CLIMATE CHANGE AND HOW IT WILL IMPACT ROAD WEATHER

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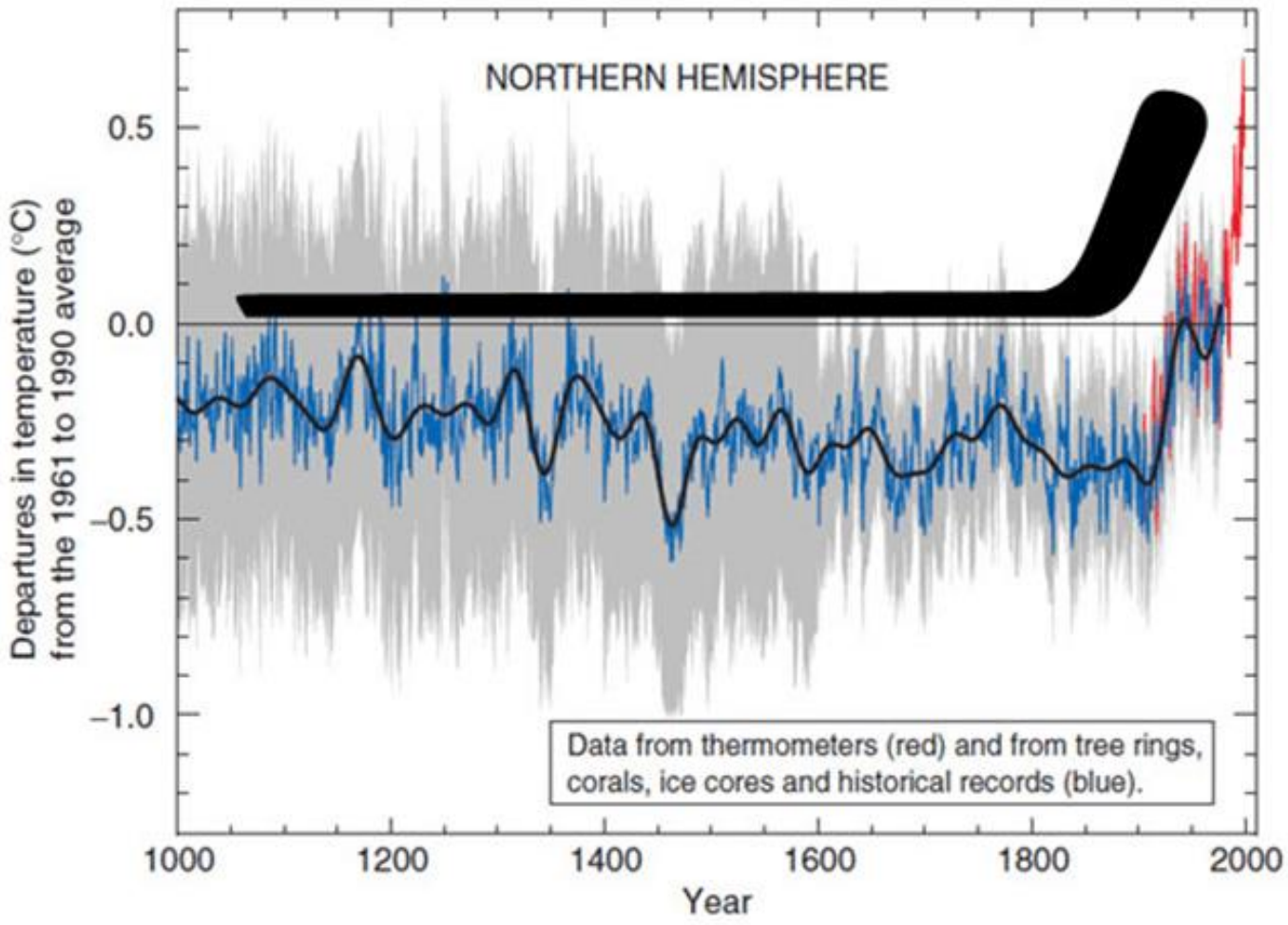
Climate change – the “hot” topic of today

- Climate change mitigation and adaptation. We will focus on adaptation.
- In order to adapt – we need to know what’s coming
- Problem – it is hard to simply describe bad winter road weather conditions
- Most of the graphs and data you will see are from one example – Lithuania. This doesn’t mean that it will be the same situation in your country.

