


The thirteenth session of North Eurasia Climate Outlook Forum (NEACOF-13)

Projection of climate changes in Belarus according to ensemble models

 Helmholtz-Zentrum
Geesthacht
Centre for Materials and Coastal Research



Irina Danilovich, Ph.D.
Senior Researcher
Centre of Climate Research
Institute for Nature Management
National Academy of Science,
Belarus

Beate Geyer, Ph.D.
Institute of Coastal
Research, Helmholtz-
Zentrum-Geesthacht,
Germany

Moscow, November, 14-16, 2017

Consortium EURO-CORDEX

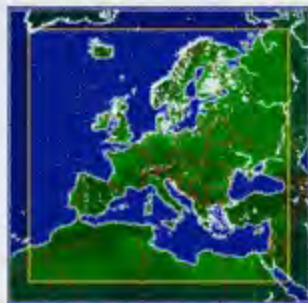
World Climatic Programme

Members

EURO-CORDEX

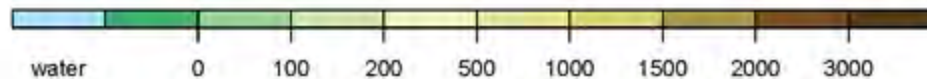
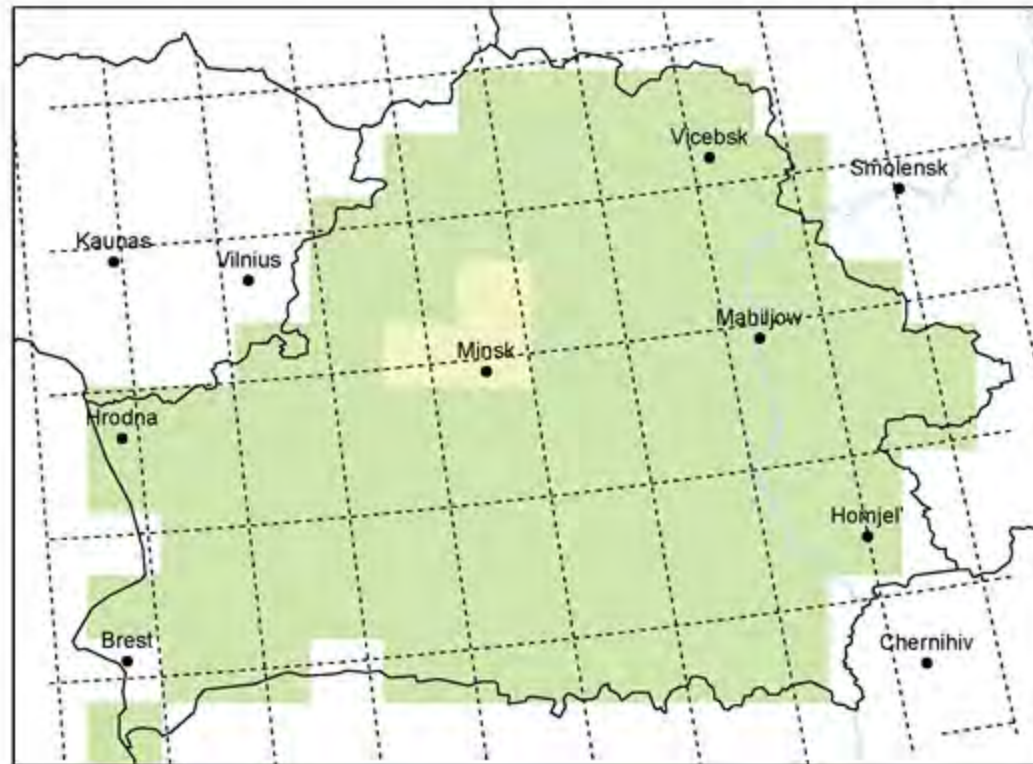
Scenario

Brandenburg Meteorology de
 Thessaloniki Castilla-La
 Netherlands Météo Luxembourg Climate
 Simon CEA/CNRS/UVSQ Research
 Community Department Climat
 Hochschule l'Environnement
 Weather Univerisidad Stuttgart Public
 Maynooth Hungarian Swedish Croatian
 IPSL Dublin Universidad Met Technische
 Luiz Charles CLM Service Hadley
 Physics Mancha Murcia
 Pierre Bonn et Bjerkens des Change
 du DMI Royal ETHZ Graz Insitut
 Aristotle Office Prague Global Laplace
 Wegener German Germany
 Dom Hydrometeorological Laboratoire
 Ireland Cantabria Insituto Czech
 CNRS Hydrological Technology
 Zürich University University France
 Sciences Meteorological
 Danish Center
 National Climatology Center
 Centre Eidgenössische



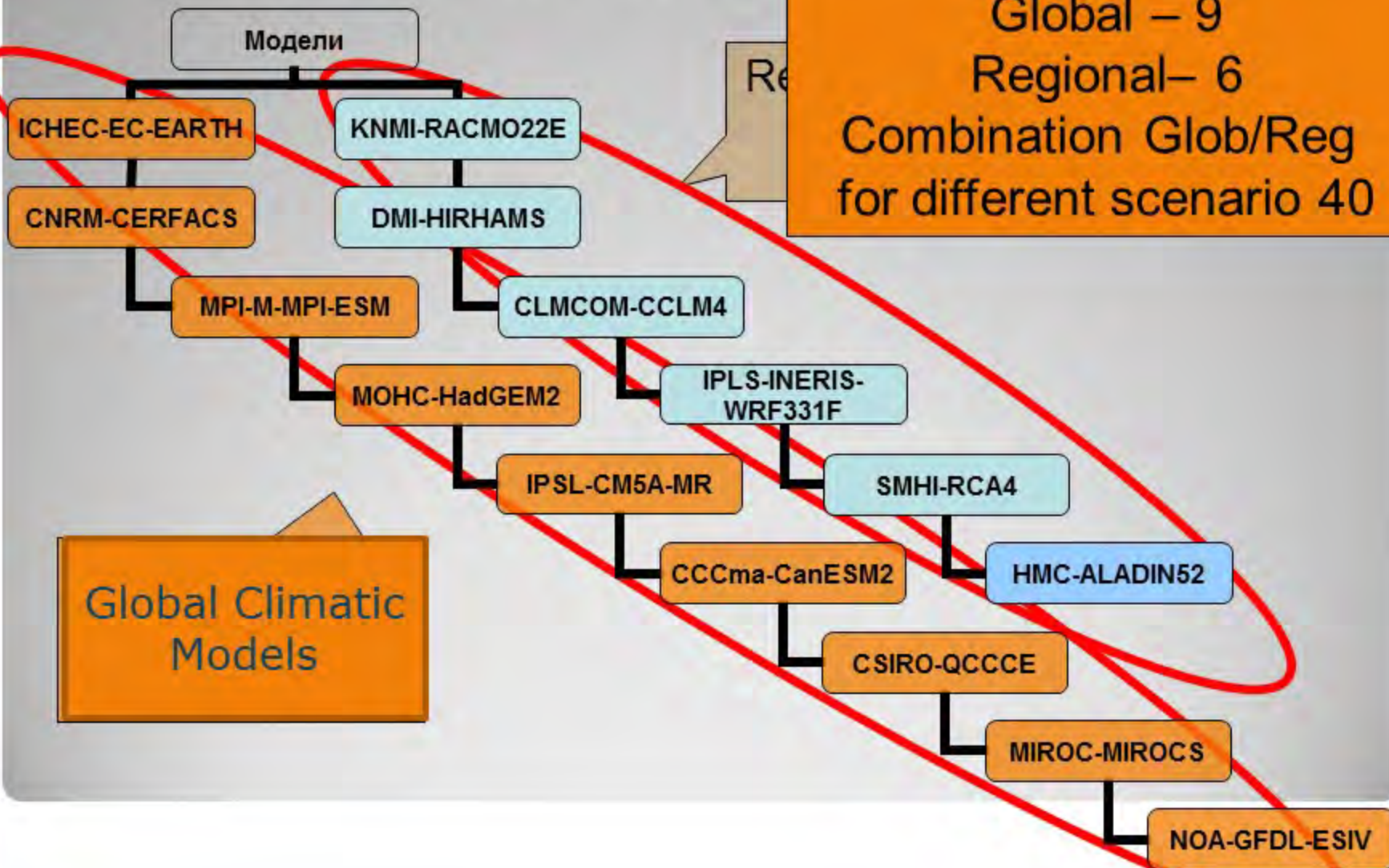
RCP 8.5	Rising radiative forcing pathway leading to 8.5 W/m ² in 2100.
RCP 4.5	Stabilization without overshoot pathway to 4.5 W/m ² at stabilization after 2100
RCP 2.6	Peak in radiative forcing at ~ 2.6 W/m ² before 2100 and decline

