Interreg

Latvia – Lithuania

Co-funded by the European Union

LATVIJAS VIDES, ĢEOLOĢIJAS UN METEOROLOĢIJAS CENTRS

ICEREG

Climate change modelling in Latvia

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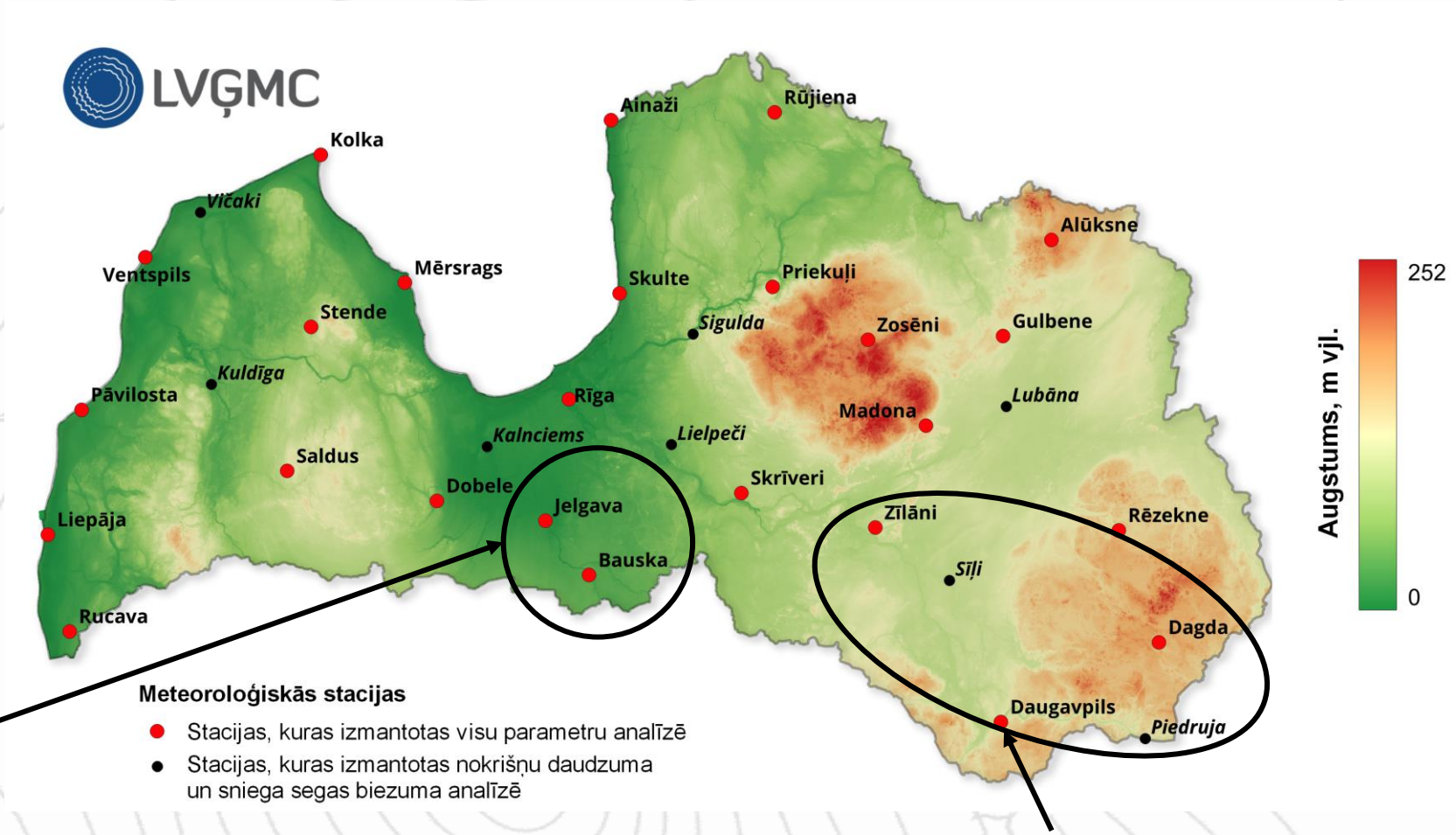
21.01.2026.

Observation data

Data behind current climate change assessment:

Parameter	Start of timeseries
temperature	1947
precipitation	1945
wind speed	1966
snow depth	1945

Station locations



Lielupe basin: Bauska and Jelgava

Daugava basin: Daugavpils, Dagda, Zīlāni, precipitation only – Piedruja, Sīļi

CMIP6 climate change scenarios

SSP – *Shared Socioeconomic Pathways*
Global results also in IPCC 6th report (2023)

Socio-economic factors such as population, economic growth, education, urbanization and rates of technological development

