



JULY 05-11, 2018, TOMSK, RUSSIA
INTERNATIONAL CONFERENCE
and Early Career Scientists School on Environmental Observations,
Modeling and Information Systems

Atmospheric precipitation and their anomalies in West Siberia against the background of global climate change

¹*Kharyutkina E.V., ^{1,2}Martynova Yu.V., ¹Loginov S.V.*

¹Institute of monitoring of climatic and ecological systems SB RAS
634055, Tomsk, 10/3 Academicheskoy ave., e-mail: kh_ev@imces.ru

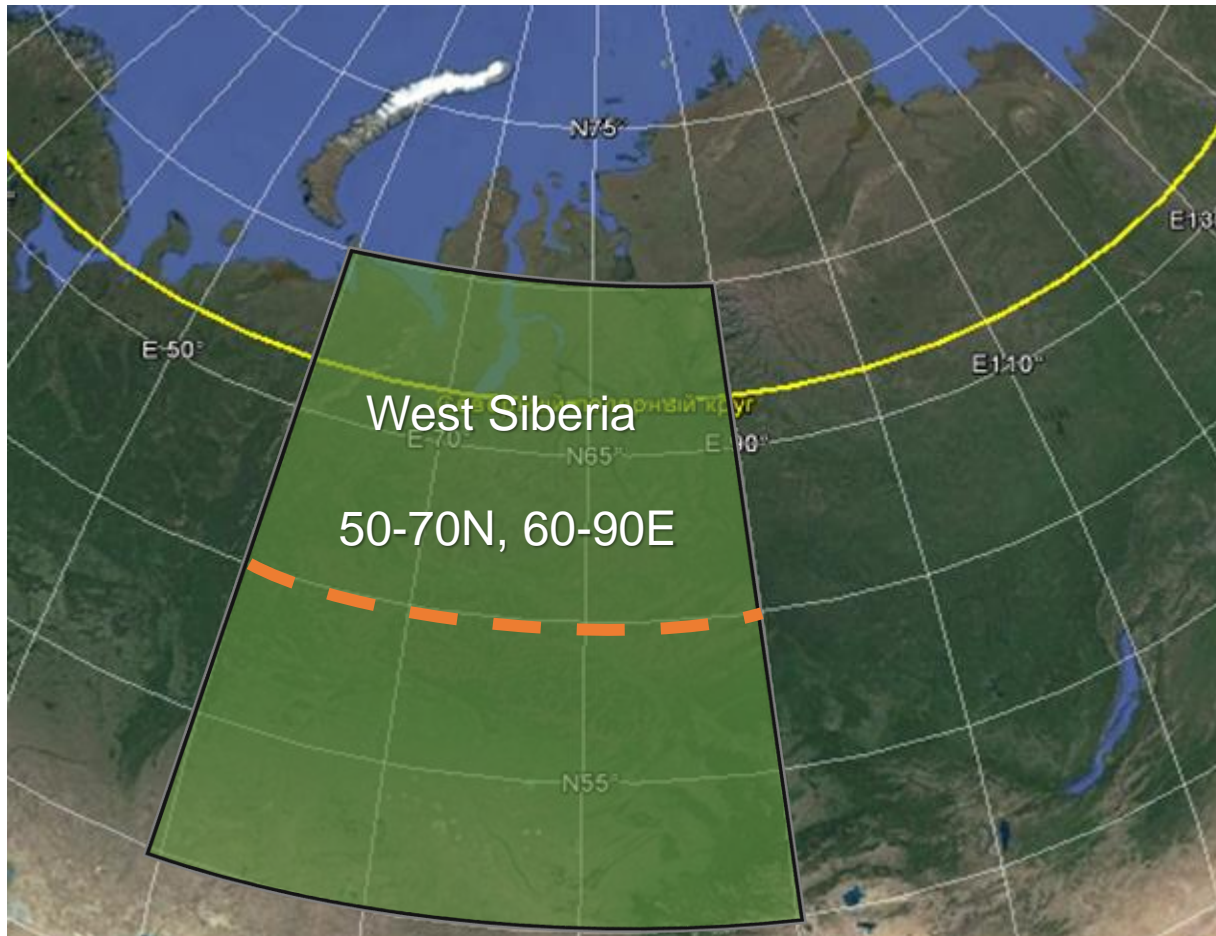
²Siberian research hydrometeorological institute of Roshydromet,
630099, Novosibirsk, Sovetskaya str., 30.