Orography and grid structure of the regional simulation of CLMcom of EURO-CORDEX with 0.44° resolution.



geometric height of the earth's surface above sea level (m)

Global and Regional



Methodology

1

Period:

For simulation:
2011-2100

Historical:
1970-2000

2

Data

Air temperature,
precipitation and
climatic indexes

Time interval:

Year and seasons:
winter XII-II, spring III-
V, summer VI-VIII,
autumn IX-XI

3

Statistics:

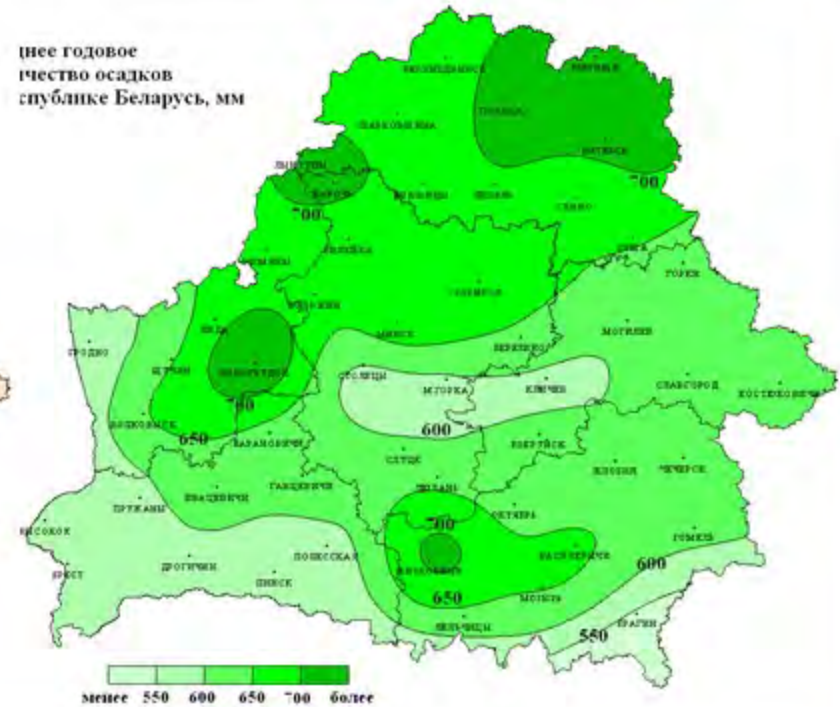
Average
Median
Standart deviation
Max/Min
X-year-mean
Significance (T-test)

Year mean temperature (left) and year sums of precipitation (right) over Belarus

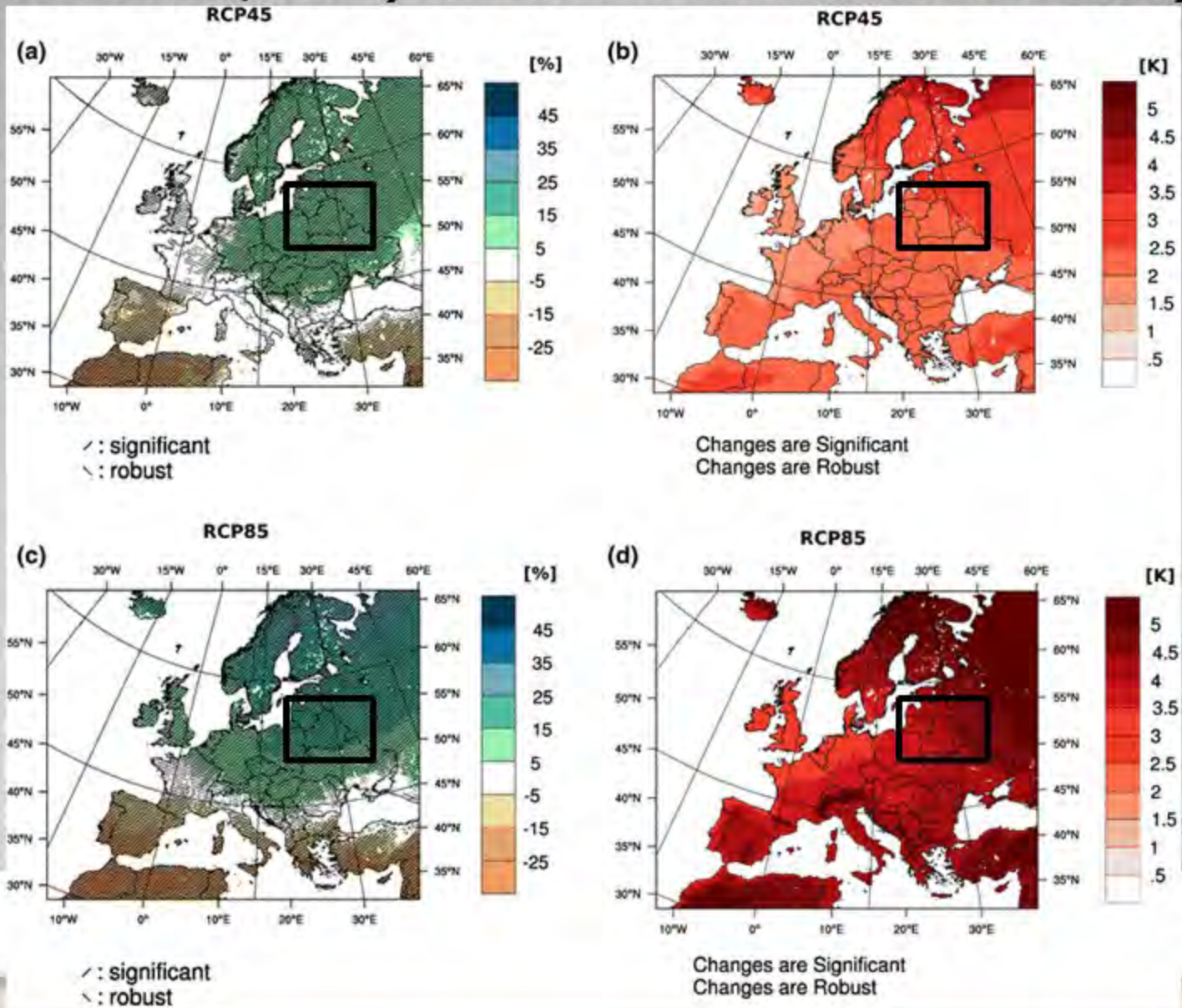
Средняя годовая температура воздуха в Республике Беларусь, °C