→

SSP1-1.9
SSP1-2.6
SSP2-4.5
SSP3-7.0
SSP4-3.4
SSP4-6.0
SSP5-8.5

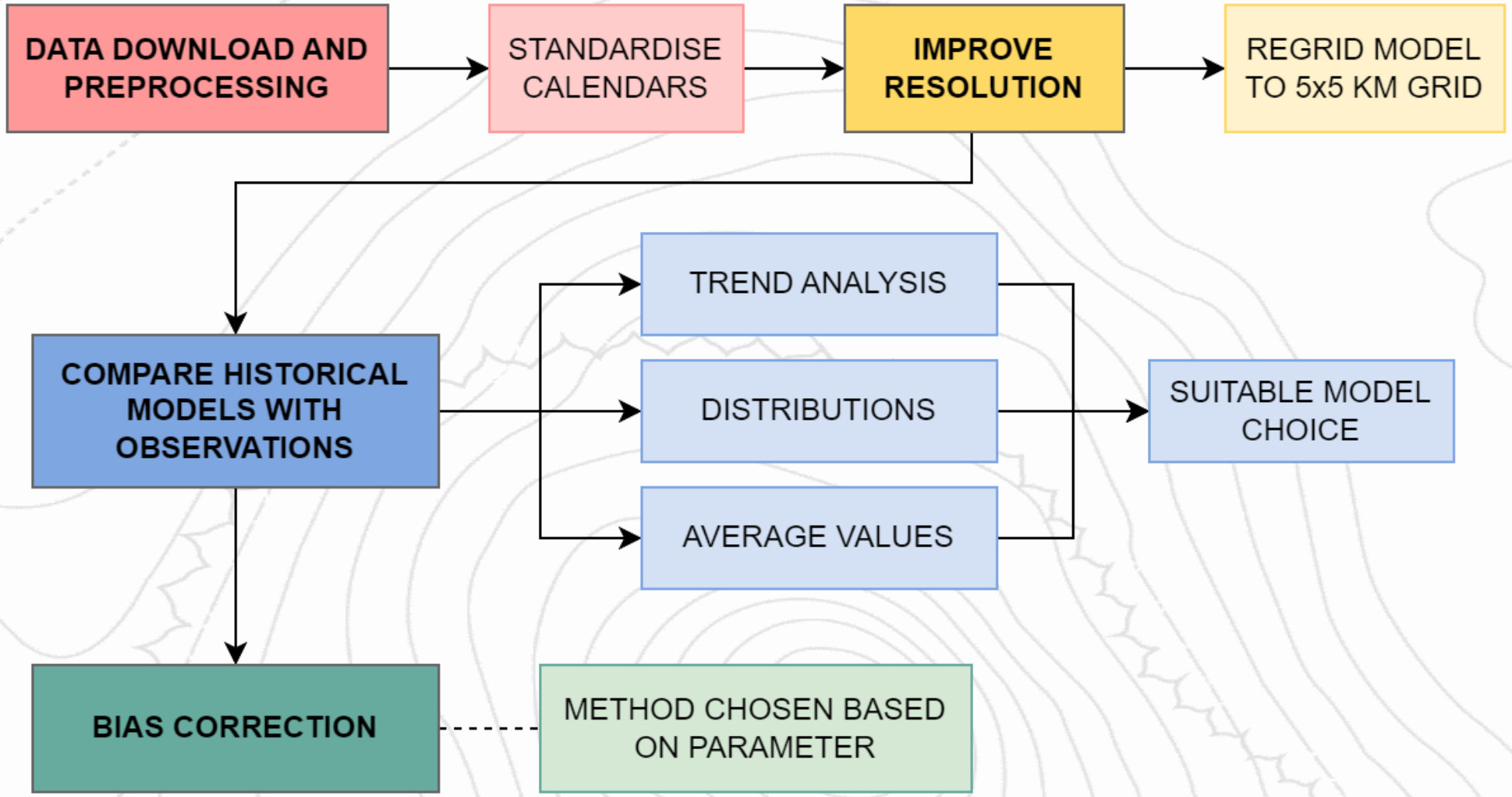
←

Concentration of greenhouse gases in the atmosphere (W/m2) This component was used in previous (RCP) scenarios.

In agreement with the policy makers, it was decided that in Latvia we will consider:

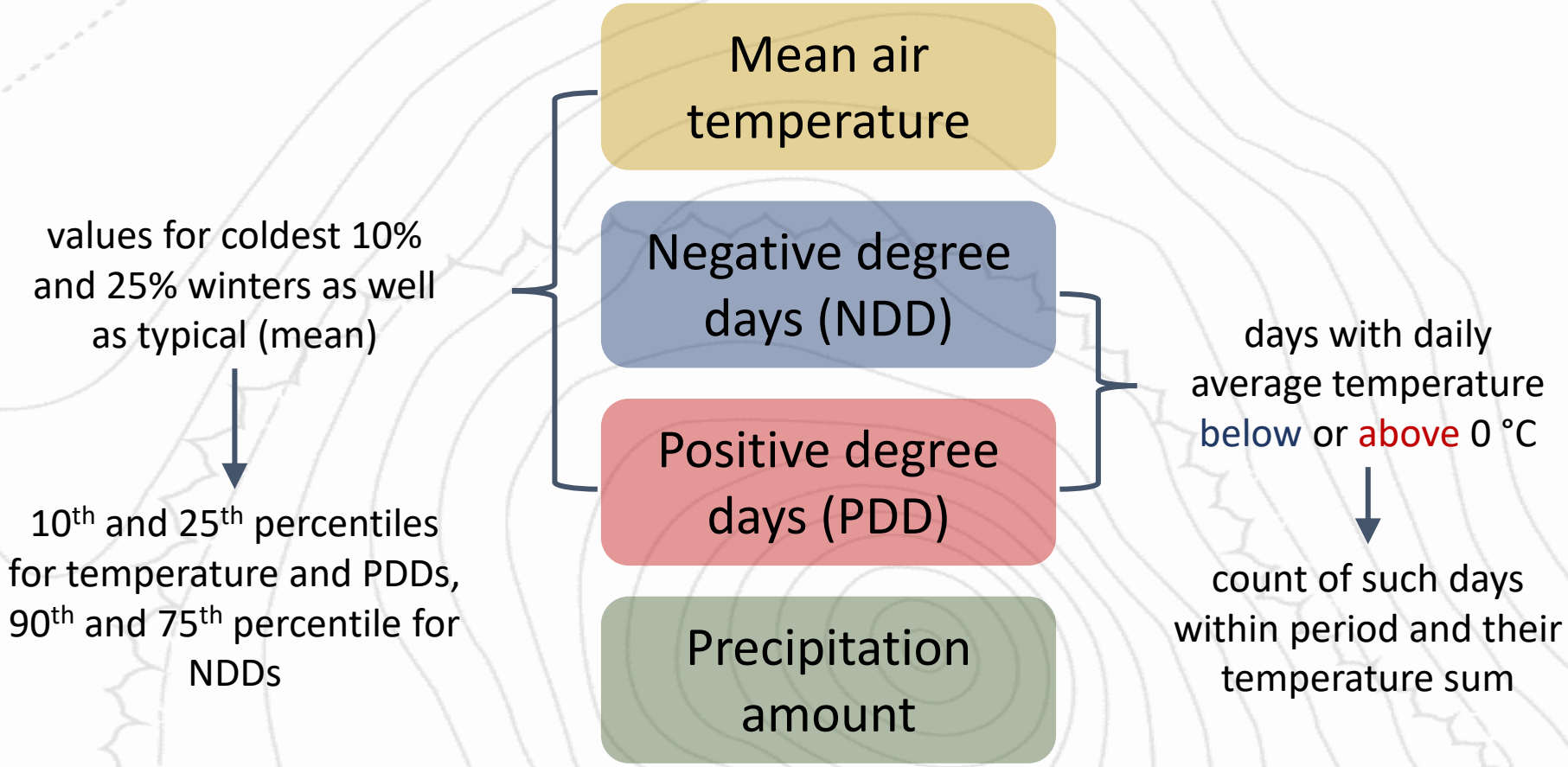
- SSP1-2.6 – **minor** climate change (not used in ICEREG)
- SSP2-4.5 – **medium** climate change
- SSP3-7.0 – **significant** climate change

