-2000	1.28	0.099

Seasonal and annual temperature 1950-2003

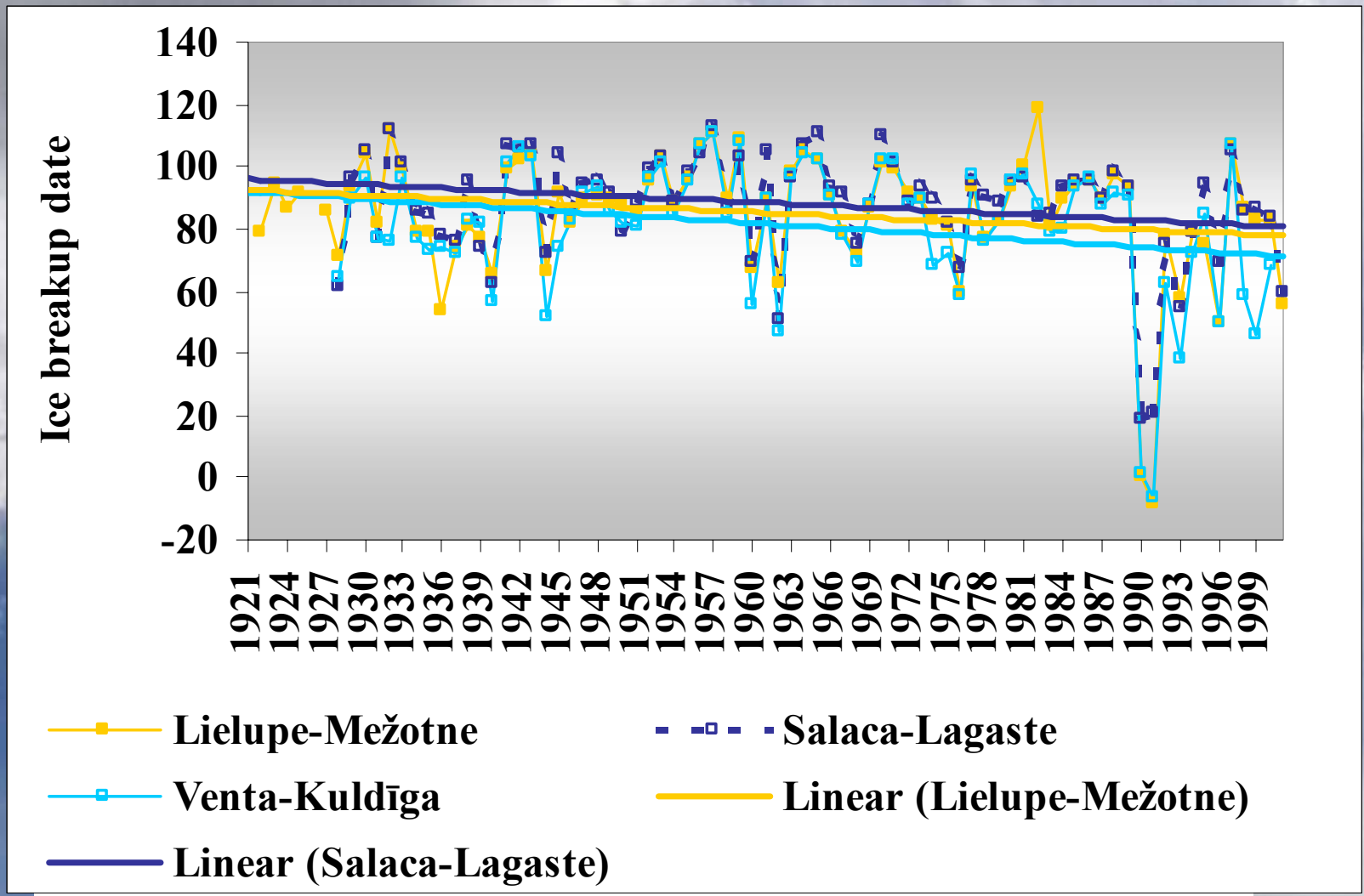


Data source: Monitoring data of Latvian Environment, geology and meteorology agency