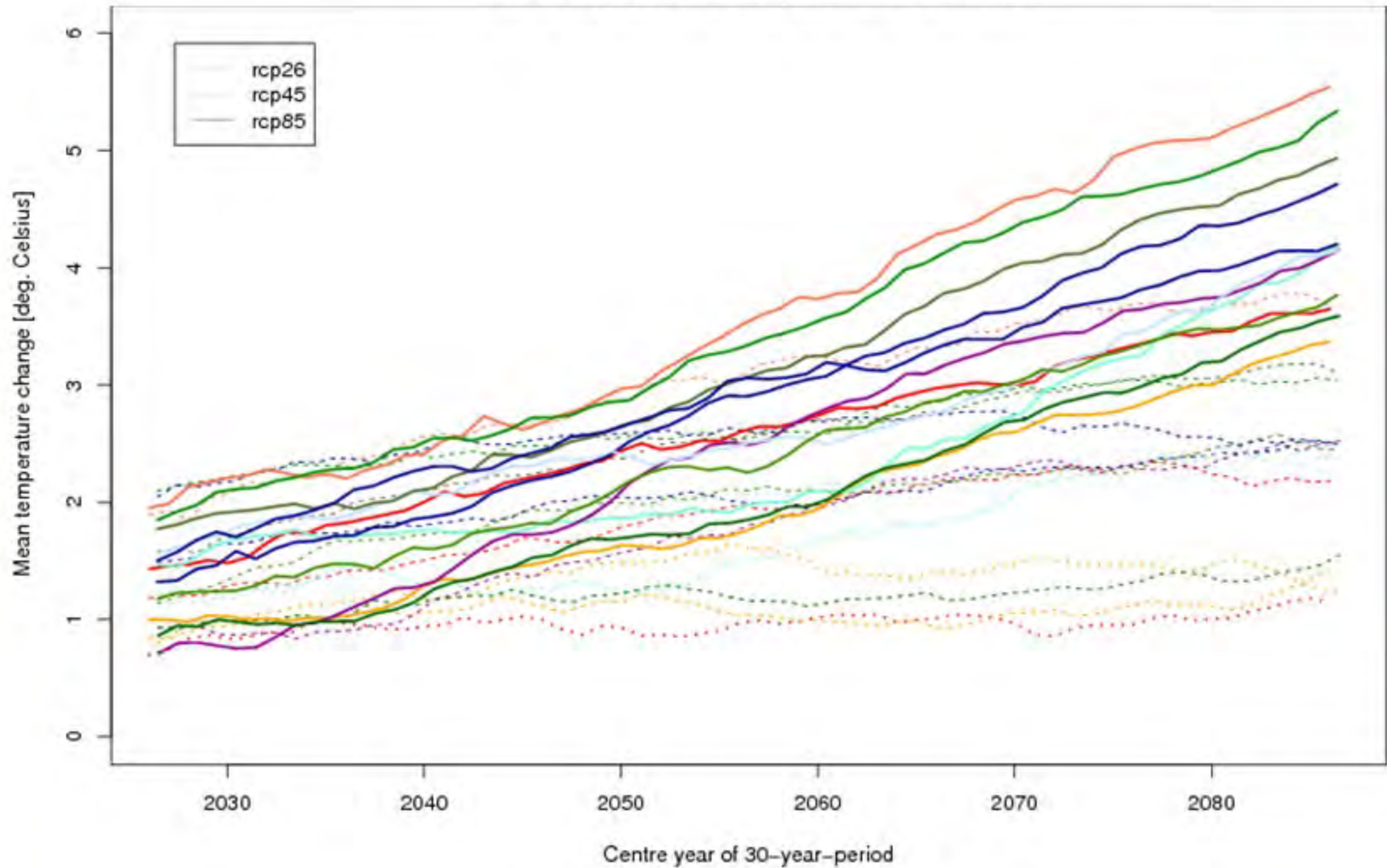
Среднее годовое количество осадков в Республике Беларусь, мм



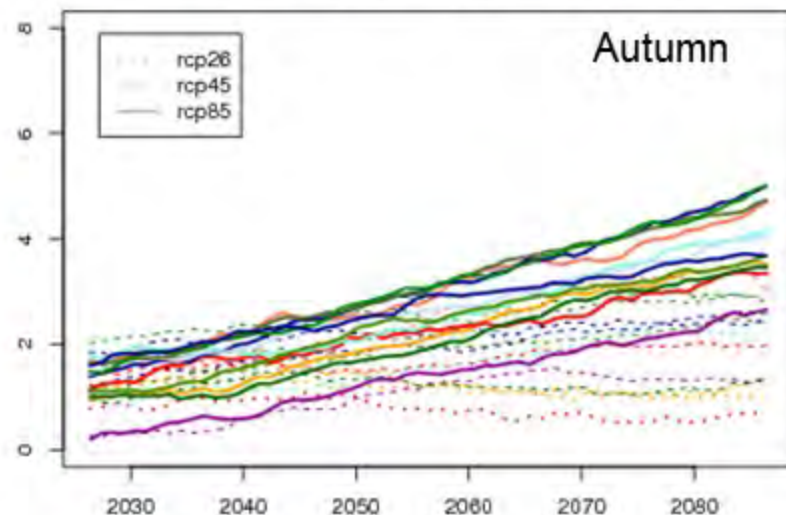
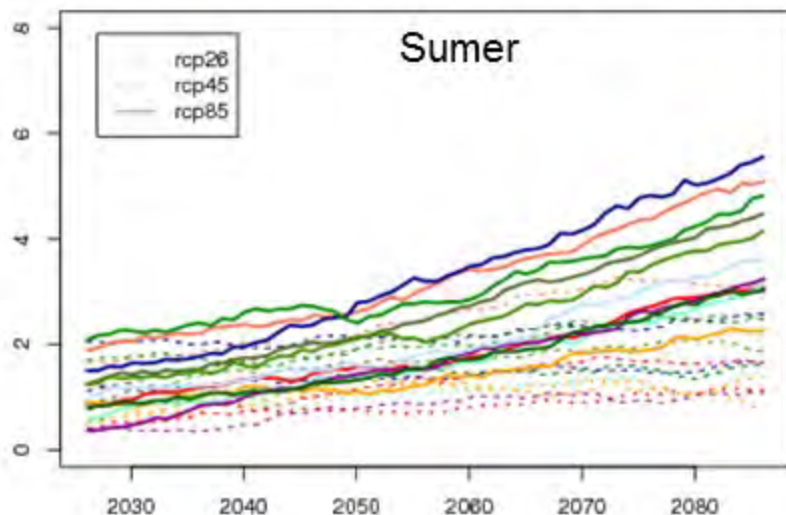
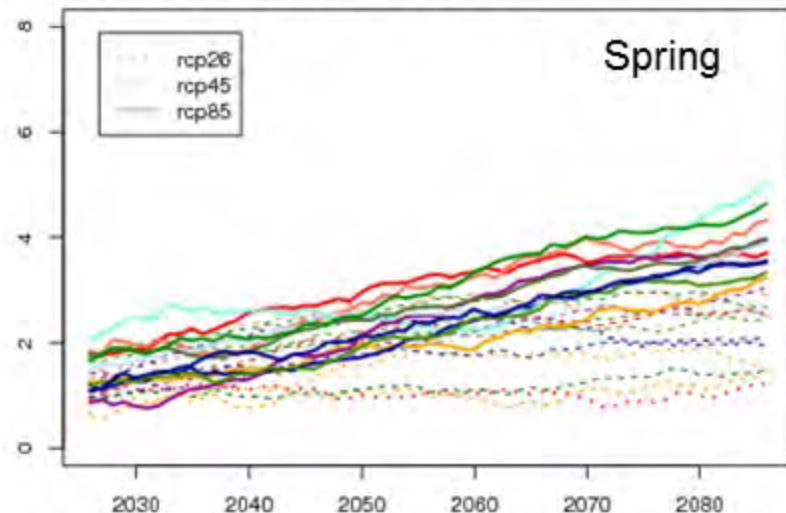
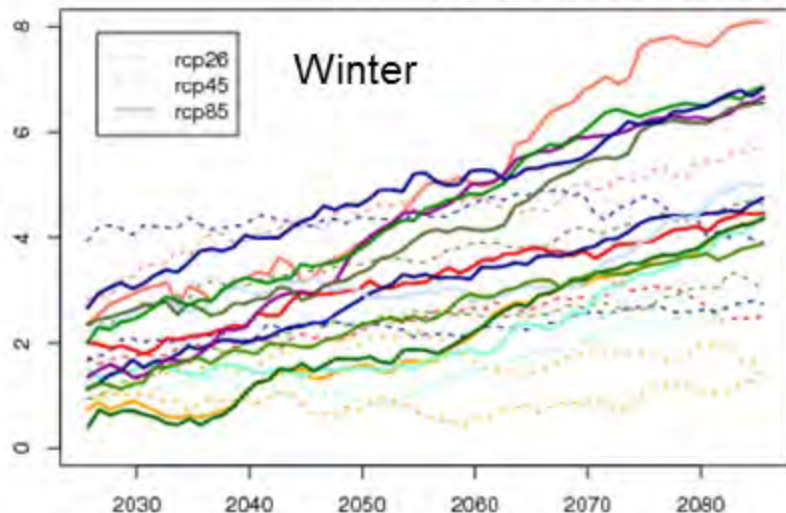
Simulated change of air temperature and precipitation (Jacob D. et al, 2014) for 2011-2100 rr. and 1971-2000)