Model analysis workflow



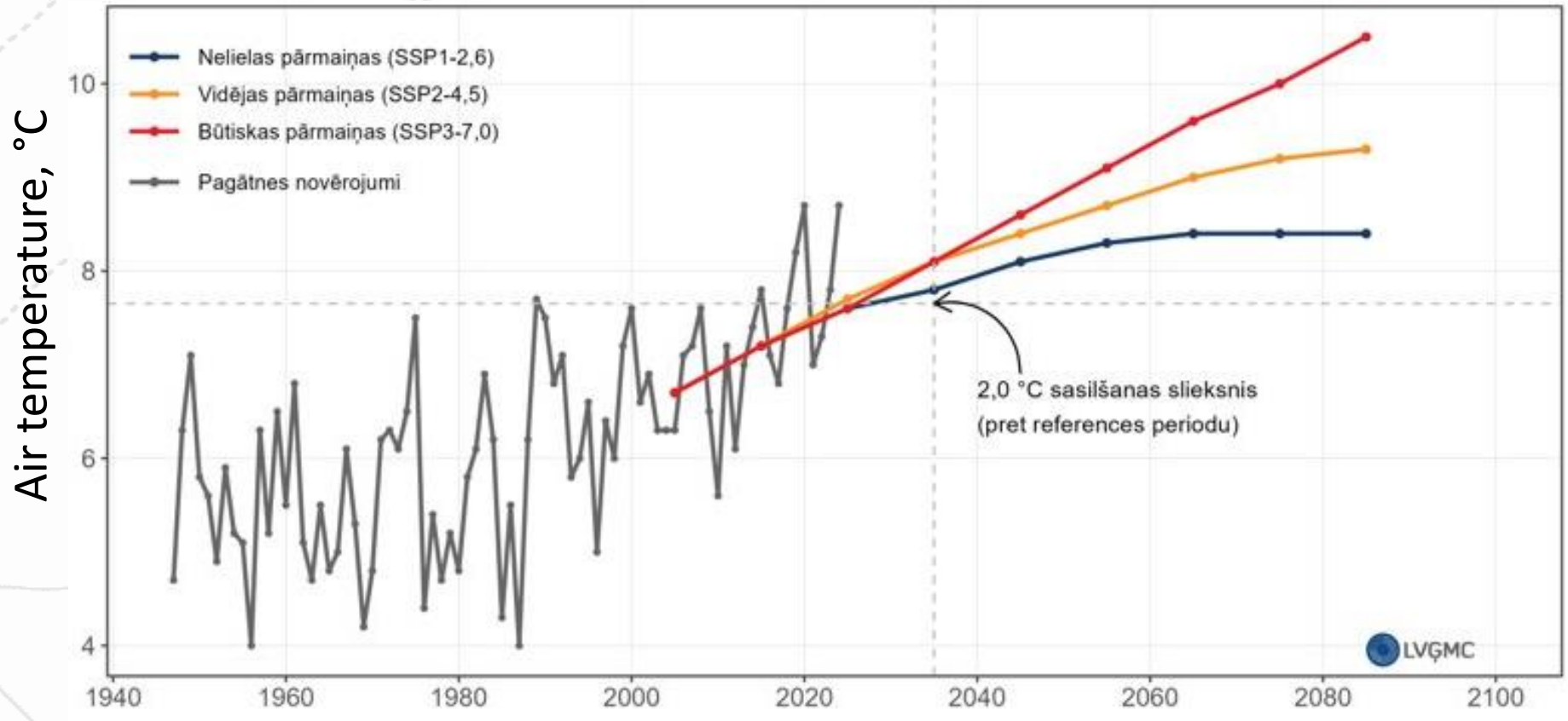
Climate indices for river basins

All indices calculated for the whole season (November–April) as well as each month



Average air temperature in Latvia

(1947–2024)



Average air temperature:

- during the climatic reference period (1961–1990): +5.6 °C
- during the period of climatic norms (1991–2020): +6.8 °C

The increase in average air temperature so far is **1.2 °C**

Past and future climate change in Latvia

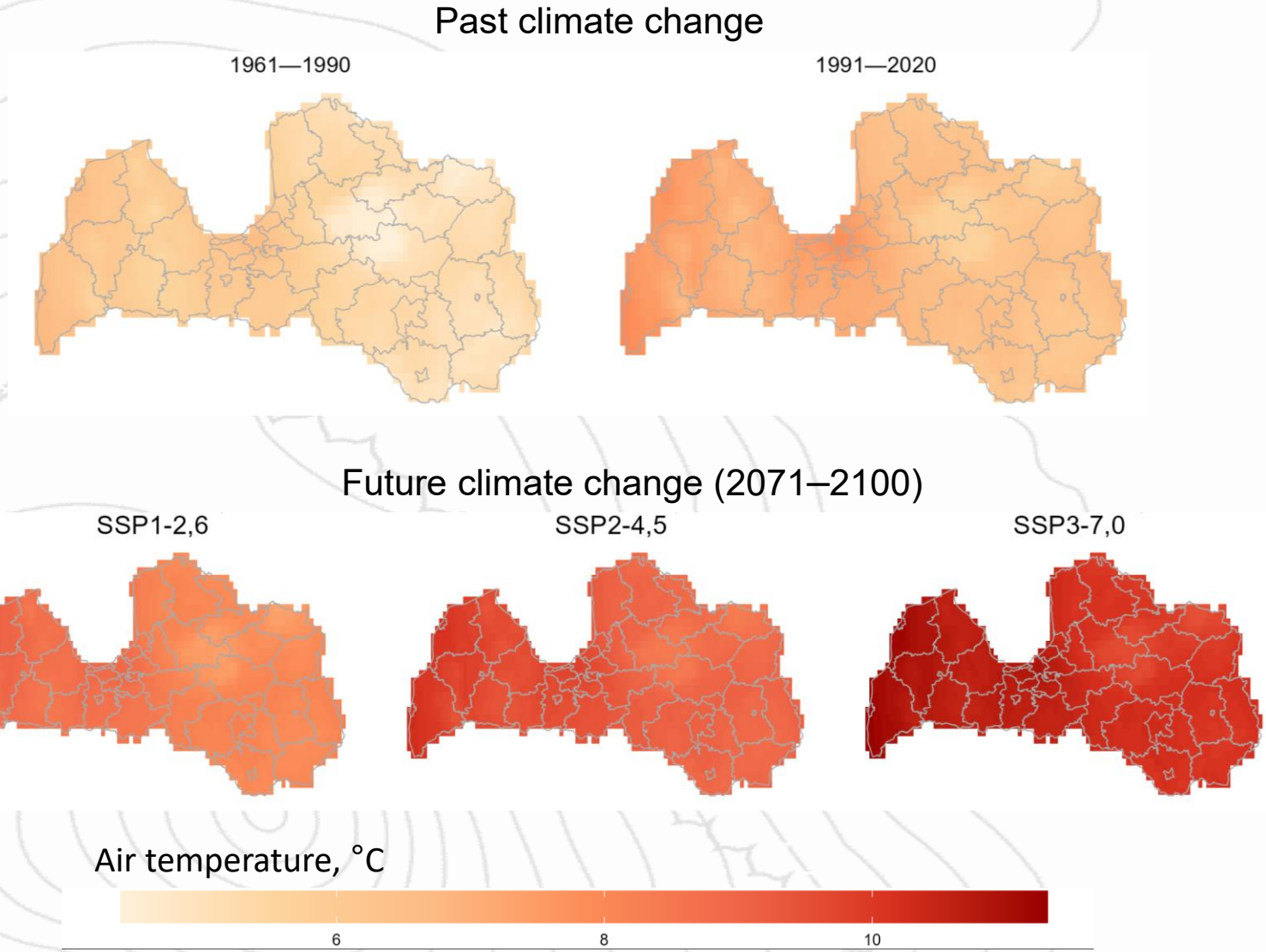
Average air temperature

Average air temperature **increase by seasons** (reference period vs. normal period):

- **Winter** from –4.4 °C to –2.4 °C (**biggest increase**);
- **Spring** from 4.8 °C to 5.9 °C;
- **Summer** from 15.6 °C to 16.7 °C;
- **Autumn** from 6.5 °C to 7.1 °C (**smallest increase**)

The **increase** of the average annual air temperature **at the end of the 21st century** in relation to the reference period (1961–1990):

- minor climate change: +2.8 °C
- medium climate change: +3.7 °C
- significant climate change: +4.9 °C