Main goal

estimation of spatio-temporal variability of atmospheric precipitation characteristics in West Siberia at the end of XX – at the beginning of XXI centuries using mathematical modelling methods

Region of under study



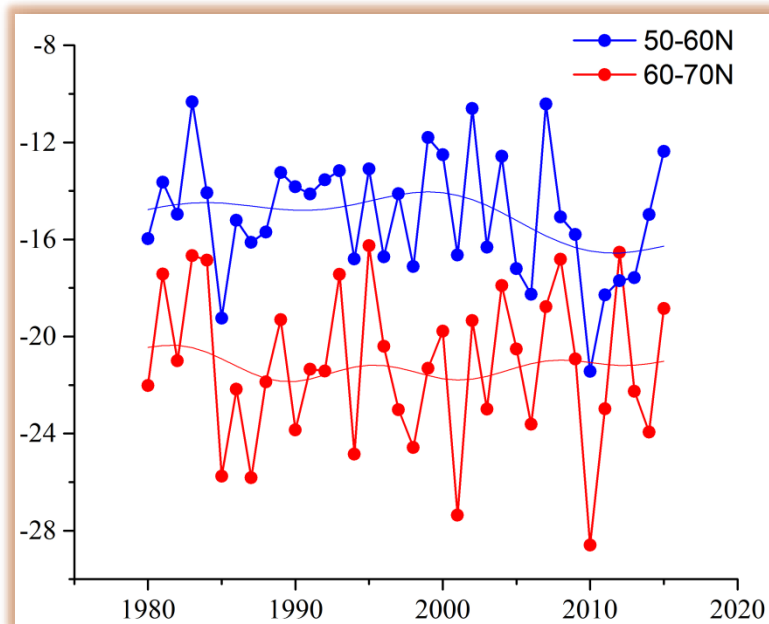
Cold season
November-March

Warm season
April-October

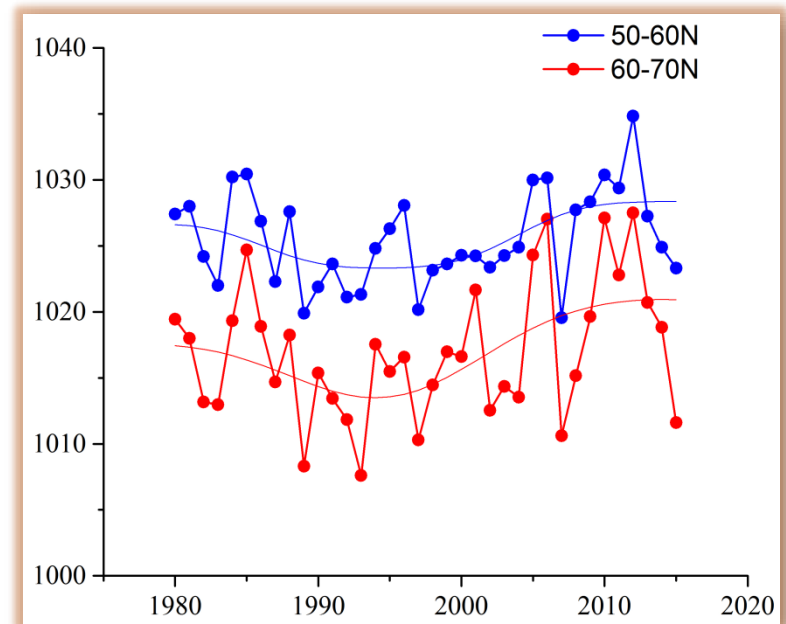
Temporal variability in the northern and in the southern parts