Change of air temperature 30-year-means compared to the means of 1971-2000

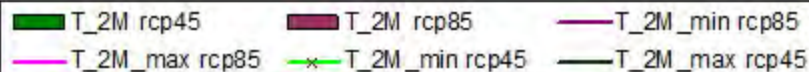
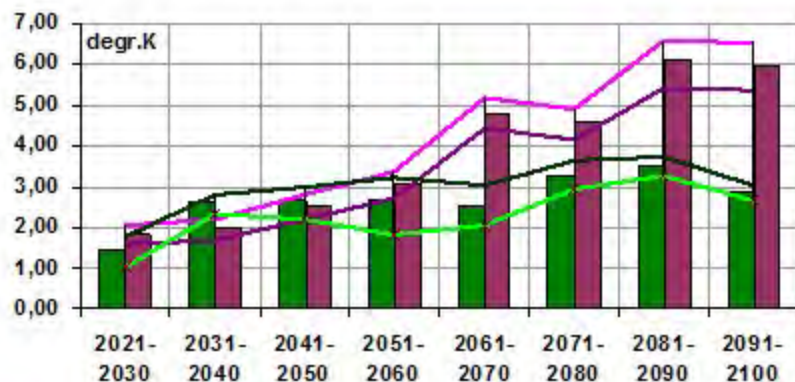


Change of air temperature 30-season-means compared to the means of 1971-2000

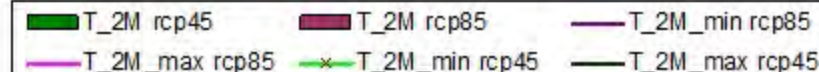
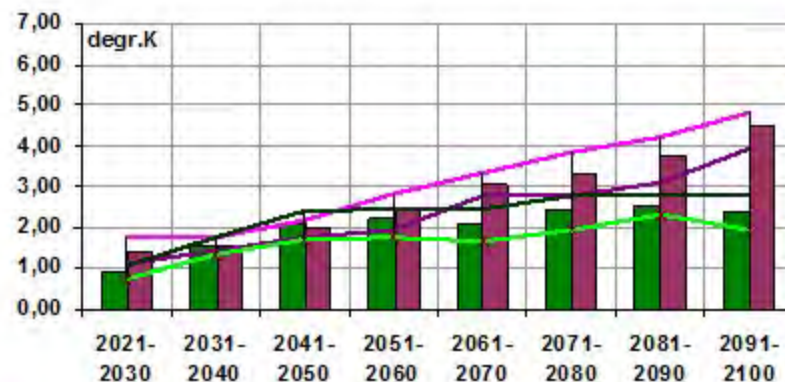


Decadal air temperature deviations by models ensemble

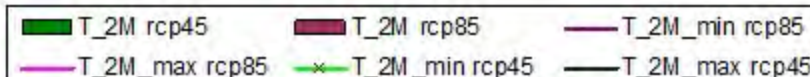
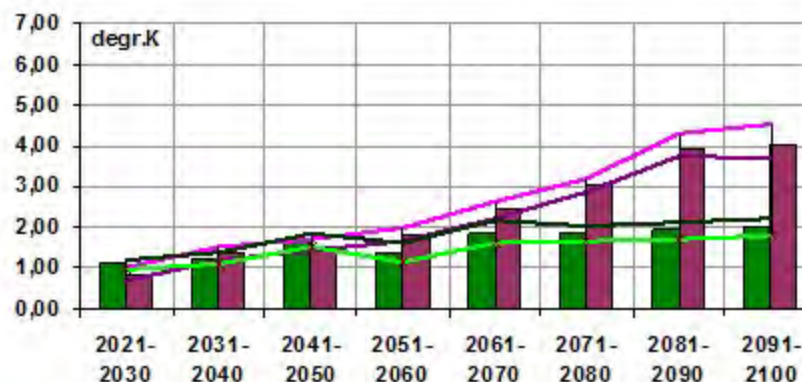
Winter



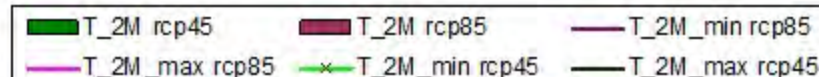
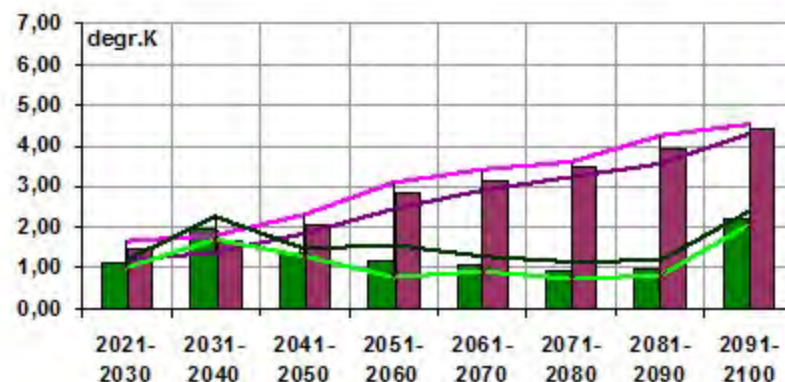
Spring



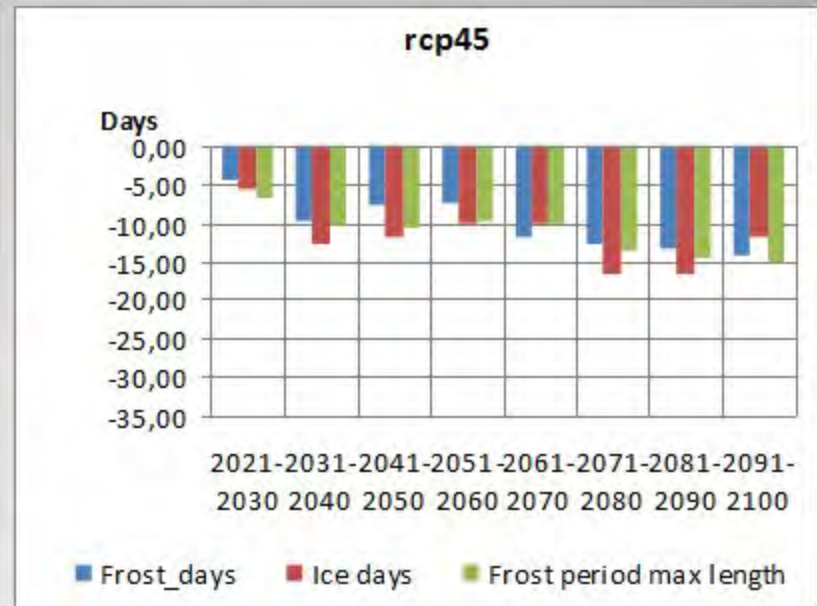
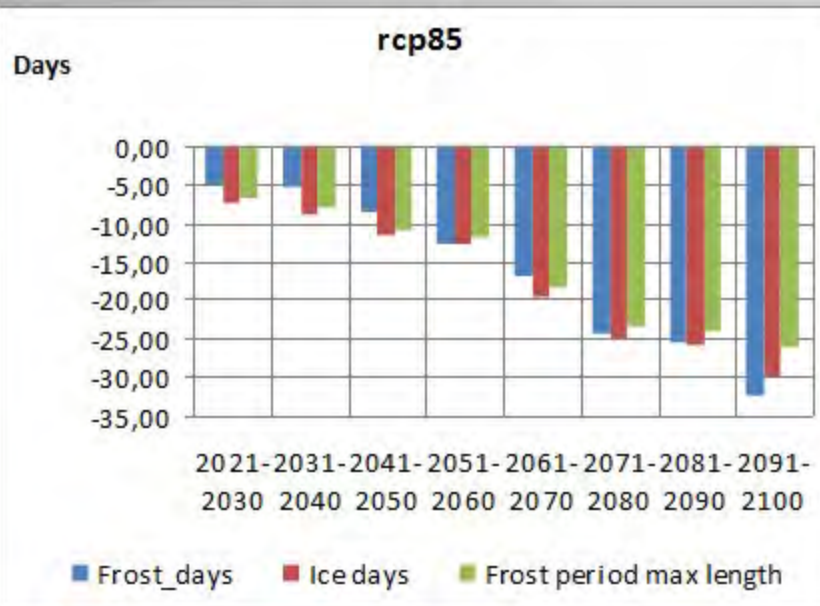
Summer