Past and future climate change in Daugava and Lielupe Rivers

Average air temperature

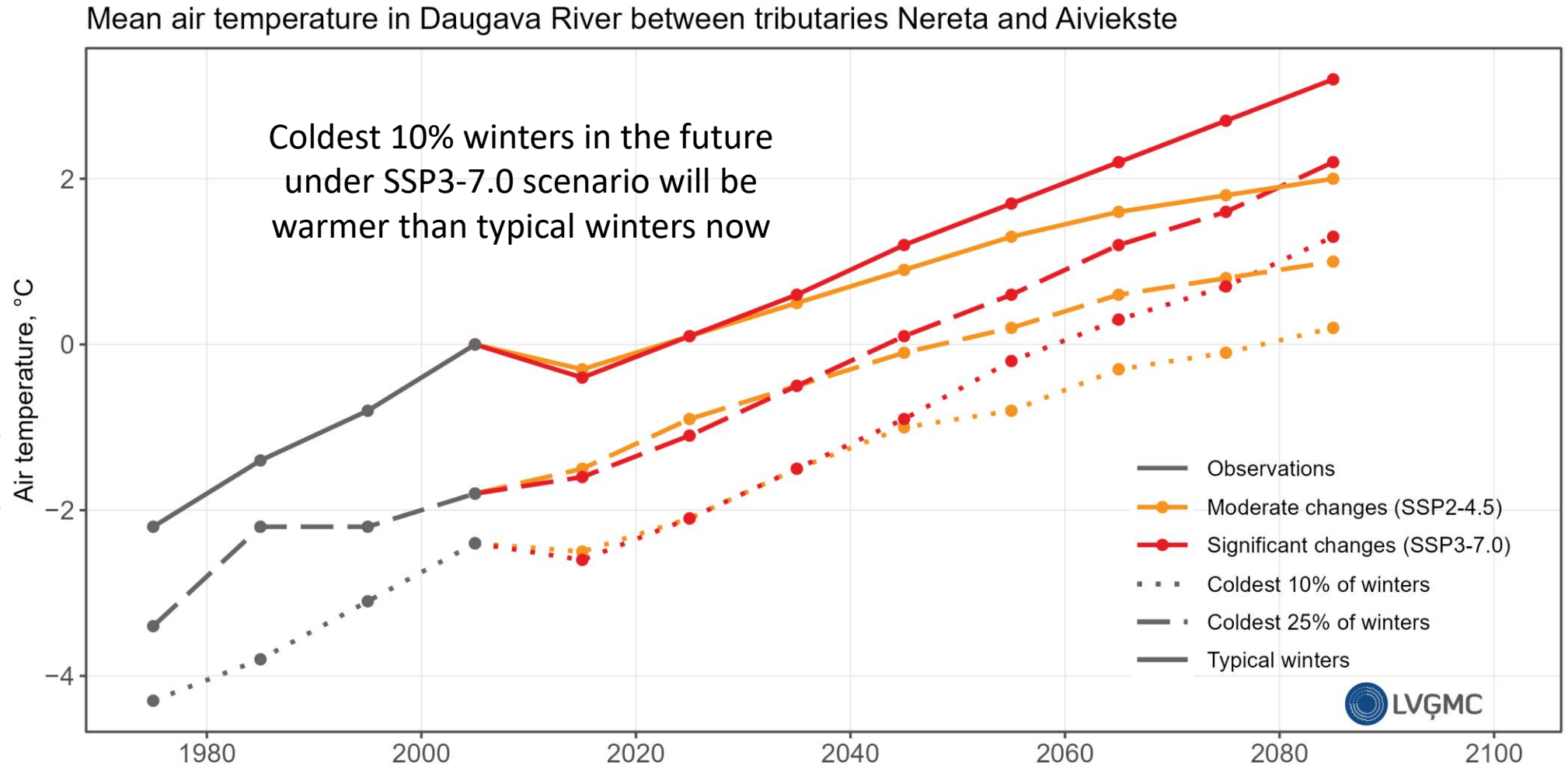
Largest increase so far in January, in the future Dec–Feb

In many cases average air temperature would be positive by the end of the century

River basin	Period	Reference; 1961–1990	Normal; 1991–2020	Normal vs. reference	Future; 2071–2100 [± model standard deviation]		Future vs. normal period	
					SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0
Daugava River	Season	−2.0 °C	−0.4 °C	↑ +1.6 °C	+1.9 [±1.0] °C	+3.1 [±0.8] °C	↑ +2.3 °C	↑ +3.5 °C
	Nov	+0.7 °C	+1.4 °C	↑ +0.7 °C	+3.9 [±1.1] °C	+5.0 [±1.2] °C	↑ +2.5 °C	↑ +3.6 °C
	Dec	−3.8 °C	−2.2 °C	↑ +1.6 °C	+0.2 [±1.2] °C	+1.6 [±1.1] °C	↑ +2.4 °C	↑ +3.8 °C
	Jan	−6.6 °C	−4.1 °C	↑ +2.5 °C	−1.8 [±1.1] °C	−0.4 [±0.9] °C	↑ +2.3 °C	↑ +3.7 °C
	Feb	−5.9 °C	−4.1 °C	↑ +1.8 °C	−1.7 [±1.1] °C	−0.3 [±0.8] °C	↑ +2.4 °C	↑ +3.8 °C
	Mar	−1.7 °C	−0.1 °C	↑ +1.6 °C	+2.1 [±1.2] °C	+3.1 [±1.0] °C	↑ +2.2 °C	↑ +3.2 °C
	Apr	+5.0 °C	+6.7 °C	↑ +1.7 °C	+8.7 [±0.9] °C	+9.6 [±0.8] °C	↑ +2.0 °C	↑ +2.9 °C
Lielupe River	Season	−1.0 °C	+0.5 °C	↑ +1.5 °C	+2.6 [±1.0] °C	+3.8 [±0.8] °C	↑ +2.1 °C	↑ +3.3 °C
	Nov	+1.7 °C	+2.4 °C	↑ +0.7 °C	+4.9 [±1.1] °C	+5.9 [±1.2] °C	↑ +2.5 °C	↑ +3.5 °C
	Dec	−2.6 °C	−1.1 °C	↑ +1.5 °C	+1.3 [±1.1] °C	+2.6 [±1.1] °C	↑ +2.4 °C	↑ +3.7 °C
	Jan	−5.1 °C	−2.8 °C	↑ +2.3 °C	−0.6 [±1.1] °C	+0.6 [±0.8] °C	↑ +2.2 °C	↑ +3.4 °C
	Feb	−4.7 °C	−2.8 °C	↑ +1.9 °C	−0.6 [±1.1] °C	+0.7 [±0.8] °C	↑ +2.2 °C	↑ +3.5 °C
	Mar	−0.8 °C	+0.7 °C	↑ +1.5 °C	+2.7 [±1.1] °C	+3.7 [±0.9] °C	↑ +2.0 °C	↑ +3.0 °C
	Apr	+5.3 °C	+6.8 °C	↑ +1.5 °C	+8.5 [±0.9] °C	+9.5 [±0.7] °C	↑ +1.7 °C	↑ +2.7 °C