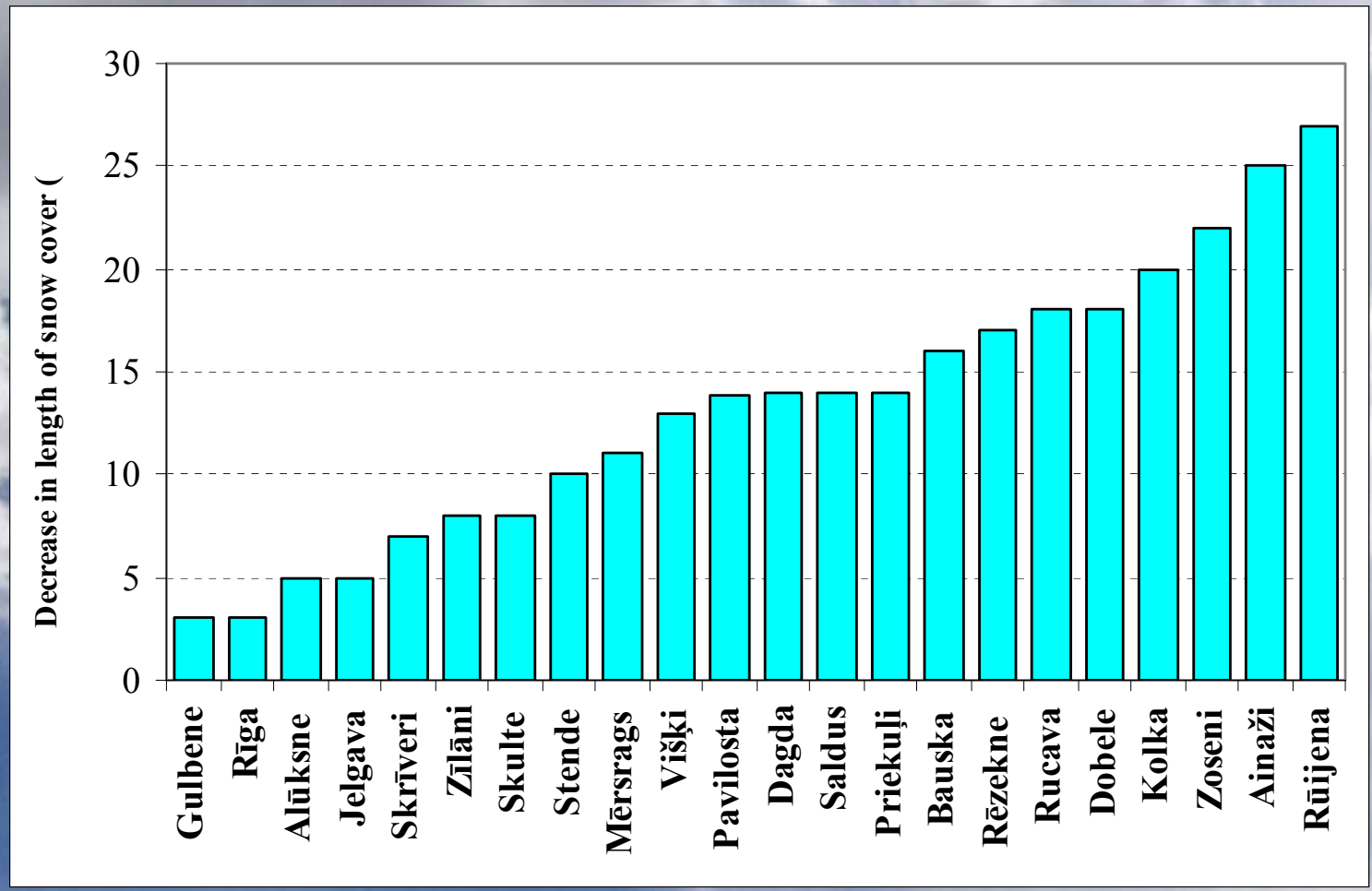
Long-term changes of seasonal river discharge in respect to mean annual values in the River Salaca



Time series of ice break-up dates of river in Latvia (1921-2000)