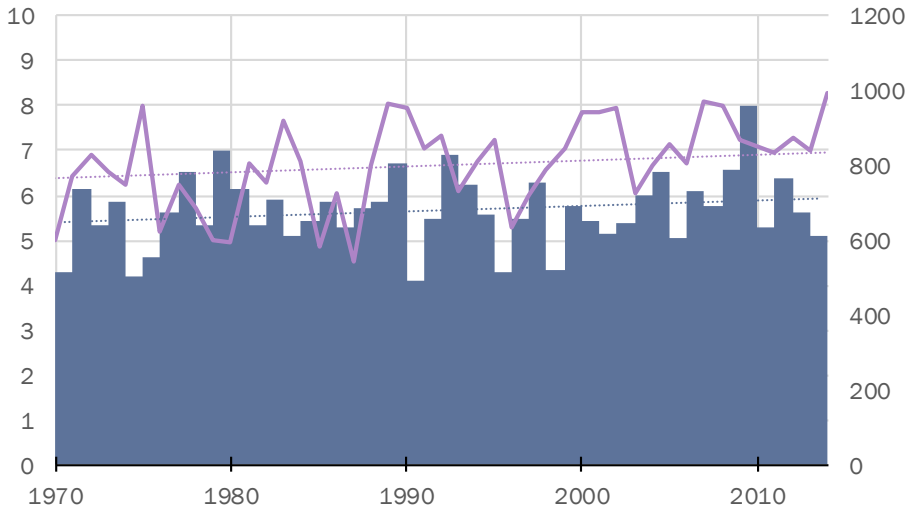
The “hockey stick”

- General facts about global warming:
  - *It is man-induced since 1800s*
  - *Continued emissions will increase the severity of global climate events*
  - *Global temperature is rising →*
  - *Global rate of precipitation anomalies is rising*
  - *Number of extreme events is rising*
  - *etc.*

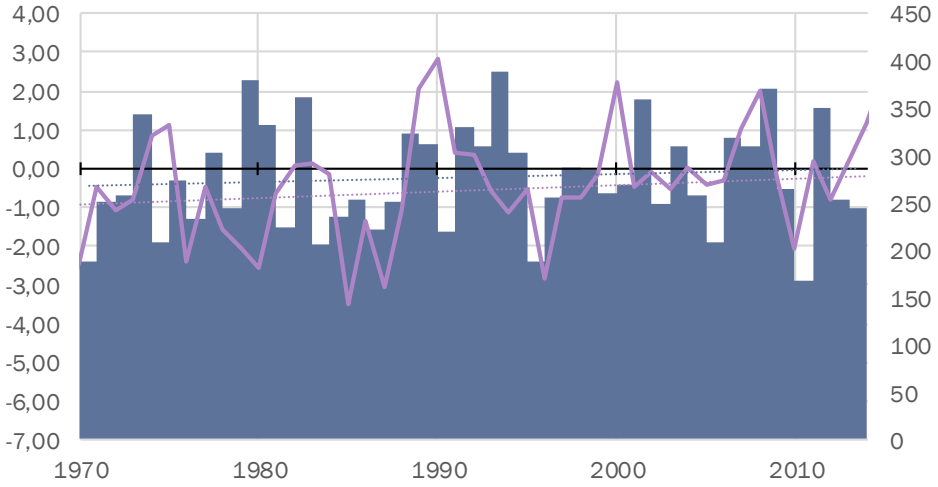


Average temperature and precipitation in Vilnius, Lithuania

Yearly



Winter (Oct-Mar)



What does climate change mean for road users? What do you think?

Go to www.menti.com and enter this code:

60 71 06

You can use either a phone or a different tab in your browser.

What does climate change mean for road users?