Past and future climate change in Daugava and Lielupe Rivers

Average air temperature



Past and future climate change in Daugava and Lielupe Rivers

Negative degree days

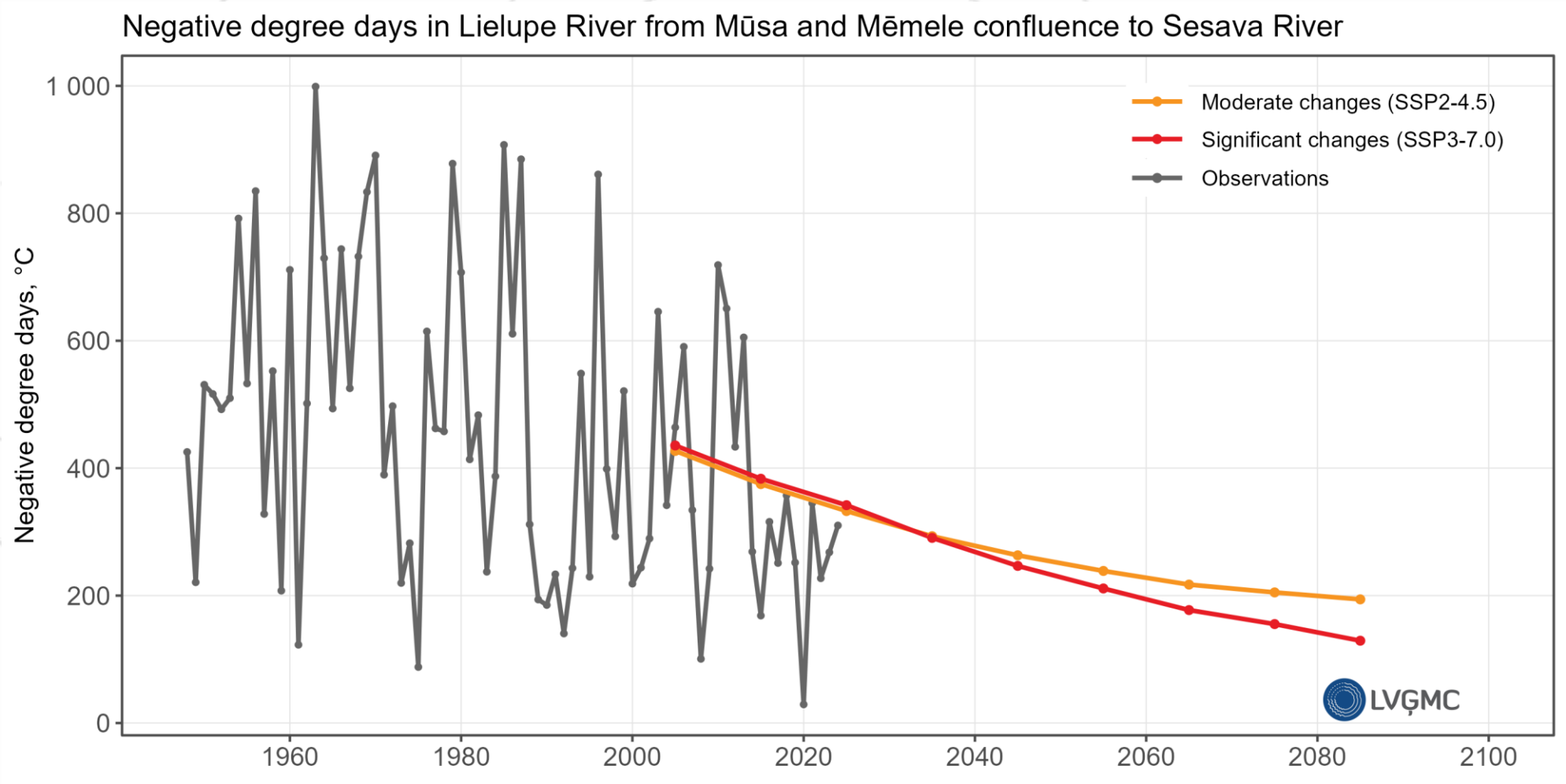
Decrease in NDDs has been slightly more prominent so far in Daugava

For both basins Jan–Feb will see the largest decrease in NDDs in the future

River basin	Period	Reference; 1961–1990	Normal; 1991–2020	Normal vs. reference	Future; 2071–2100 [± model standard deviation]		Future vs. normal period	
					SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0
Daugava River	Season	657.8 °C	469.7 °C	↓ −188.1 °C	260.5 [±73.5] °C	177.5 [±55.6] °C	↓ −209.2 °C	↓ −292.2 °C
	Nov	42.6 °C	38.3 °C	↓ −4.3 °C	12.6 [±7.2] °C	7.0 [±4.7] °C	↓ −25.7 °C	↓ −31.3 °C
	Dec	136.3 °C	98.8 °C	↓ −37.5 °C	49.9 [±19.2] °C	31.5 [±16.9] °C	↓ −48.9 °C	↓ −67.3 °C
	Jan	214.4 °C	144.6 °C	↓ −69.8 °C	89.3 [±27.1] °C	63.8 [±18.9] °C	↓ −55.3 °C	↓ −80.8 °C
	Feb	173.8 °C	132.3 °C	↓ −41.5 °C	81.7 [±22.1] °C	57.6 [±16.2] °C	↓ −50.6 °C	↓ −74.7 °C
	Mar	86.7 °C	54.0 °C	↓ −32.7 °C	24.9 [±10.8] °C	17.5 [±9.0] °C	↓ −29.1 °C	↓ −36.5 °C
	Apr	4.0 °C	1.7 °C	↓ −2.3 °C	0.2 [±0.3] °C	0.1 [±0.1] °C	↓ −1.5 °C	↓ −1.6 °C
Lielupe River	Season	526.1 °C	366.4 °C	↓ −159.7 °C	194.1 [±60.2] °C	129.2 [±44.5] °C	↓ −172.3 °C	↓ −237.2 °C
	Nov	30.3 °C	26.1 °C	↓ −4.2 °C	8.1 [±5.1] °C	4.4 [±3.1] °C	↓ −18.0 °C	↓ −21.7 °C
	Dec	107.8 °C	76.8 °C	↓ −31.0 °C	35.5 [±14.5] °C	22.0 [±12.2] °C	↓ −41.3 °C	↓ −54.8 °C
	Jan	172.8 °C	115.8 °C	↓ −57.0 °C	67.3 [±23.1] °C	47.2 [±15.3] °C	↓ −48.5 °C	↓ −68.6 °C
	Feb	145.3 °C	105.0 °C	↓ −40.3 °C	63.0 [±19.0] °C	42.9 [±15.1] °C	↓ −42.0 °C	↓ −62.1 °C
	Mar	67.8 °C	41.9 °C	↓ −25.9 °C	18.4 [±9.6] °C	12.7 [±7.5] °C	↓ −23.5 °C	↓ −29.2 °C
	Apr	2.2 °C	0.8 °C	↓ −1.4 °C	0.1 [±0.2] °C	0 [±0] °C	↓ −0.7 °C	↓ −0.8 °C

Past and future climate change in Daugava and Lielupe Rivers

Negative degree days



Past and future climate change in Daugava and Lielupe Rivers

Number of days with negative mean air temperature

Historically Daugava basin has had more days with negative air temperature than Lielupe, and this would stay true in the future

Largest decreases in December, but also March

River basin	Period	Reference; 1961–1990	Normal; 1991–2020	Normal vs. reference	Future; 2071–2100 [± model standard deviation]		Future vs. normal period	
					SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0
Daugava River	Season	99 days	83 days	↓ −16 days	61 [±12] days	46 [±11] days	↓ −22 days	↓ −37 days
	Nov	11 days	10 days	↓ −1 day	5 [±2] days	3 [±2] days	↓ −5 days	↓ −7 days
	Dec	21 days	18 days	↓ −3 days	13 [±3] days	9 [±4] days	↓ −5 days	↓ −9 days
	Jan	24 days	21 days	↓ −3 days	17 [±3] days	14 [±3] days	↓ −4 days	↓ −7 days
	Feb	23 days	19 days	↓ −4 days	16 [±3] days	13 [±2] days	↓ −3 days	↓ −6 days
	Mar	17 days	13 days	↓ −4 days	8 [±2] days	6 [±3] days	↓ −5 days	↓ −7 days
	Apr	2 days	2 days	↕ 0 days	0 [±0] days	0 [±0] days	↓ −2 days	↓ −2 days
Lielupe River	Season	86 days	71 days	↓ −15 days	47 [±10] days	35 [±9] days	↓ −24 days	↓ −36 days
	Nov	9 days	8 days	↓ −1 day	3 [±2] days	2 [±1] days	↓ −5 days	↓ −6 days
	Dec	19 days	15 days	↓ −4 days	10 [±3] days	7 [±3] days	↓ −5 days	↓ −8 days
	Jan	22 days	18 days	↓ −4 days	14 [±3] days	11 [±2] days	↓ −4 days	↓ −7 days
	Feb	21 days	17 days	↓ −4 days	13 [±3] days	10 [±3] days	↓ −4 days	↓ −7 days
	Mar	14 days	12 days	↓ −2 days	7 [±2] days	4 [±2] days	↓ −5 days	↓ −8 days
	Apr	1 day	1 day	↕ 0 days	0 [±0] days	0 [±0] days	↓ −1 day	↓ −1 day