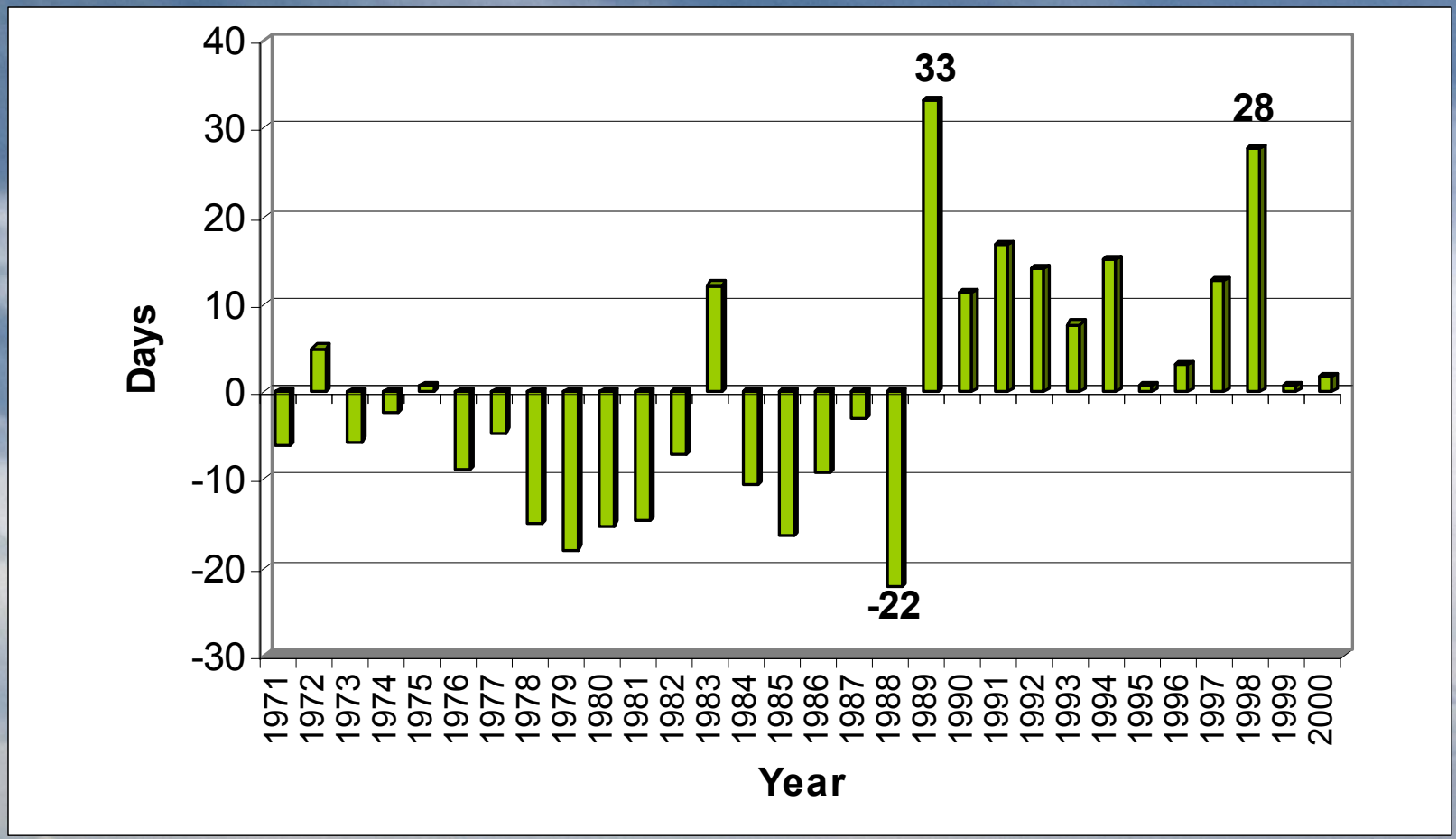


Decrease in length of snow cover (days) in Latvia for a period 1945-2004

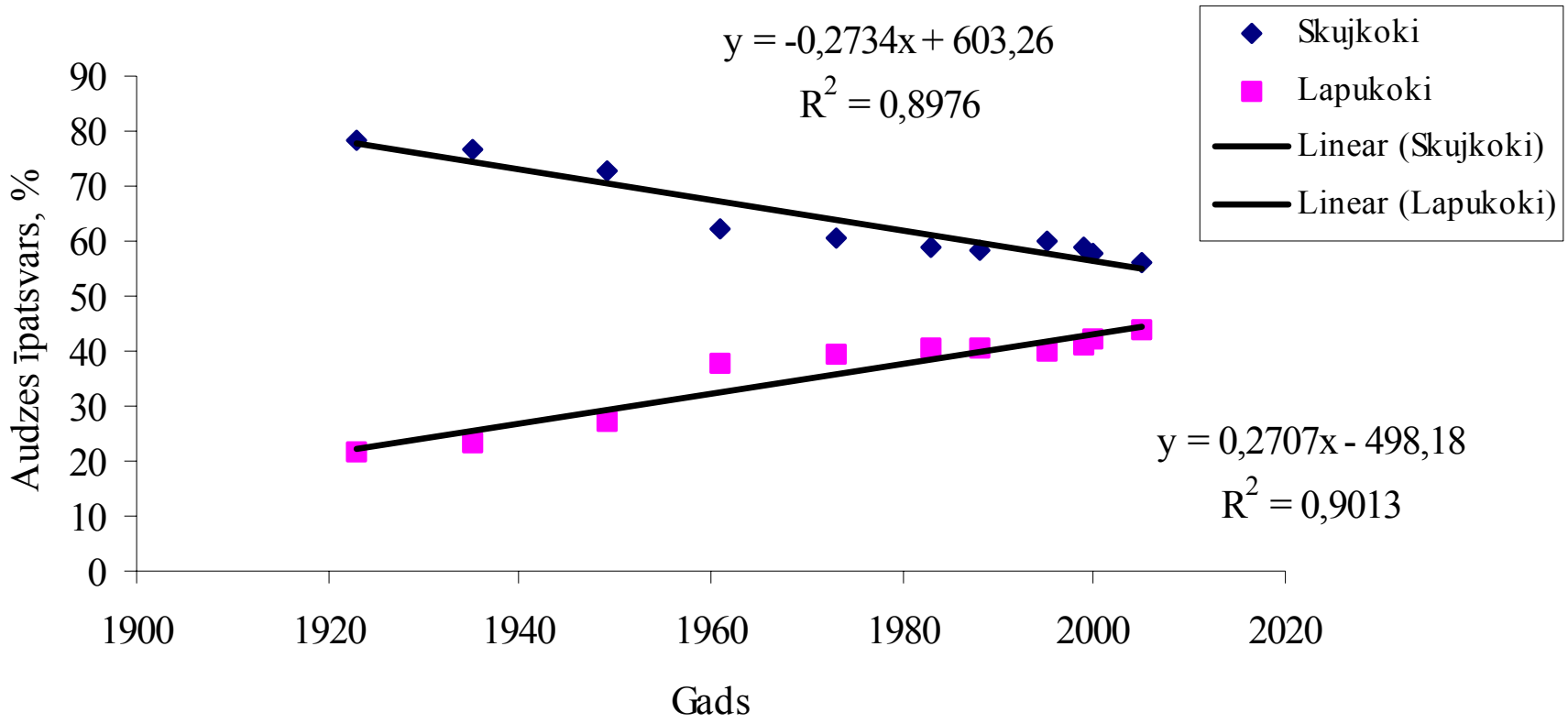


Data source: Monitoring data of Latvian Environment, geology and meteorology agency