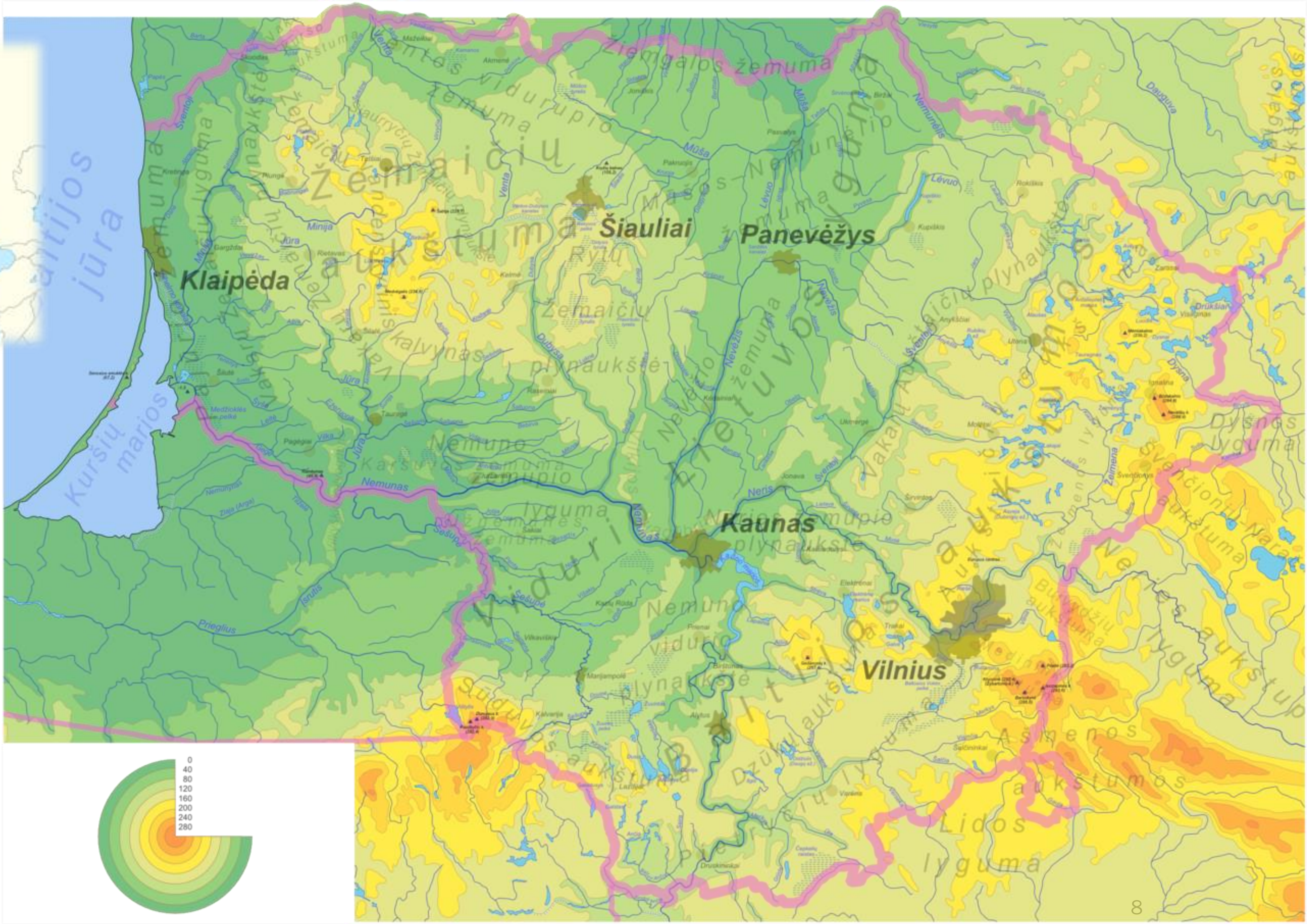
- What we would generally expect?
- Rising temperature:
  - *GOOD – it will be warm*
  - *GOOD – too warm for snow*
  - *GOOD – less costs for winter road maintenance*
- Rising precipitation:
  - *NO IMPACT – since it's warm, there will be less snow*