Autumn

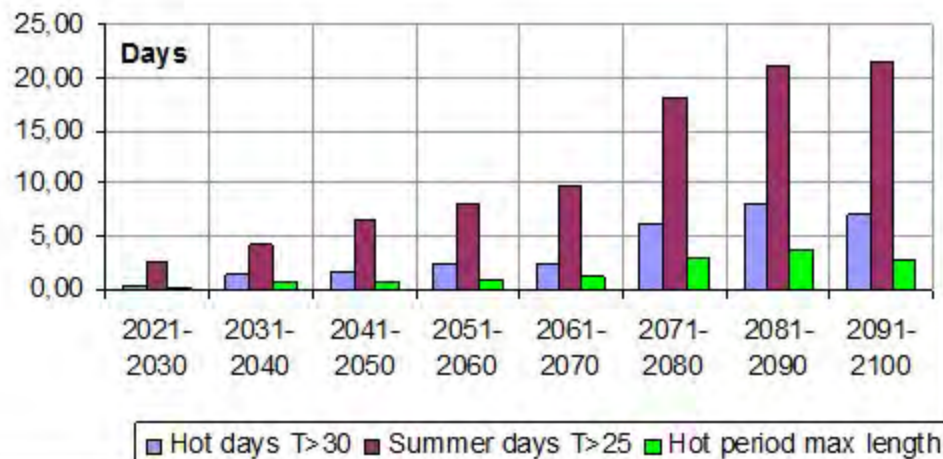


Decadal air temperature indexes

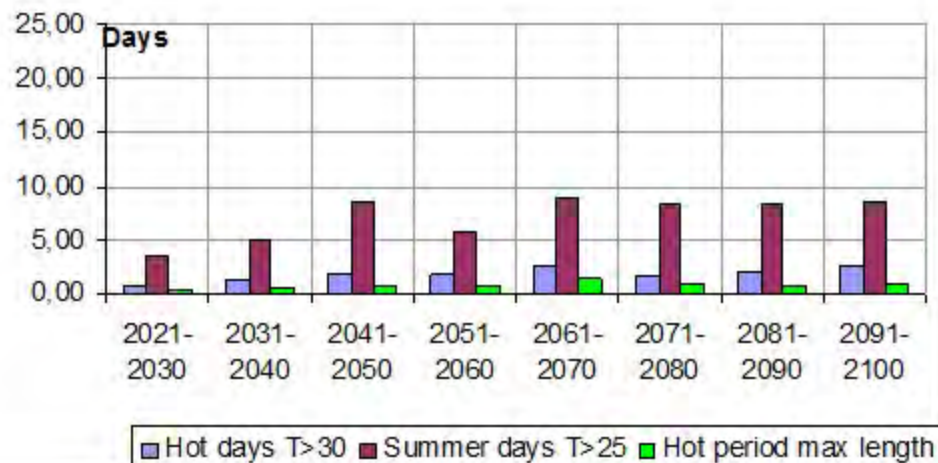


Decadal air temperature indexes

rcp85



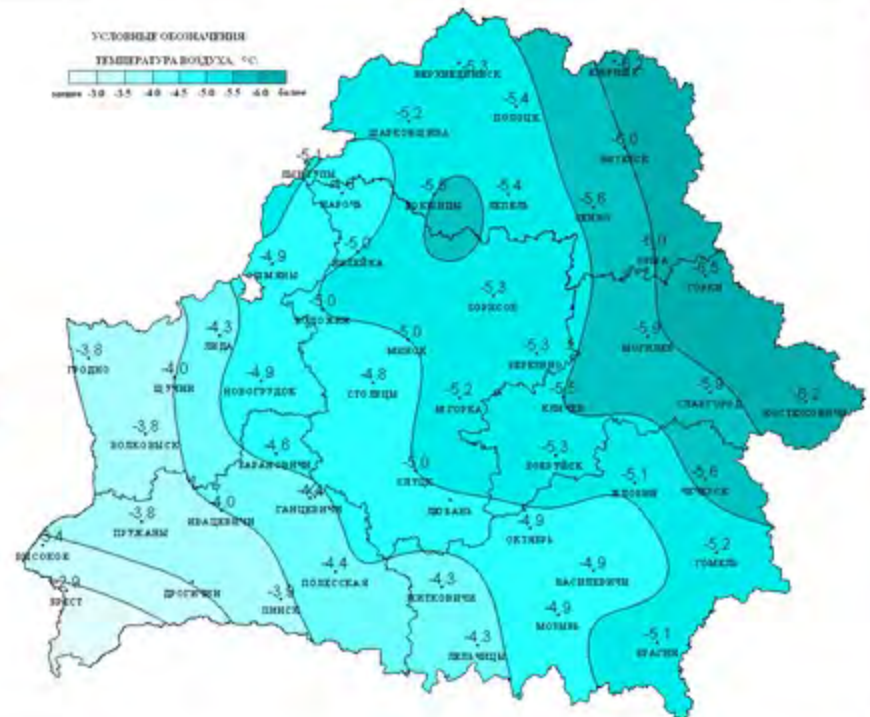
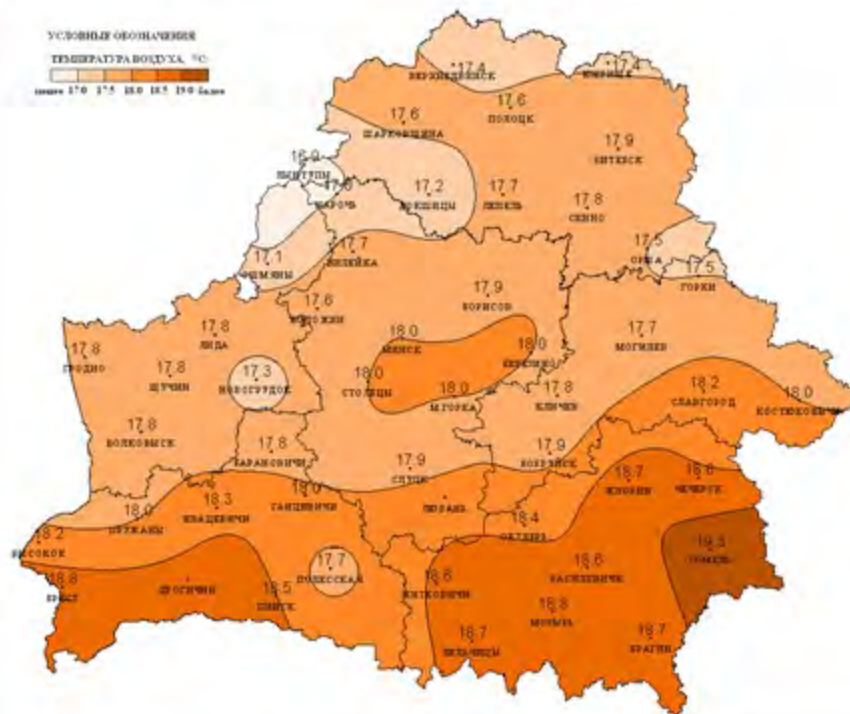
rcp45



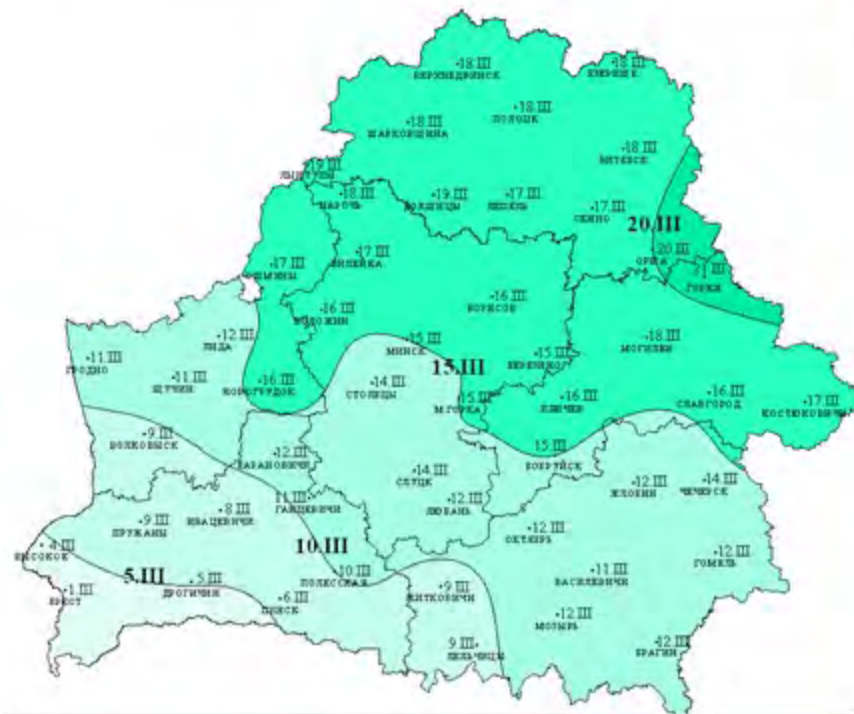
**Climatic indices over territory of Belarus
according to air temperature
(numbers in bold are statistically significant, $p < 0,05$).**