Changes of spring phenophases *Betula pendula* 1971-2000

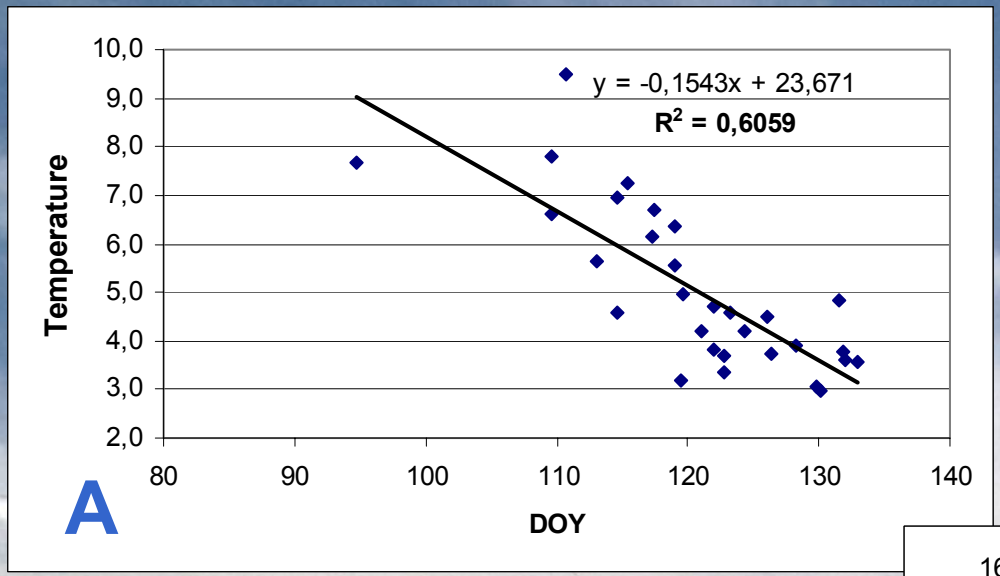


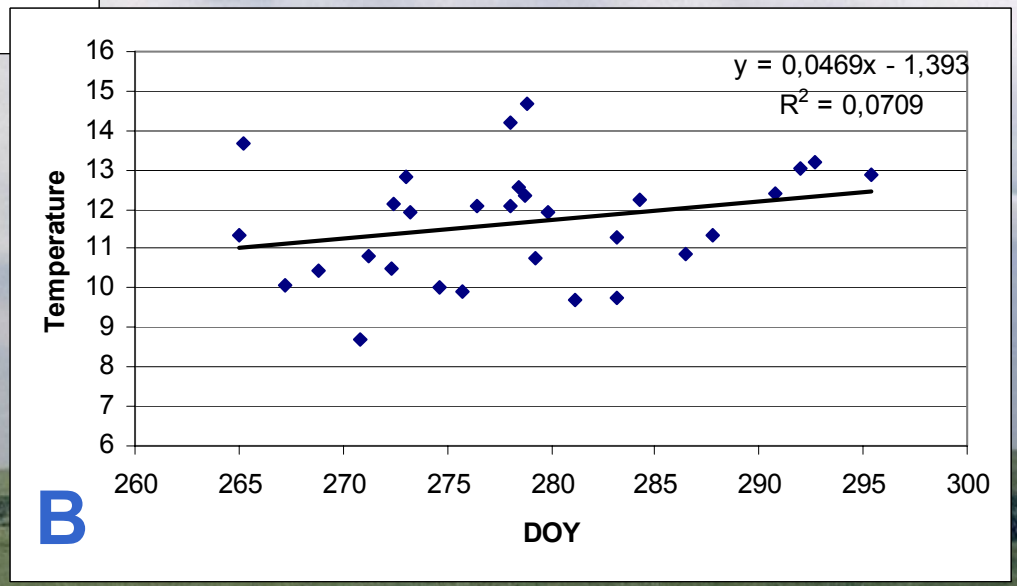
Changes in vegetation



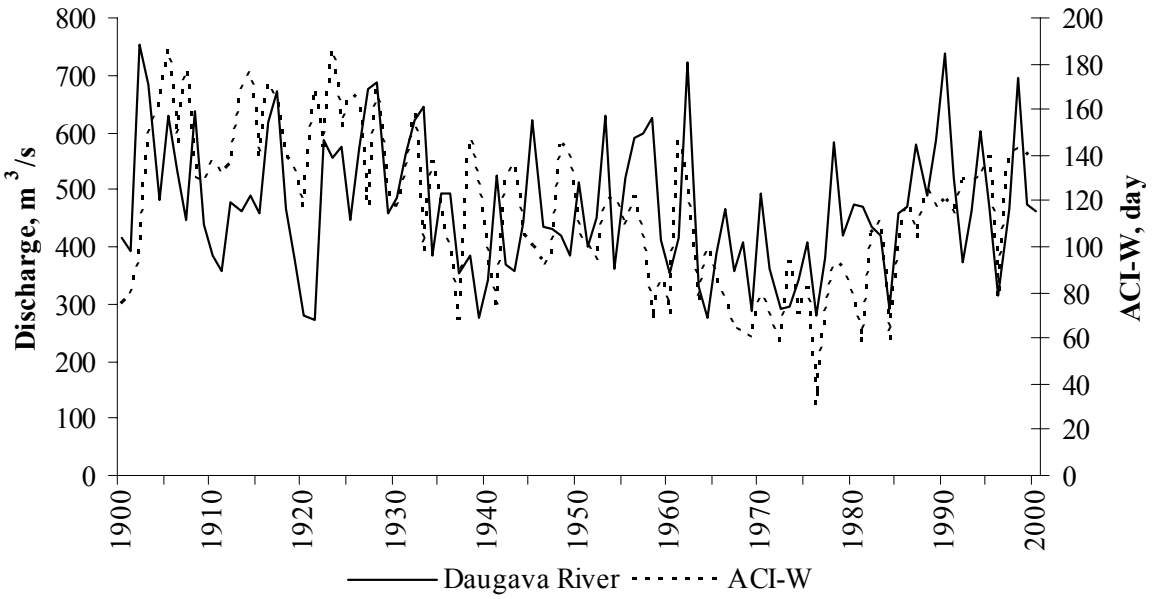
According to prof.M.Laiviņš

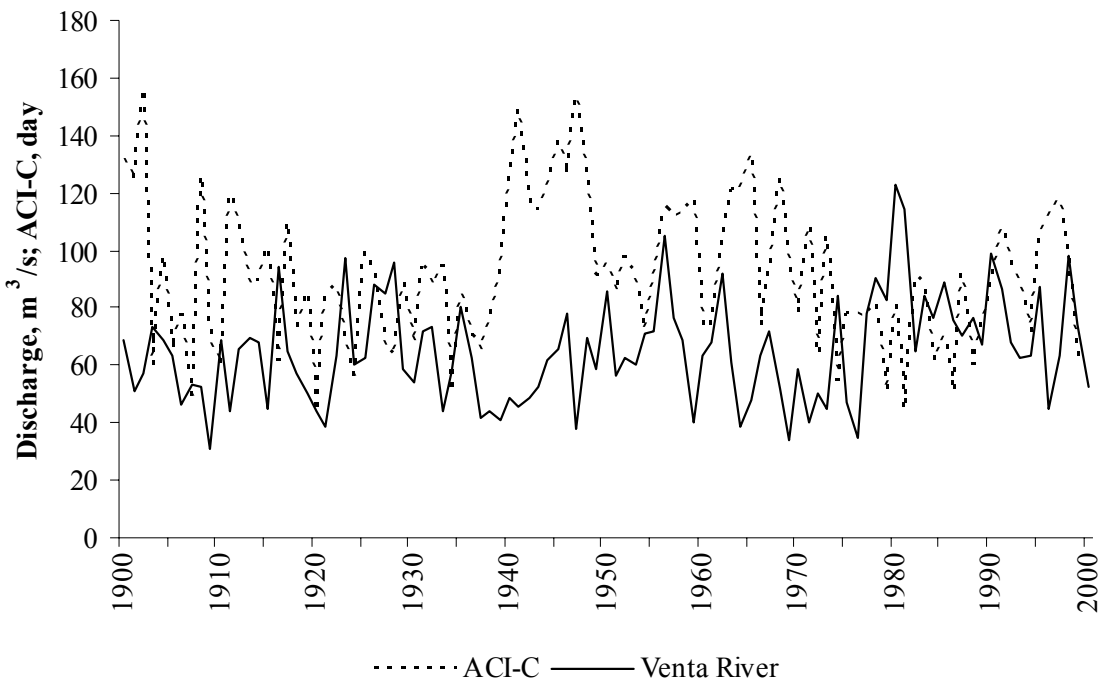
Correlation between temperature and leave development (A) and leaf fall (B) for *Betula pendula*





- **Stronger correlation with temperature of the previous month;**
- **There is no linkage with phenological phases and precipitation**





The character of river runoff and atmospheric circulation

Conclusions for climate variability in Latvia:

- Air temperature observations show progressive warming over all the territory of Latvia (spatial variability of temperature is 0,8 to 1,4°C) with relatively more rapid rise for the second half of the last century.
- The annual precipitation increase about 7,5% is characteristic for the last century. The study allows to make conclusion that precipitation has increased more in cold period of year.
- The study confirms increase of winter runoff in proportion to the total runoff for the studied rivers.
- The ice cover period in the studied rivers has been decreasing. The reduction of ice-covered period for the last 30 years has been from 2.8 to 5.1 days every 10 years.

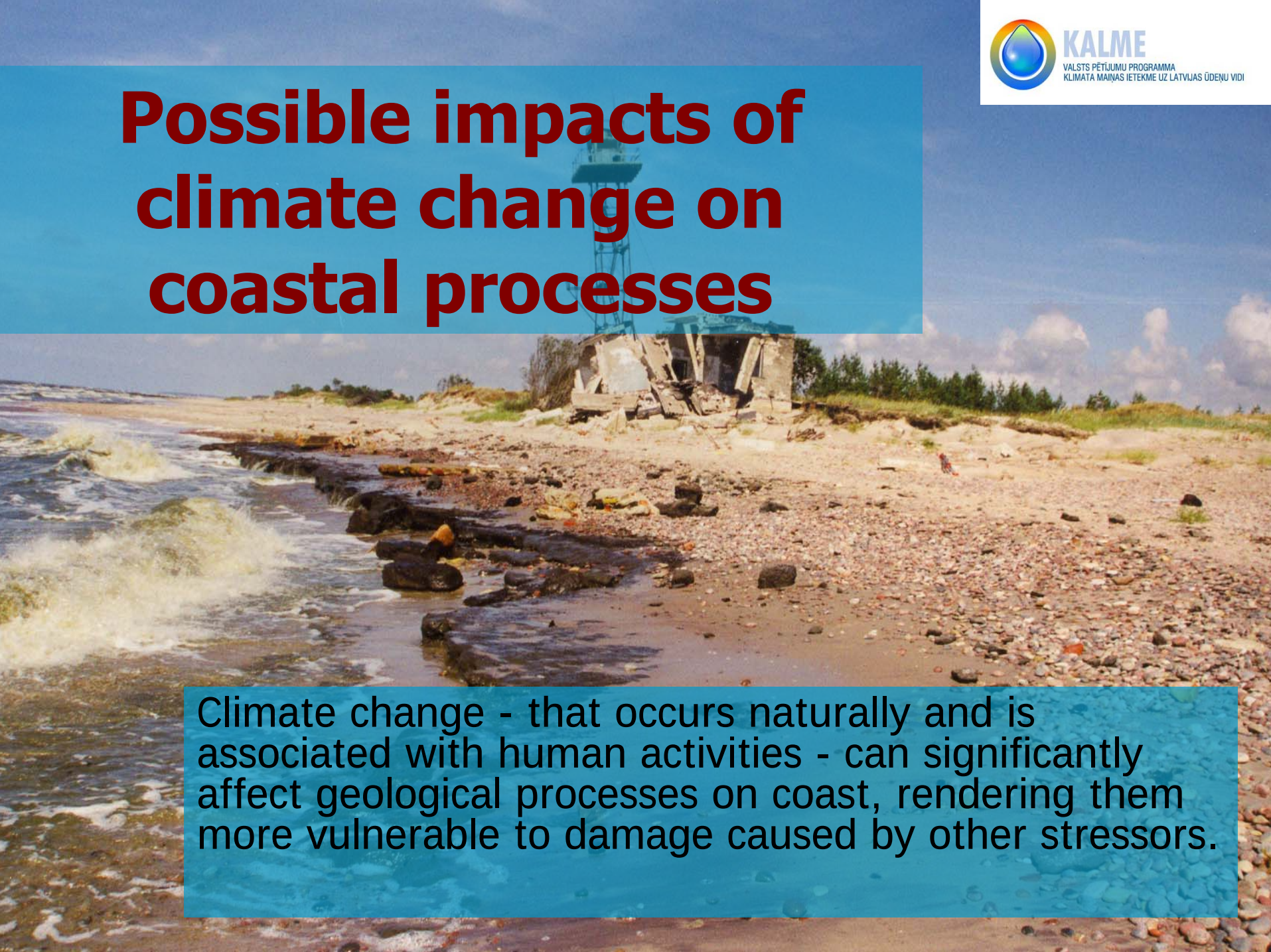
Results:

- M. Kļaviņš, V. Rodinovs, I. Kokorīte, T. Frisk (2005). Long-term changes of aquatic chemistry with respect to river runoff and contaminant loading changes in Latvia Proc. Latv. Acad. Sci, B., 59(5) 175–182
- I.Kokorīte, M.Kļaviņš, V.Rodinovs (2005) Long term changes of runoff of dissolved organic carbon from teritory of Latvia, Acta Universitas Latviensis, 692, 86-94
- Draveniece A., Briede A., Rodinovs V., Kļaviņš M. (2006) Long-term changes of snow cover in Latvia as an indicator of climate variability. Proc. Latv. Acad. Sci, B., 69(2/3), 85-92
- M.Klavins, A.Briede, V.Rodinov, T.Frisk (2006) Ice regime of rivers in Latvia in relation to climatic variability. Verh. Internat. Verein. Limnol., 29, 1825-1828
- M.Kļaviņš, V.Rodinovs (2005) Long-term changes of acidification indicators in atmospheric precipitations and surface waters of Latvia. Proc. Latv. Acad. Sci, B., 59 (3/4), 145 – 151

- M.Kļaviņš, G.Spriņģe, V.Rodinov, I.Druvietis, E.Parele, A.Briede Water quality changes in relation to changing loading levels. Vatten, 2000, 56, 39-47
- M.Kļaviņš, V.Rodinov, I.Kokorīte, I.Kļaviņa, E.Apsīte (2001) Long-term and seasonal changes in chemical composition of surface waters in Latvia. Environ. Monitoring and Assesment., 66, 233-251
- T.Juhna, M.Kļaviņš (2001) Water quality changes in Latvia and Riga 1980-2000:possibilities and problems. Ambio, 30(4-5), 306-314
- M.Klavins, A.Briede, V.Rodinov, I.Kokorite, T.Frisk (2002) Long-term changes of the river runoff in Latvia. Boreal Environ. Res., 7(4), 447-457
- M.Kļaviņš, A.Briede, V.Rodinovs, L.Lizuma, T.Frisk (2004) Ice regime in rivers of Latvia in relation to climatic variability and North Atlantic oscillation. Proc. Latv. Acad. Sci, B., 58(3/4), 131-140

KALME
VALSTS PĒTĪJUMU PROGRAMMA
KLIMATA MAIŅAS IETEKME UZ LATVIJAS ŪDEŅU VIDI

Possible impacts of climate change on coastal processes

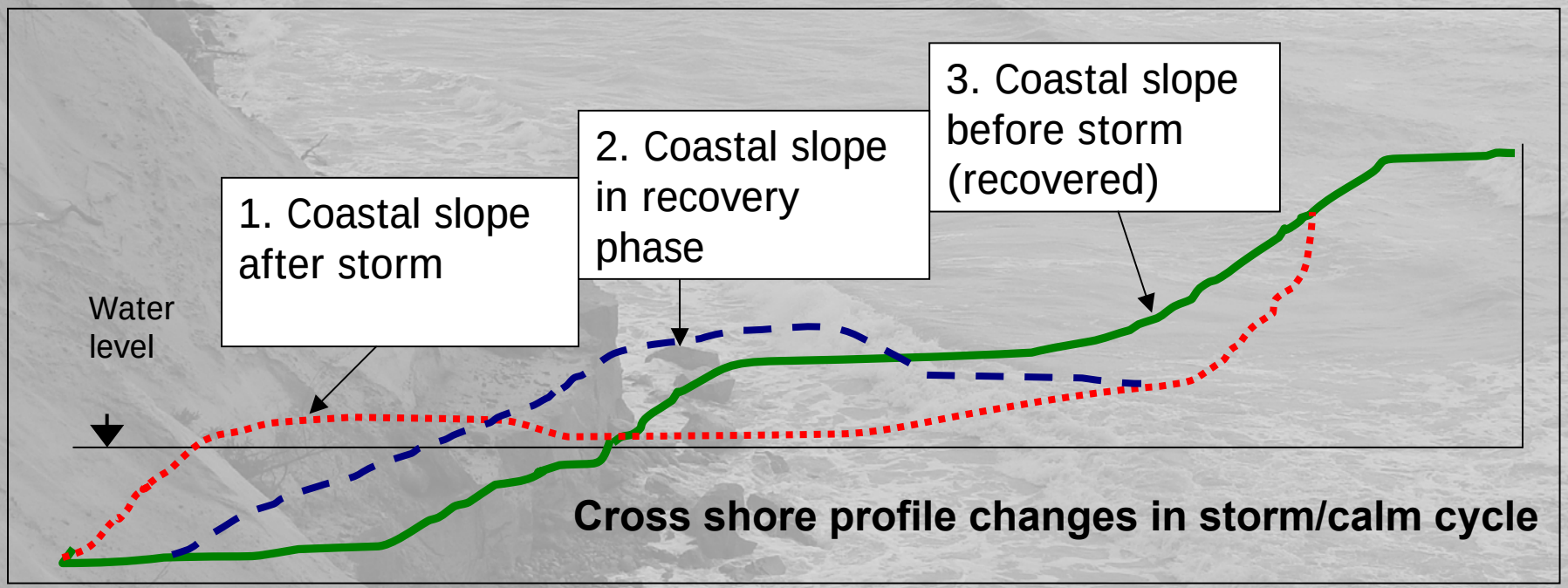


Climate change - that occurs naturally and is associated with human activities - can significantly affect geological processes on coast, rendering them more vulnerable to damage caused by other stressors.