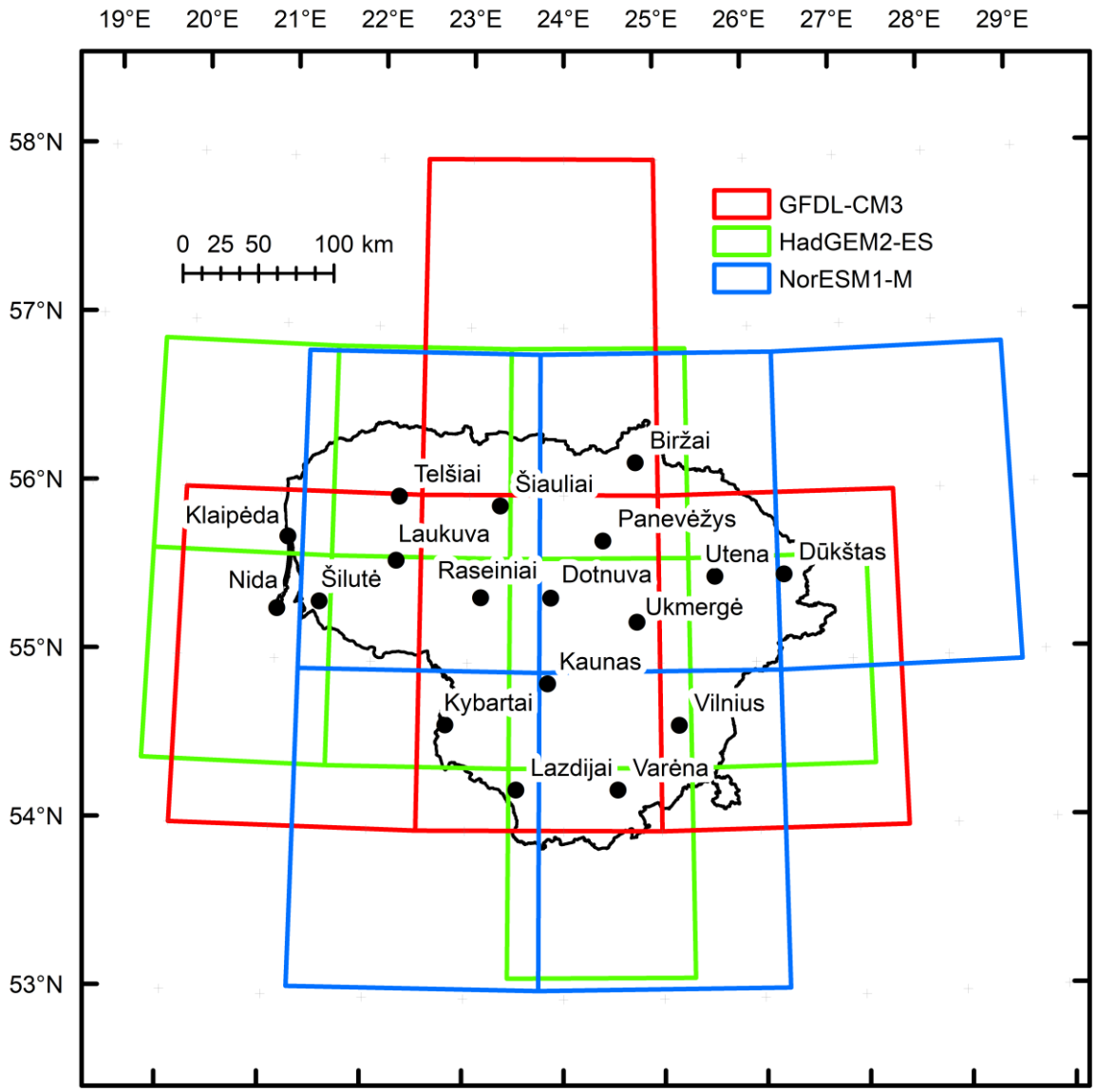
- What if:
  - *Instead of average -5°C we will have 0°C ?*
  - *Instead of a week of +1 cm of snow every day we will have one event with +7 cm?*
- It is difficult to evaluate the impact of climate change to winter road weather using only regular parameters.