Past and future climate change in Daugava and Lielupe Rivers

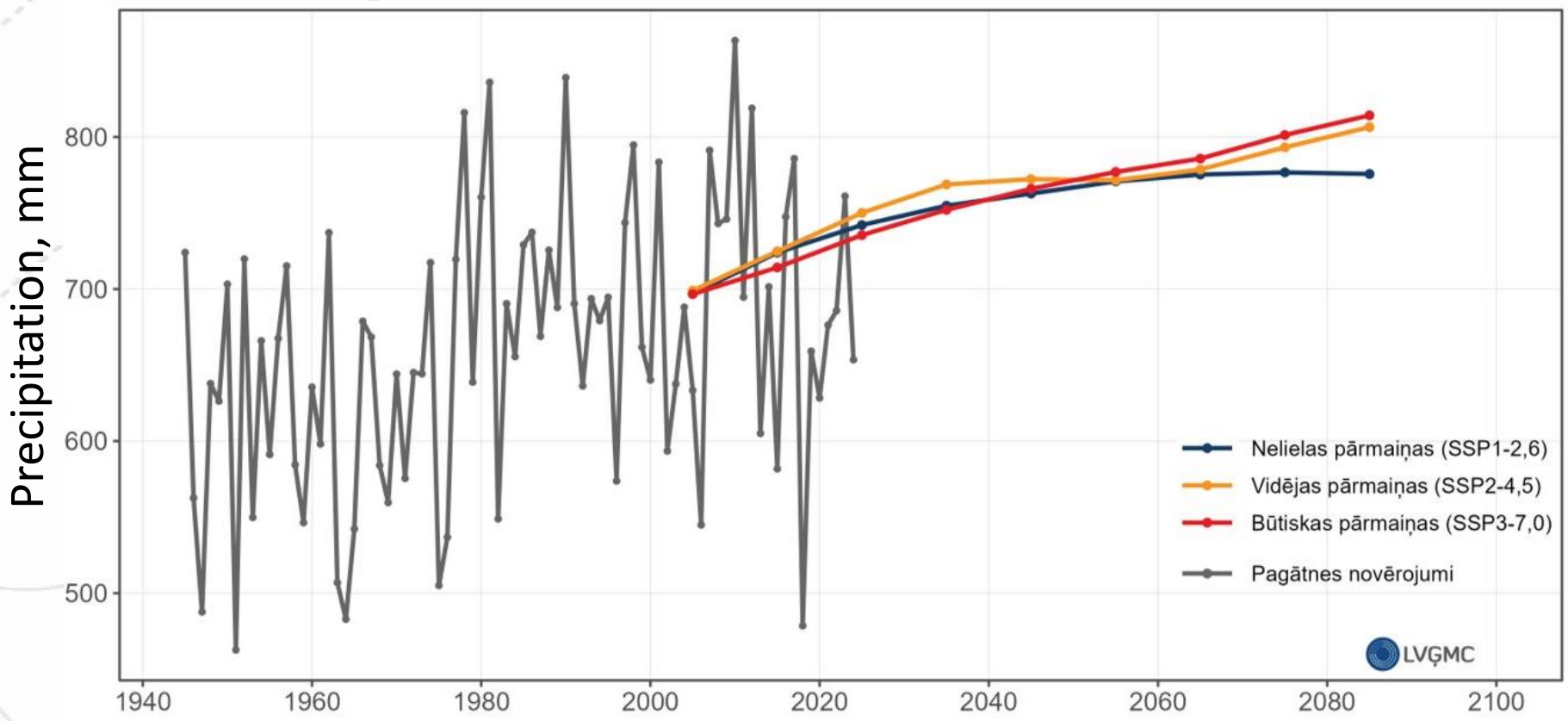
Positive degree days

Different effects – Nov and Apr see the largest increases in the future

River basin	Period	Reference; 1961–1990	Normal; 1991–2020	Normal vs. reference	Future; 2071–2100 [± model standard deviation]		Future vs. normal period	
					SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0
Daugava River	Season	286.0 °C	400.3 °C	↑ +114.3 °C	596.6 [±129.2] °C	737.8 [±110.5] °C	↑ +196.3 °C	↑ +337.5 °C
	Nov	64.5 °C	79.6 °C	↑ +15.1 °C	129.5 [±27.4] °C	156.4 [±32.3] °C	↑ +49.9 °C	↑ +76.8 °C
	Dec	17.6 °C	30.2 °C	↑ +12.6 °C	55.4 [±21.4] °C	80.3 [±22.8] °C	↑ +25.2 °C	↑ +50.1 °C
	Jan	8.8 °C	18.4 °C	↑ +9.6 °C	33.1 [±15.4] °C	49.5 [±14.7] °C	↑ +14.7 °C	↑ +31.1 °C
	Feb	8.0 °C	17.8 °C	↑ +9.8 °C	33.3 [±15.1] °C	48.0 [±14.3] °C	↑ +15.5 °C	↑ +30.2 °C
	Mar	32.8 °C	52.2 °C	↑ +19.4 °C	90.9 [±29.2] °C	115.0 [±25.5] °C	↑ +38.7 °C	↑ +62.8 °C
	Apr	154.2 °C	202.1 °C	↑ +47.9 °C	260.2 [±28.0] °C	288.6 [±23.3] °C	↑ +58.1 °C	↑ +86.5 °C
Lielupe River	Season	339.6 °C	461.5 °C	↑ +121.9 °C	674.7 [±134.2] °C	825.1 [±112.5] °C	↑ +213.2 °C	↑ +363.6 °C
	Nov	80.9 °C	96.6 °C	↑ +15.7 °C	153.9 [±28.9] °C	181.0 [±32.5] °C	↑ +57.3 °C	↑ +84.4 °C
	Dec	27.0 °C	41.8 °C	↑ +14.8 °C	75.3 [±23.4] °C	103.3 [±25.0] °C	↑ +33.5 °C	↑ +61.5 °C
	Jan	15.5 °C	27.8 °C	↑ +12.3 °C	48.4 [±17.6] °C	67.5 [±15.5] °C	↑ +20.6 °C	↑ +39.7 °C
	Feb	13.2 °C	26.1 °C	↑ +12.9 °C	44.9 [±16.8] °C	62.9 [±15.6] °C	↑ +18.8 °C	↑ +36.8 °C
	Mar	42.1 °C	63.4 °C	↑ +21.3 °C	102.6 [±28.7] °C	127.4 [±23.9] °C	↑ +39.2 °C	↑ +64.0 °C
	Apr	161.0 °C	205.7 °C	↑ +44.7 °C	255.6 [±25.3] °C	283.1 [±21.6] °C	↑ +49.9 °C	↑ +77.4 °C

Yearly precipitation amount in Latvia

(1945–2024)



Total precipitation:

- Reference period (1961–1990): 655 mm
- Climate normal period (1991–2020): 684.5 mm