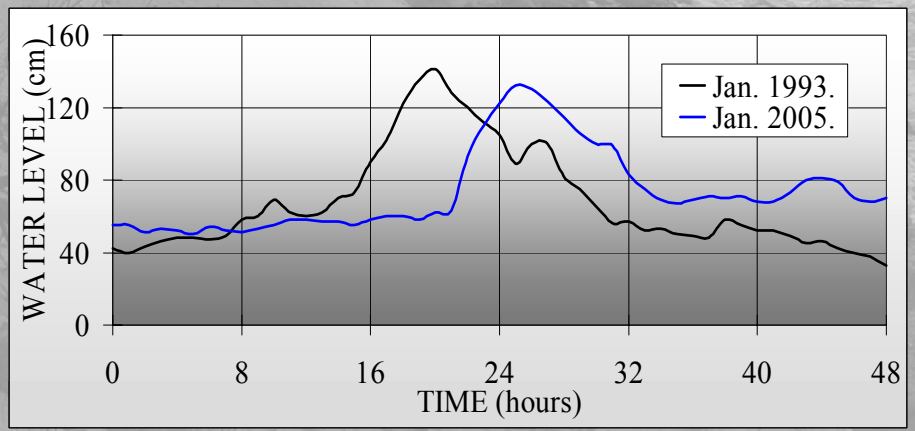
The main factors connected with climate change determining and affecting geological processes in coastal zone are:

1. Wind regime (storm recurrence an intensity, wind direction during storm and calm conditions),
2. air temperature during winter (ice and ground frost conditions, freezing and thawing cycles),
3. Sea level.