LET'S SEE WHAT IS PREDICTED

Lithuania as an example

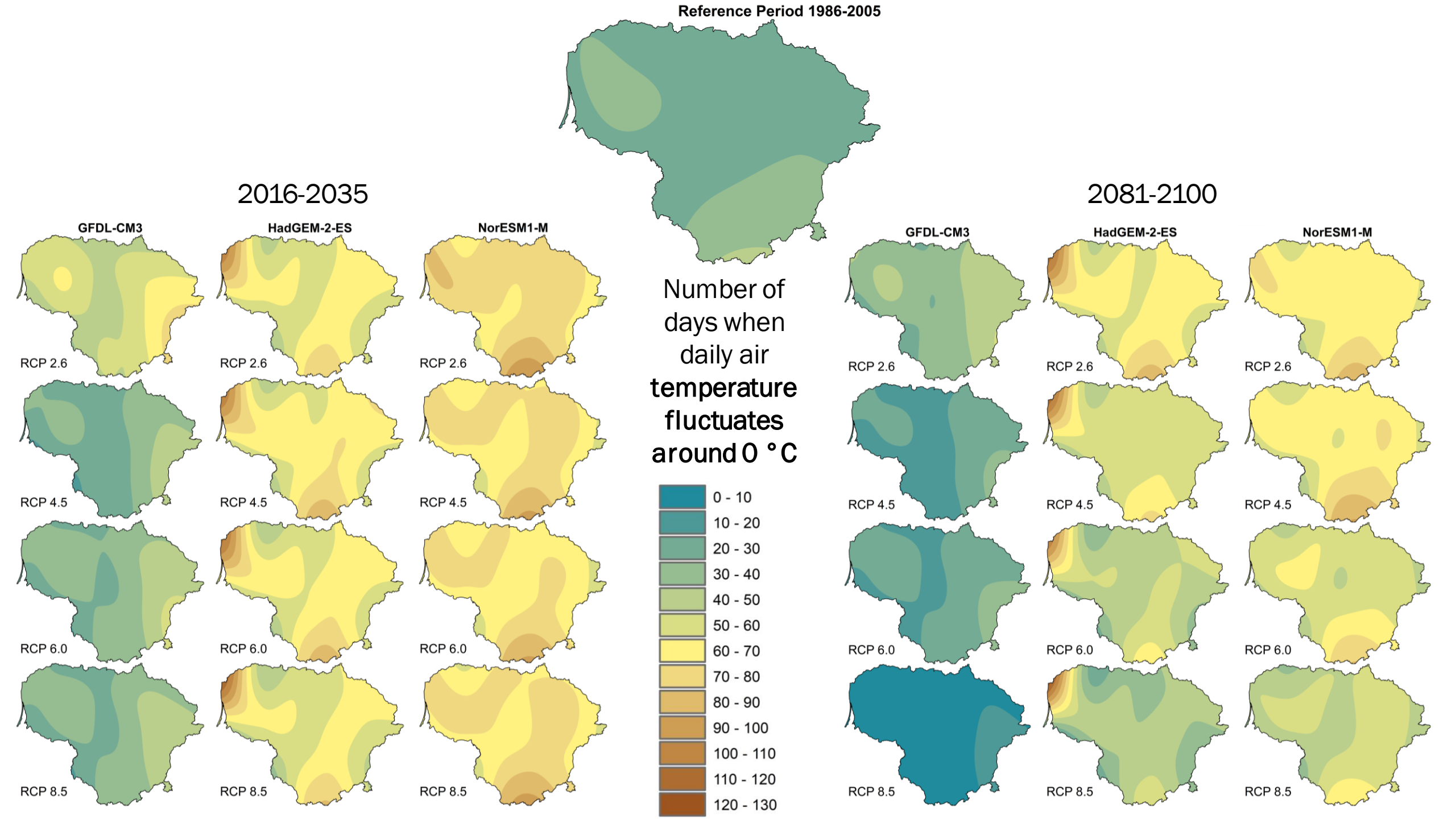
Full paper: https://doi.org/10.1007/s00704-019-02938-1