Climate index	2071–2100	
	RCP4.5	RCP8.5
Tmax	2	4
Tmin	3	5
Summer days change	9	24
Hot days change	2	8
Hot periods change	0	0
Tropical nights	1	5
Frost days change	-41	-69
Ice days change	-26	-43
Last frost days in spring	-16	-25
Green beginning change	-15	-29
Vegetation begin change	0.2-	0.2-
Vegetation period length	25	56

Tmax (left) and Tmin (right) monthly temperature over Belarus

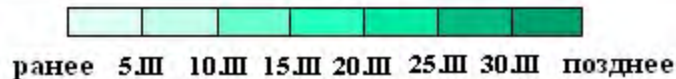


Last frost days in spring over Belarus



Since instrumental observation start
1881-1990

Since climate warming 1989-2009




Green season start over Belarus



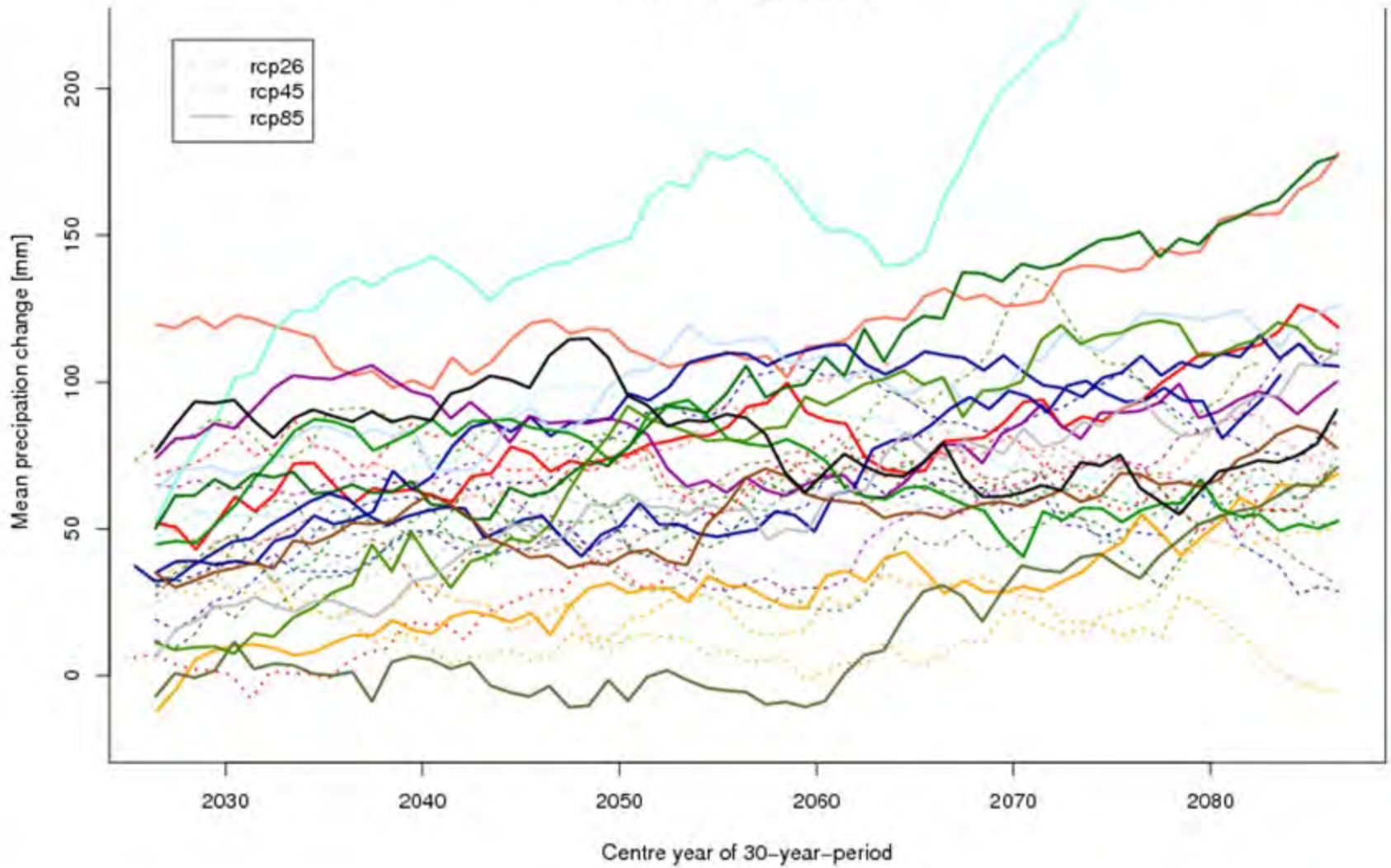
Since instrumental observation start
1881–1990

Since climate warming 1989–2009

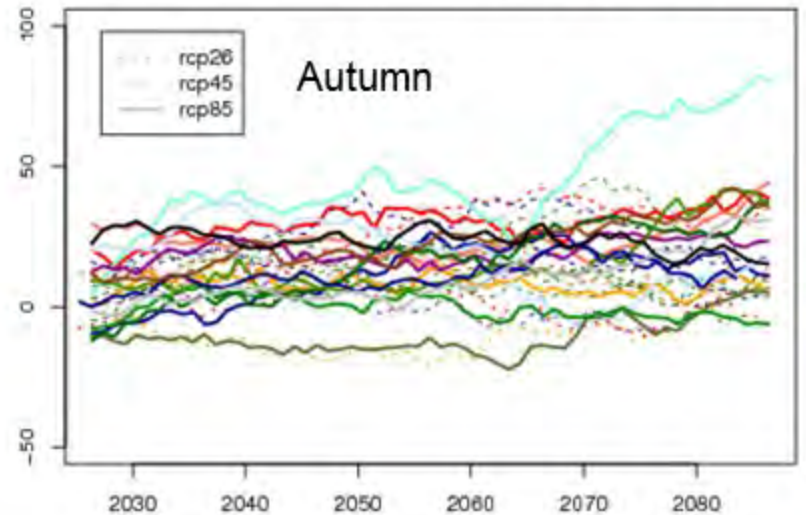
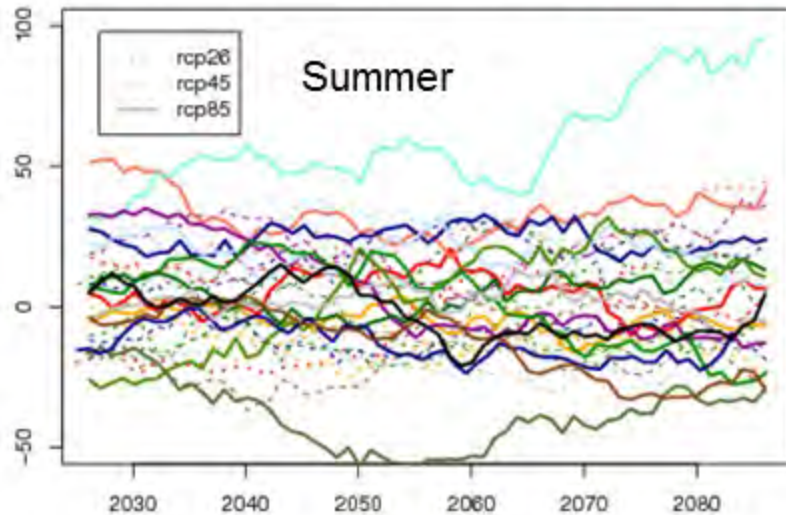
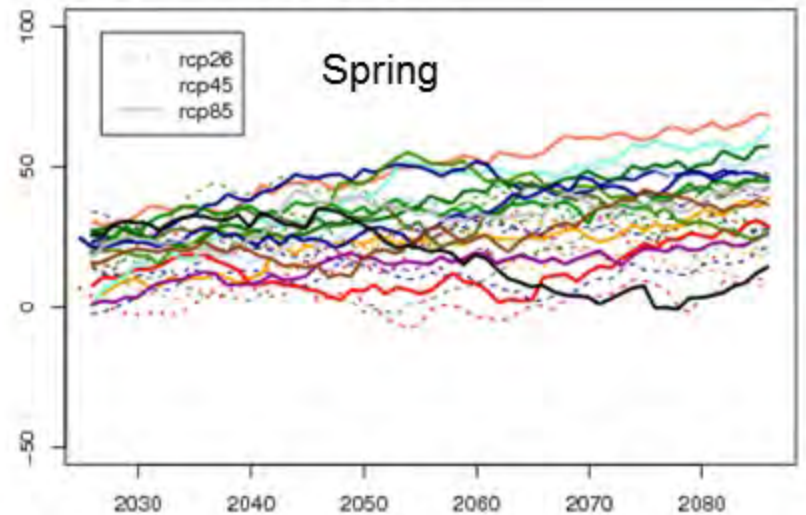
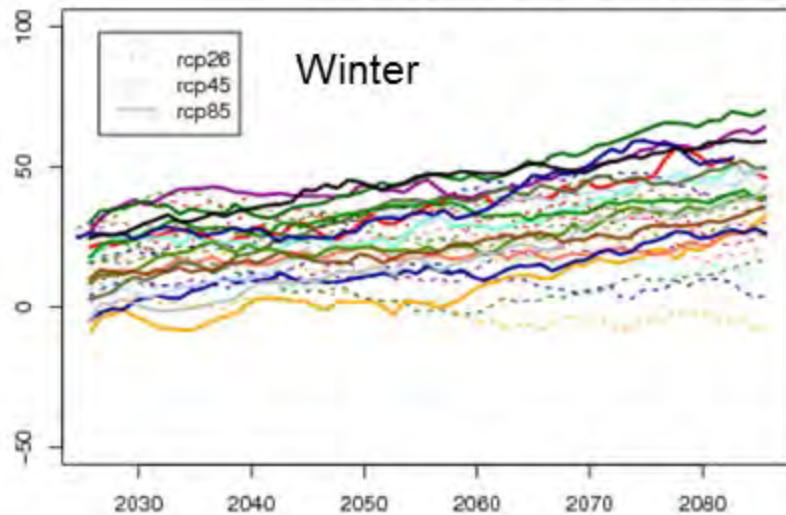