Wind regime - storm recurrence

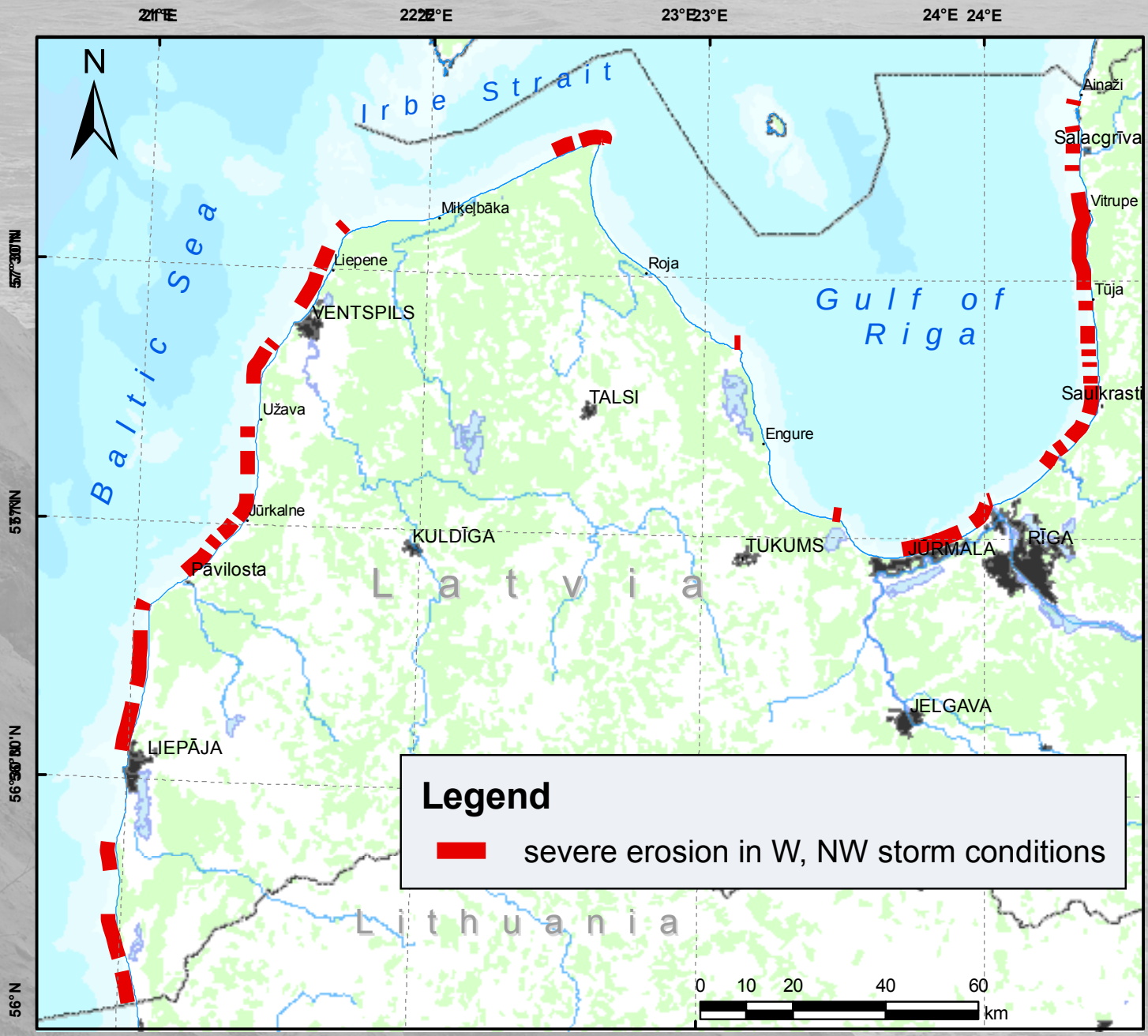


Cross shore profile changes in storm/calm cycle



Storm surge level in Liepāja port. Storms of Jan.1993 and Jan. 2005

Wind regime - wind direction during storm and calm conditions



Erosion vulnerability of the coast

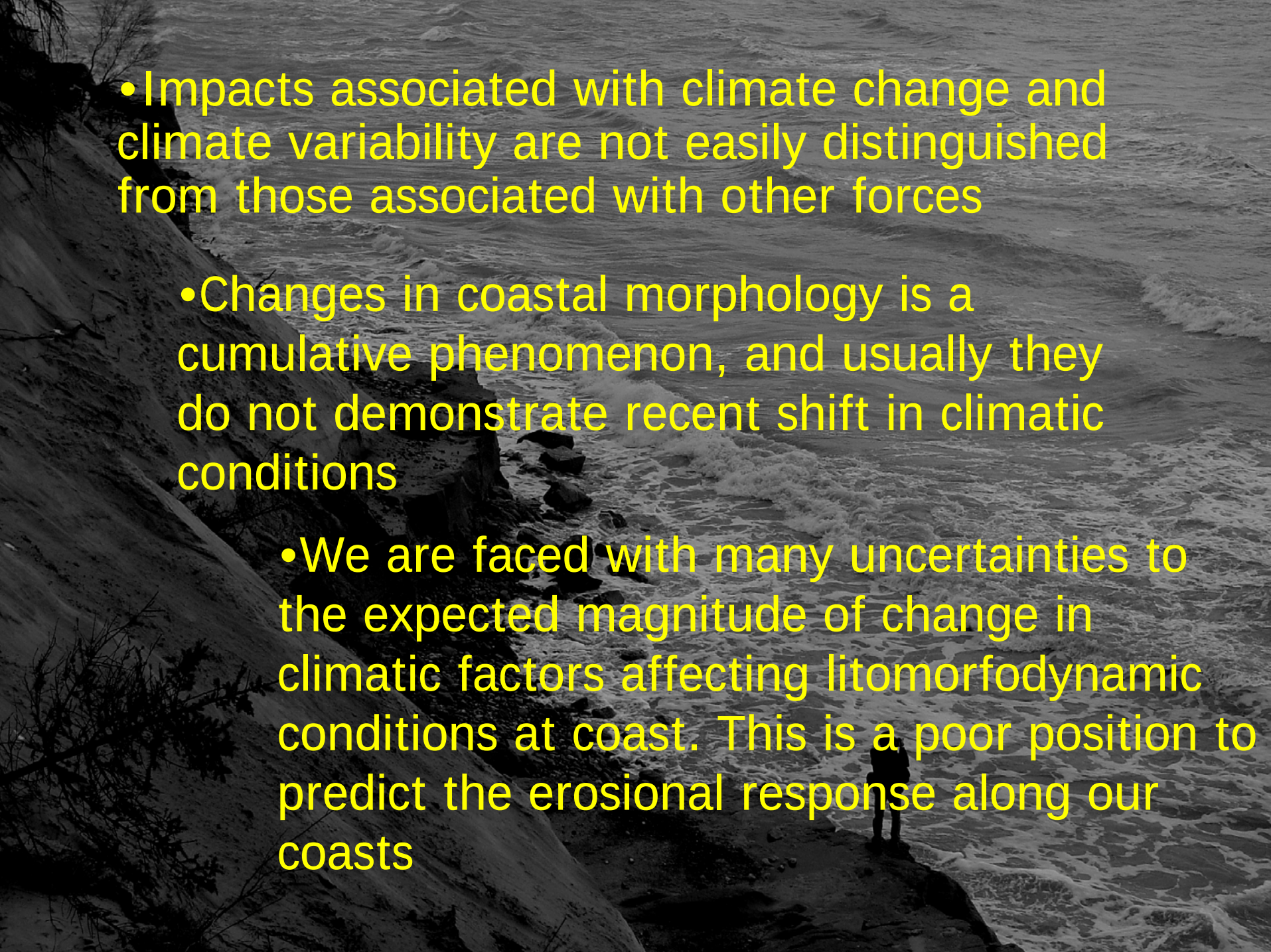
Risk limiting factors:

- Beach volume,
- Beach litology,
- Presence and volume of foredune,
- Height of the "mainland",
- Volume of sand in nearshore zone,
- Geological property's of a bluff.

Air temperature during winter - ice and ground frost conditions

Sea level


21°E
22°E
23°E
24°E
57°30'N
57°N
56°30'N
56°N
N
Irbe Strait
Baltic Sea
Gulf of Riga
Latvia
Lithuania
Ainaži
Salacgrīva
Vitrupe
Tūja
Saulkrasti
Mikeļbāka
Liepene
Roja
VENTSPILS
Užava
TALSI
Engure
Jūrkalne
KULDĪGA
TUKUMS
JŪRMALA
RĪGA
Pāvilosta
JELGAVA
LIEPĀJA
Legend
main risk zones in case of sea level rise
0 10 20 40 60
km



- Impacts associated with climate change and climate variability are not easily distinguished from those associated with other forces
  - Changes in coastal morphology is a cumulative phenomenon, and usually they do not demonstrate recent shift in climatic conditions
    - We are faced with many uncertainties to the expected magnitude of change in climatic factors affecting litomorfodynamic conditions at coast. This is a poor position to predict the erosional response along our coasts


Thank you for attention!