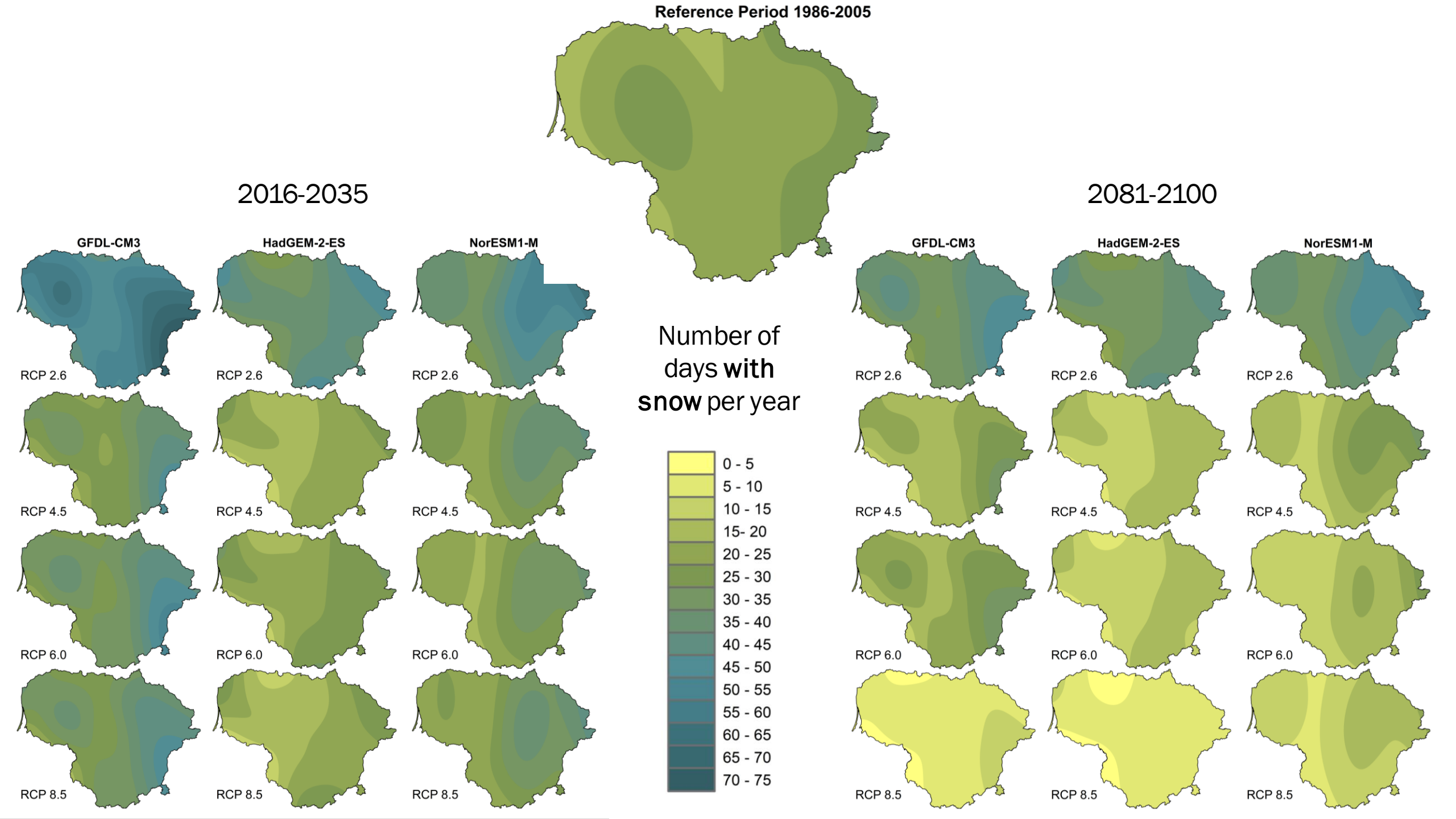

Klaipėda
Šiauliai
Panevėžys
Kaunas
Vilnius
Žemaičių aukštuma
Kuršių marios
Nemunas
0
40
80
120
160
200
240
280