Current annual precipitation amount **increase is 4%**

Past and future climate change in Latvia

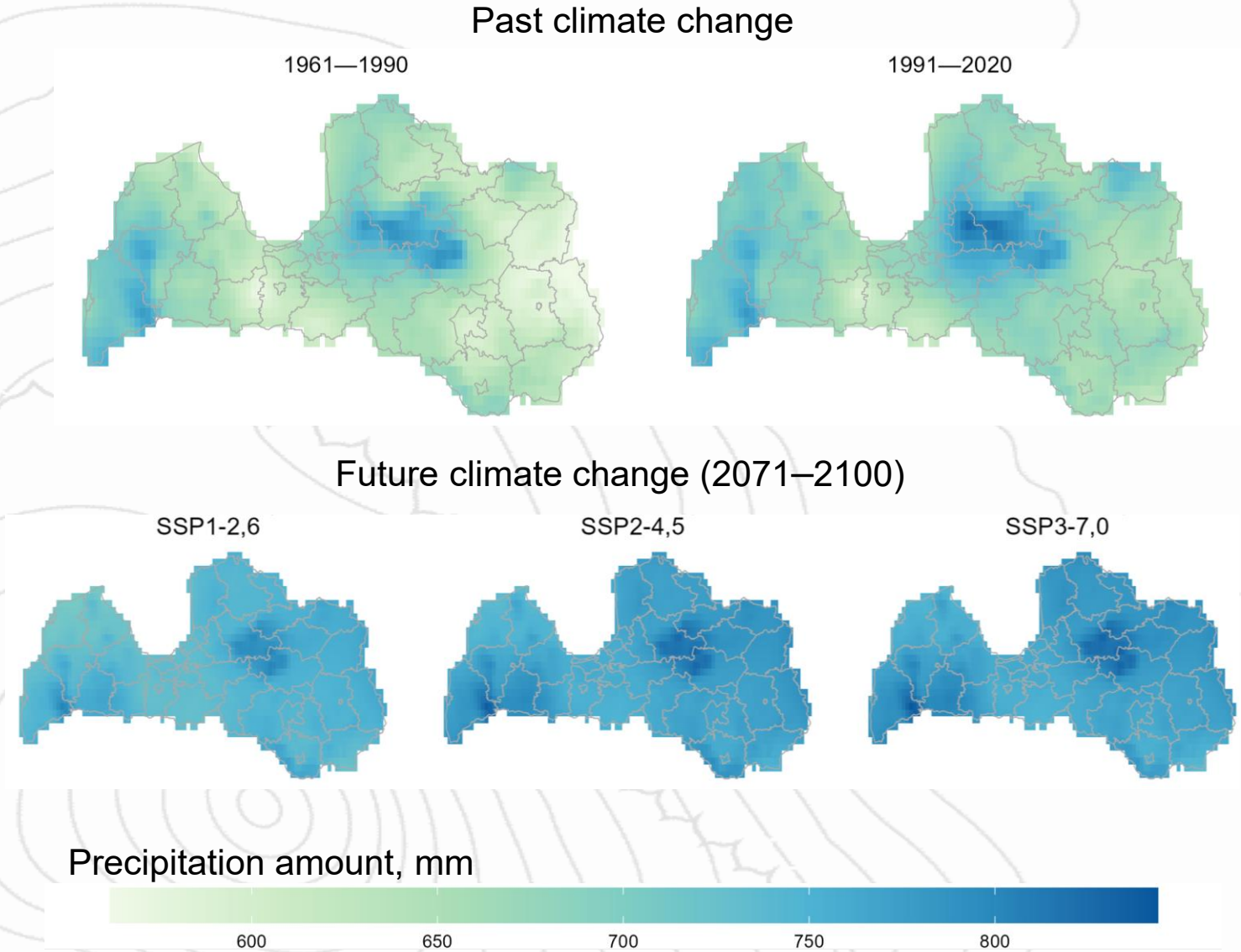
Precipitation amount

Precipitation amount increase by seasons (reference period vs. normal period):

- **Winter** from 121.8 to 144.2 mm (+18.4%);
- **Spring** from 118.5 to 123.4 mm (4.1%);
- **Summer** from 215.1 to 222.3 mm (3.3%);
- **Autumn** from 200.6 to 194.6 mm (–3.0%)

The **increase** of the precipitation amount **at the end of the 21st century** in relation to the reference period (1961–1990):

- minor climate change: 18%
- medium climate change: 23%
- significant climate change: 24%



Past and future climate change in Daugava and Lielupe Rivers

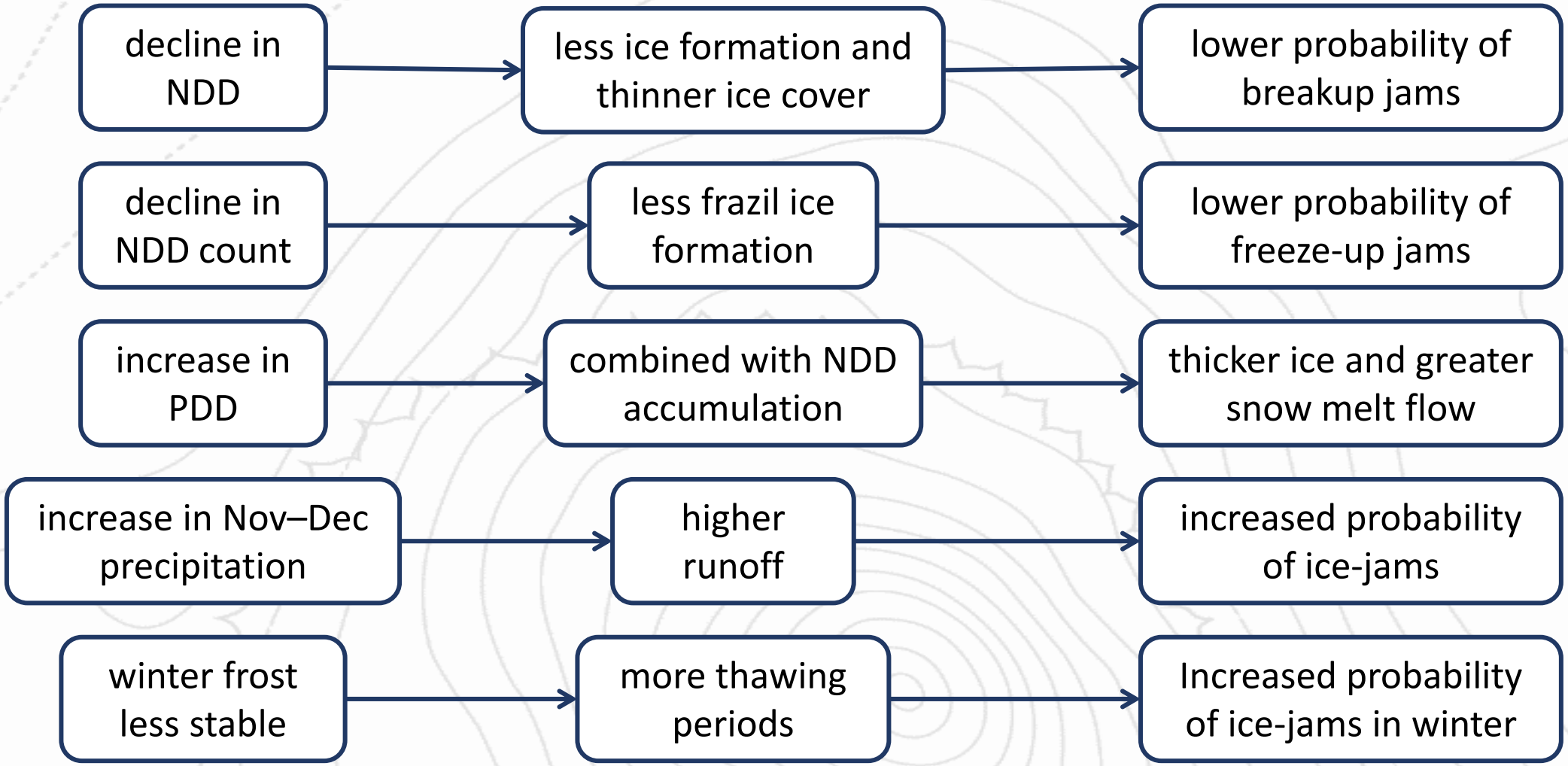
Precipitation amount

Changes more variable than for temperature

However the future trend is the same for all periods – increasing, the largest increase projected for Mar–Apr