 ранее 1.IV 5.IV 10.IV 15.IV позднее

Change of precipitation 30-year-sums compared to the sums of 1971-2000

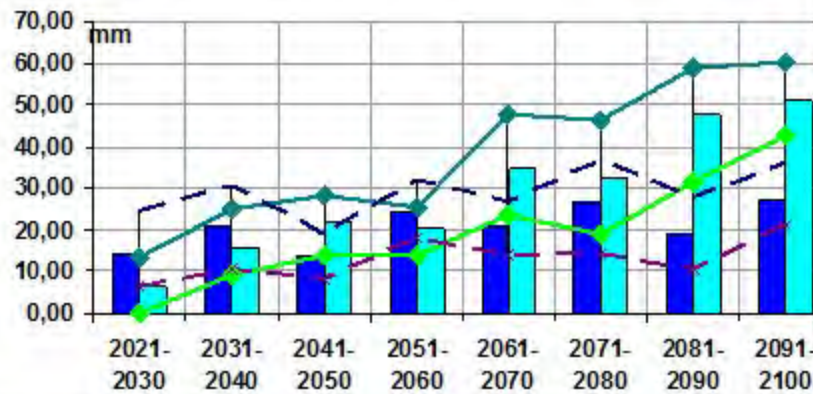


Change of precipitation 30-season-sums compared to the sums of 1971-2000

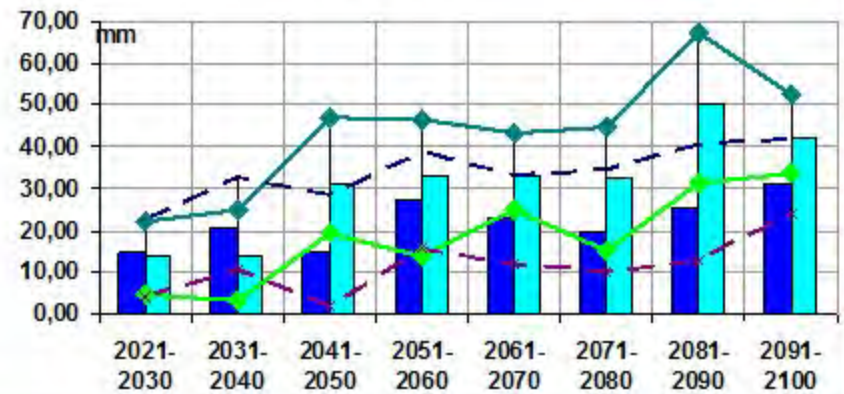


Decadal precipitation sums deviations by models ensemble

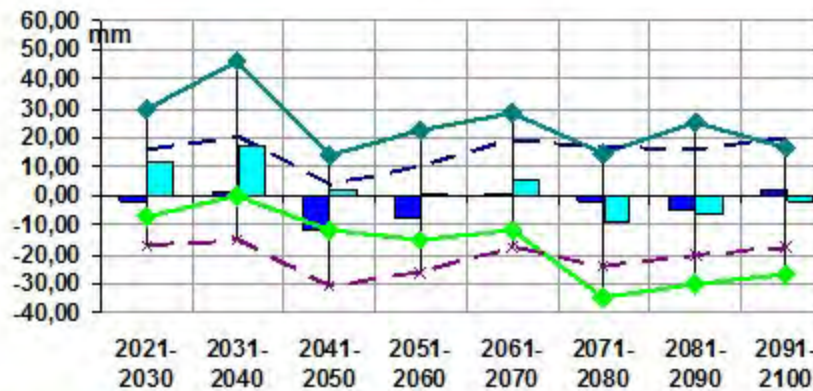
Winter



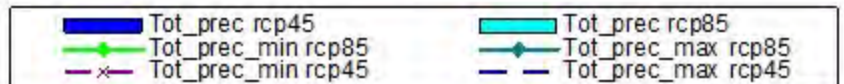
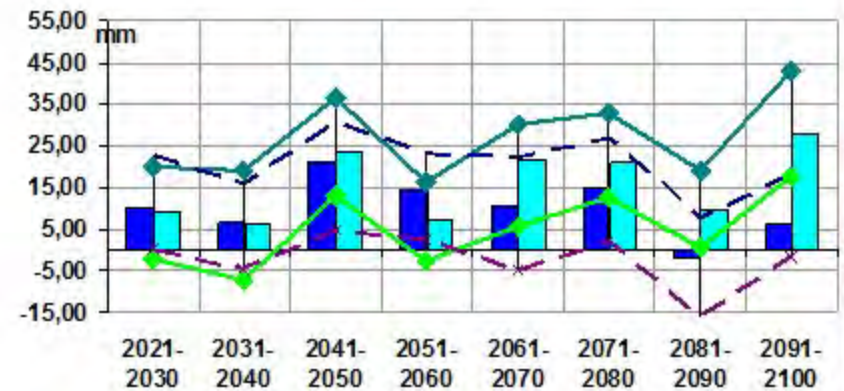
Spring