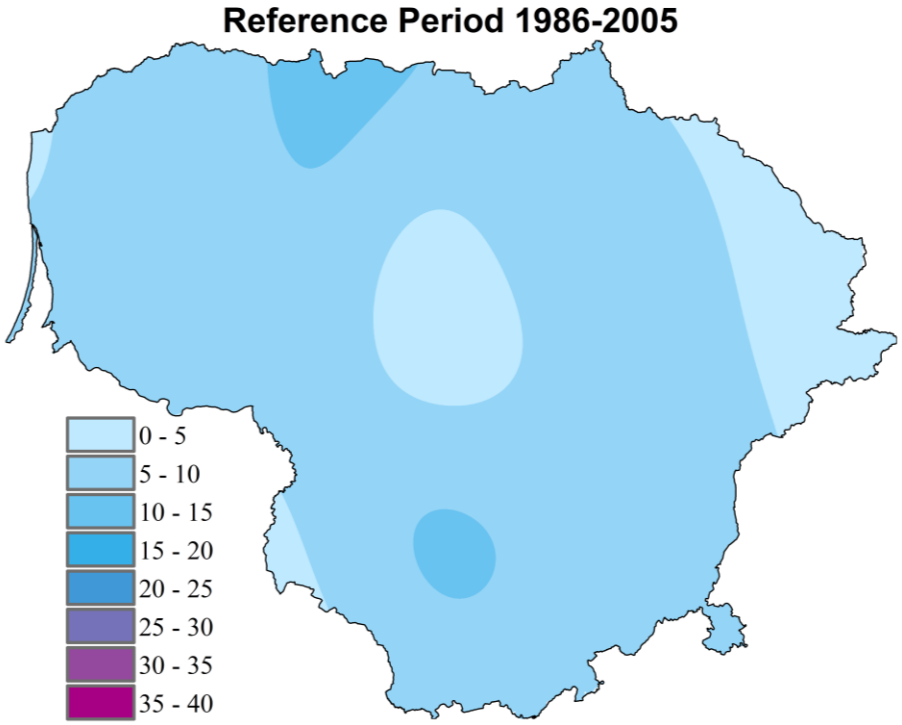


DATA

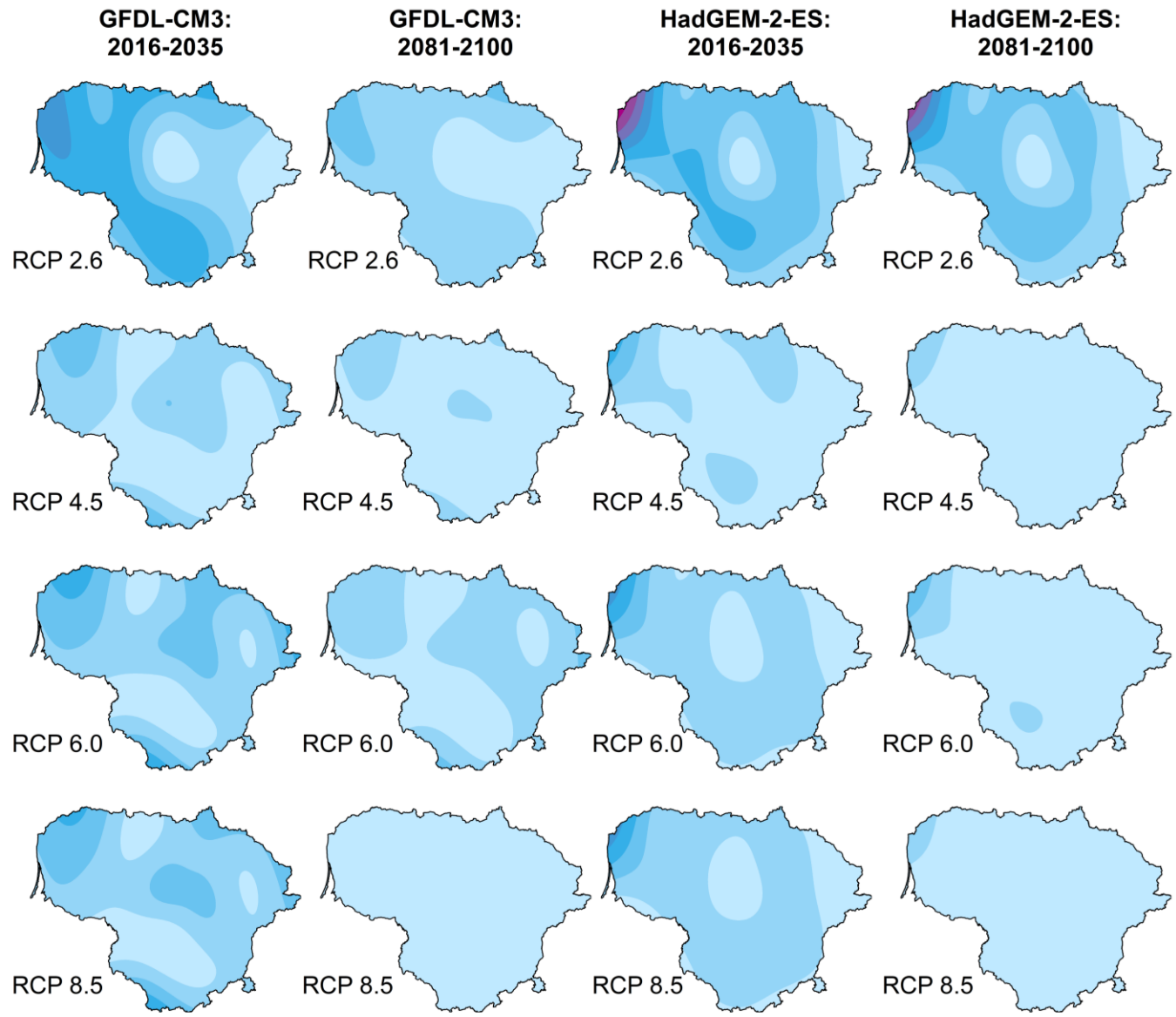
- 18 meteorological stations (data from 1985-2005)
- 3 CMIP5 models:
  - *GFDL-CM3*
  - *NorESM1-M*
  - *HadGEM2-ES*
- 3 time periods:
  - *reference period (1986-2005)*
  - *near-term (2016-2035) projection*
  - *long-term (2081-2100) projection*
- 4 RCPs:
  - *RCP2.6*
  - *RCP4.5*
  - *RCP6.0*
  - *RCP8.5*


Reference Period 1986-2005
2016-2035
2081-2100
GFDL-CM3
HadGEM-2-ES
NorESM1-M
RCP 2.6
RCP 4.5
RCP 6.0
RCP 8.5
Number of days when daily air temperature fluctuates around 0 °C
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
100 - 110
110 - 120
120 - 130


Reference Period 1986-2005
2016-2035
2081-2100
GFDL-CM3
HadGEM-2-ES
NorESM1-M
RCP 2.6
RCP 4.5
RCP 6.0
RCP 8.5
Number of days with snow per year
0 - 5
5 - 10
10 - 15
15- 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75



Number of days with
adverse driving conditions:
High winds, snowfall and
freezing temperature

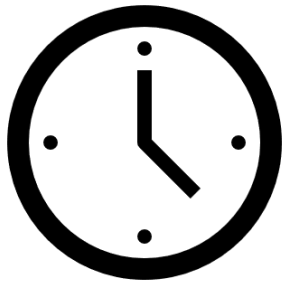


WHAT ARE THE BEST WAYS TO ADAPT?

Education

- Increased awareness and understanding – increased development
  - *Innovation companies should research new ways and technologies*
  - *Maintenance companies should understand that weather patterns will change*
  - *Maintenance companies should strive for rapid technological improvements*
- However, education takes time





New technologies

- Road weather forecasting
- Dynamic route planning and optimization
- Computer/AI controlled gritting
- Etc.

THANK YOU