River basin	Period	Reference; 1961–1990	Normal; 1991–2020	Normal vs. reference	Future; 2071–2100 [± model standard deviation]		Future vs. normal period	
					SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0
Daugava River	Season	244.6 mm	255.0 mm	↑ +4.3%	350.3 [±31.2] mm	363.6 [±35.5] mm	↑ +37.4%	↑ +42.6%
	Nov	55.0 mm	53.4 mm	↓ −2.9%	69.4 [±7.4] mm	69.5 [±8.7] mm	↑ +30.0%	↑ +30.1%
	Dec	50.2 mm	46.4 mm	↓ −7.6%	64.2 [±8.9] mm	66.4 [±11.4] mm	↑ +38.4%	↑ +43.1%
	Jan	36.3 mm	44.2 mm	↑ +21.8%	55.6 [±6.8] mm	58.3 [±7.6] mm	↑ +25.8%	↑ +31.9%
	Feb	27.5 mm	39.3 mm	↑ +42.9%	47.8 [±6.7] mm	51.9 [±8.3] mm	↑ +21.6%	↑ +32.1%
	Mar	34.6 mm	36.1 mm	↑ +4.3%	51.2 [±7.7] mm	55.4 [±6.9] mm	↑ +41.8%	↑ +53.5%
	Apr	41.0 mm	35.5 mm	↓ −13.4%	62.0 [±8.5] mm	62.3 [±6.3] mm	↑ +74.6%	↑ +75.5%
Lielupe River	Season	231.6 mm	236.4 mm	↑ +2.1%	353.2 [±40.7] mm	365.6 [±45.5] mm	↑ +49.4%	↑ +54.7%
	Nov	53.9 mm	49.8 mm	↓ −7.6%	71.5 [±10.4] mm	71.8 [±12.5] mm	↑ +43.6%	↑ +44.2%
	Dec	45.9 mm	45.0 mm	↓ −2.0%	67.5 [±10.6] mm	69.9 [±14.1] mm	↑ +50.0%	↑ +55.3%
	Jan	32.9 mm	41.1 mm	↑ +24.9%	57.4 [±9.0] mm	60.5 [±9.9] mm	↑ +39.7%	↑ +47.2%
	Feb	26.0 mm	33.7 mm	↑ +29.6%	47.8 [±7.7] mm	51.6 [±9.6] mm	↑ +41.8%	↑ +53.1%
	Mar	32.3 mm	31.3 mm	↓ −3.1%	50.2 [±8.4] mm	53.5 [±6.3] mm	↑ +60.4%	↑ +70.9%
	Apr	40.5 mm	35.5 mm	↓ −12.3%	58.8 [±8.3] mm	58.3 [±6.7] mm	↑ +65.6%	↑ +64.2%

Implications for ice-jams



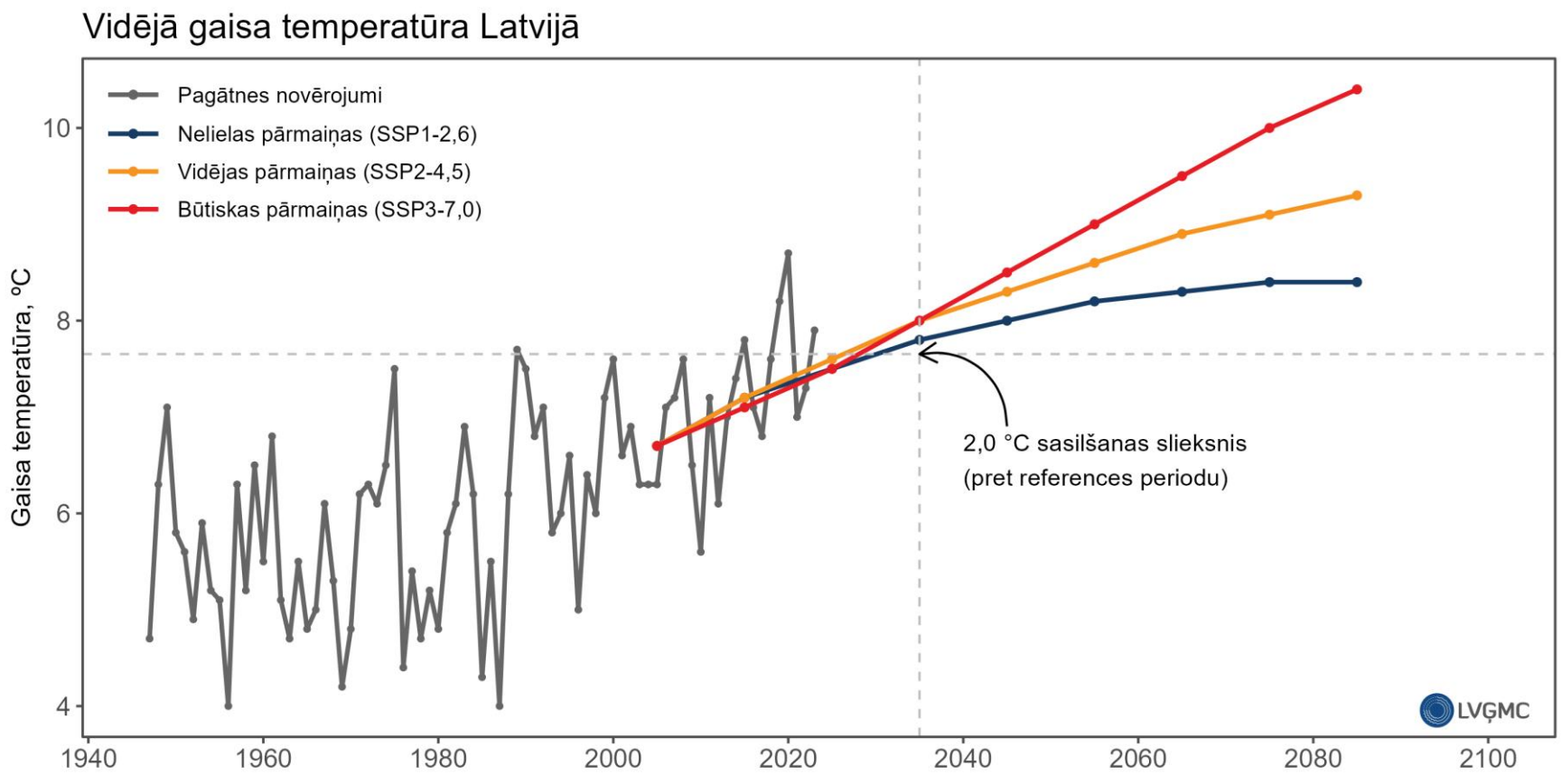
Conclusions

While climate models suggest a long-term warming trend, which on average could decrease ice-jam probability, natural variability will continue to result in occasional colder winters.

In the future precipitation is projected to increase, especially during winter, which could be favourable for ice-jam formation.

The frequency and intensity of extremely cold winters are projected to decline, but we see now already that due to climate change the winter season is less stable, with more fluctuations around 0 °C and therefore more thawing periods

Thank you for your attention!



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