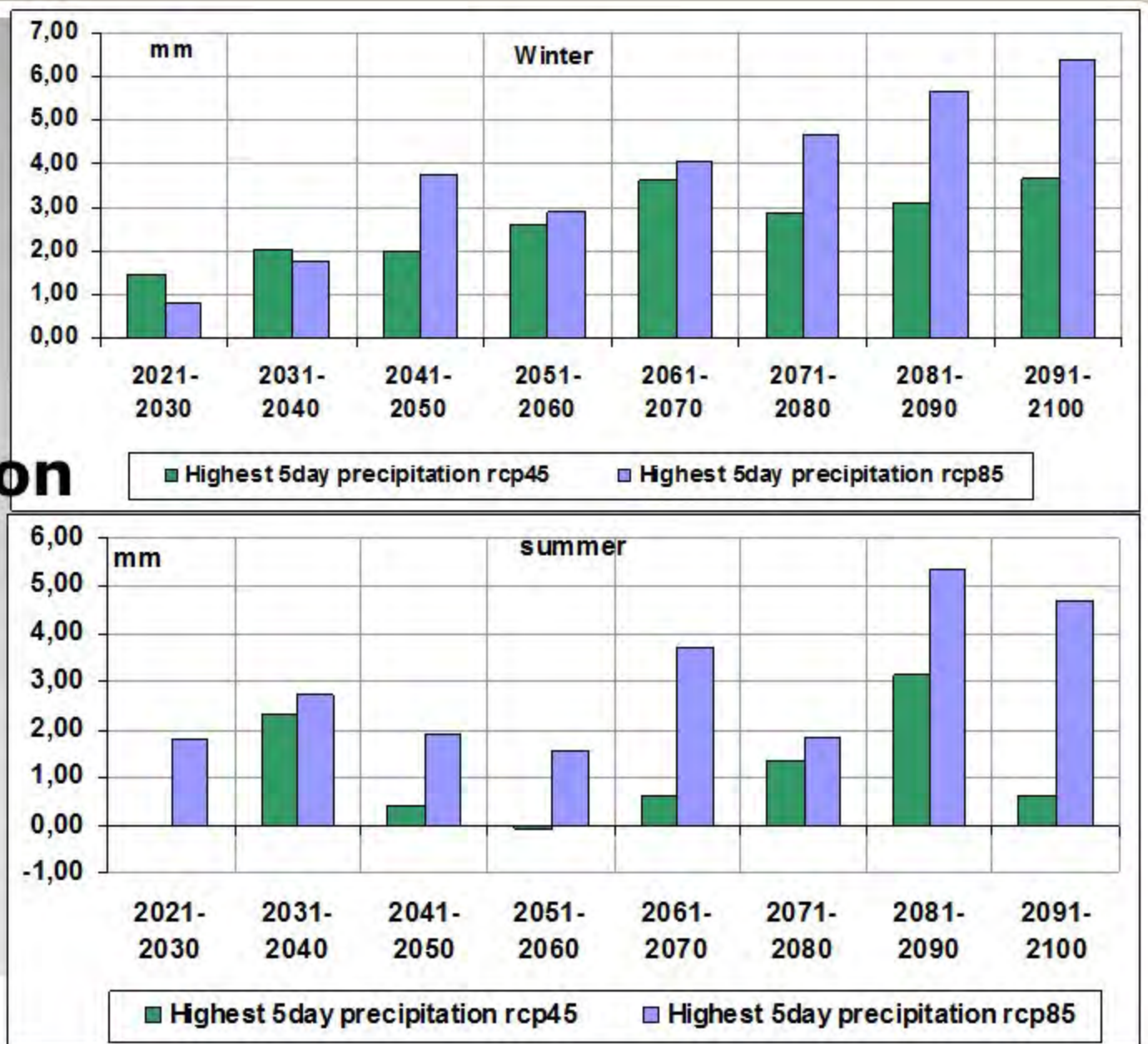
Summer



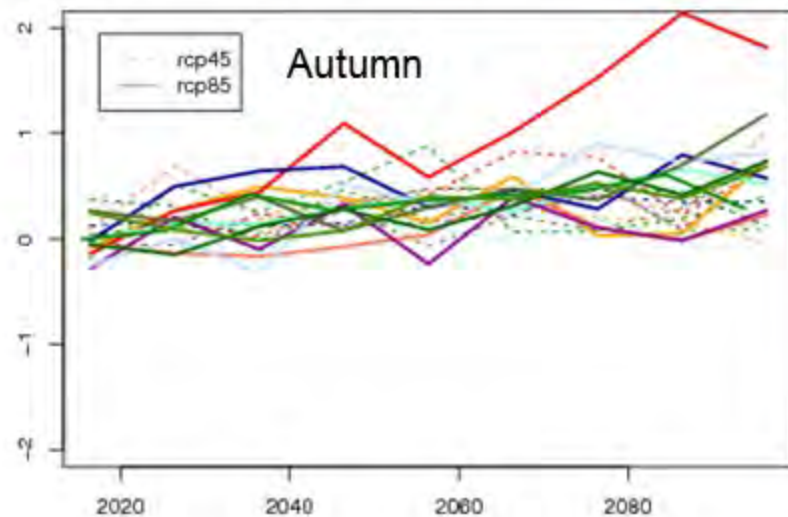
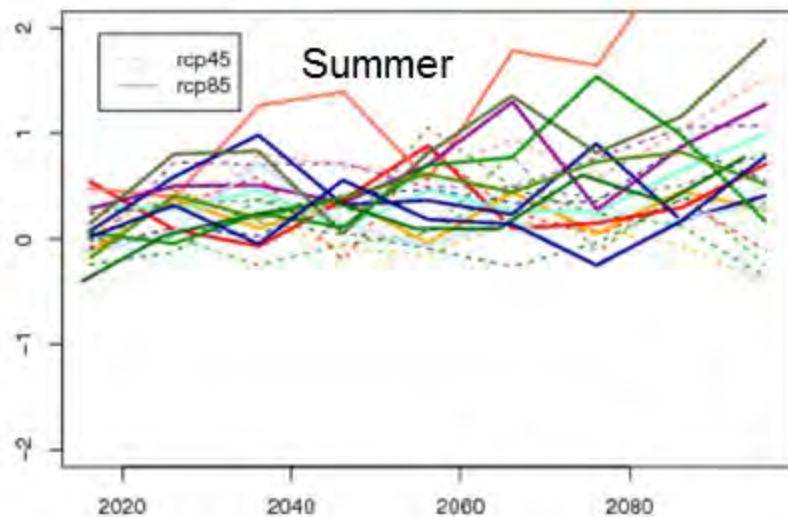
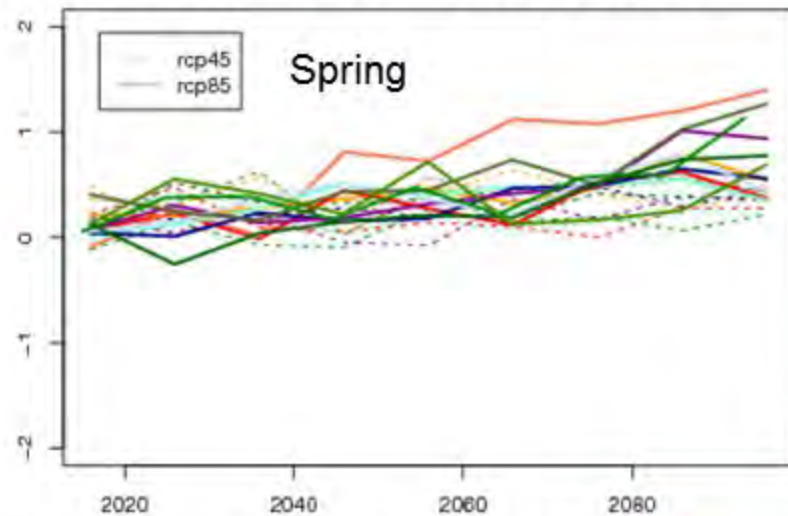
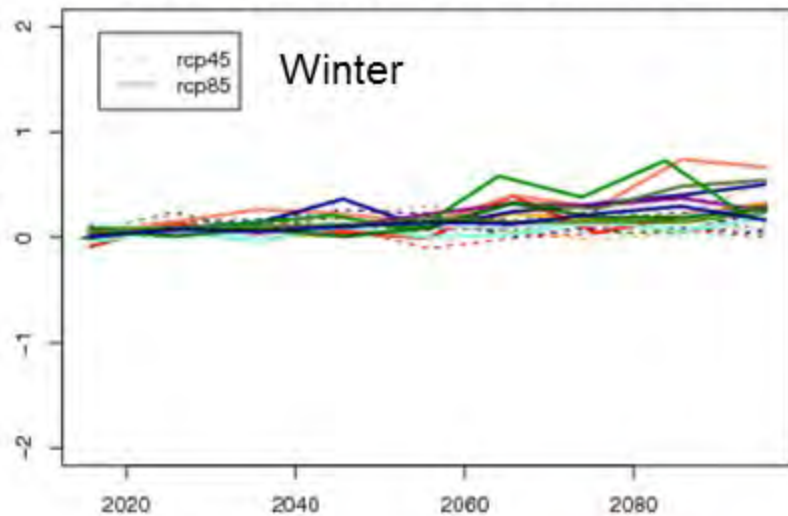
Autumn



Decadal precipitation indexes



Change of precipitation heavy days 30-season-sums compared to the mean seasonal sums of 1971-2000



**Climatic indexes over territory of Belarus
according to precipitation
(numbers in bold are statistically significant, $p < 0,05$)**

Climatic index	2071–2100		
	RCP2.6	RCP4.5	RCP8.5
Dry periods	0	0	0.1
Number of 5 days periods over change	0	0	0
Number of 5 days periods over change	0	0	0
Precipitation days change	3	-2	-6
Precipitation wet days change	3	0	0
Wet period change	0.6	1	2
Precipitation intense days change	2	4	6
Total precipitation 5 days 95% change	2	4	5
Highest 5 days precipitation	2	5	9

Thank you for attention!