Winter season

Temperature



Pressure



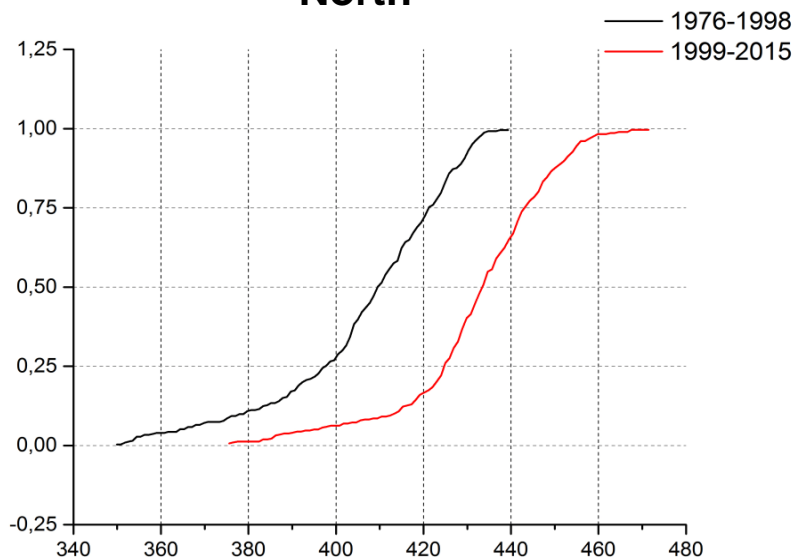
ERA Interim

<http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

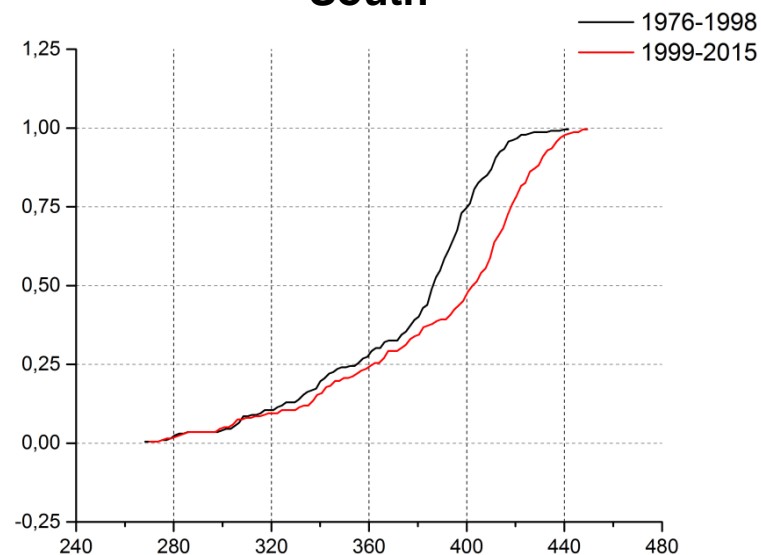
Sample distribution function for amount of precipitation

Warm season

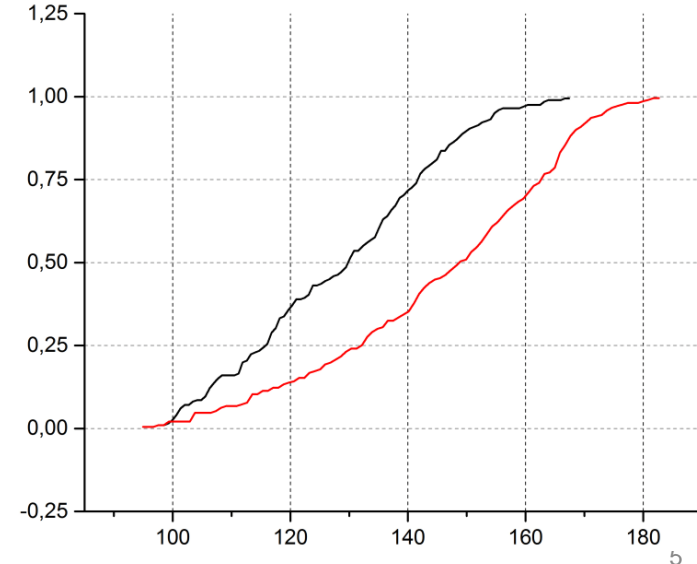
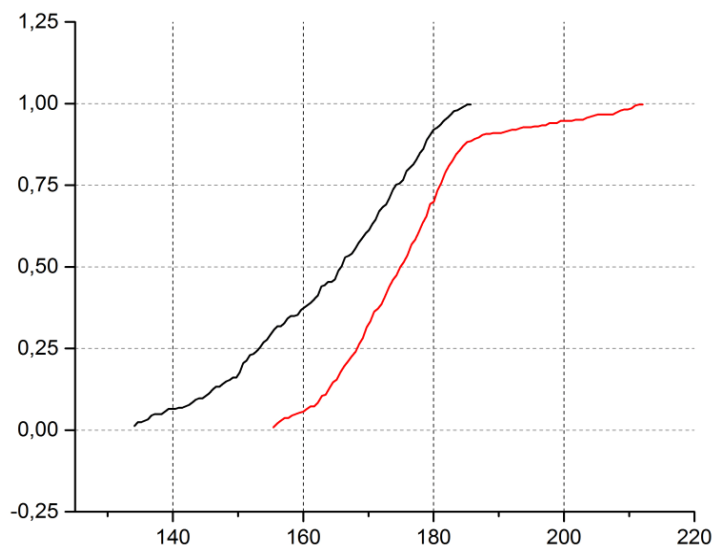
North



South



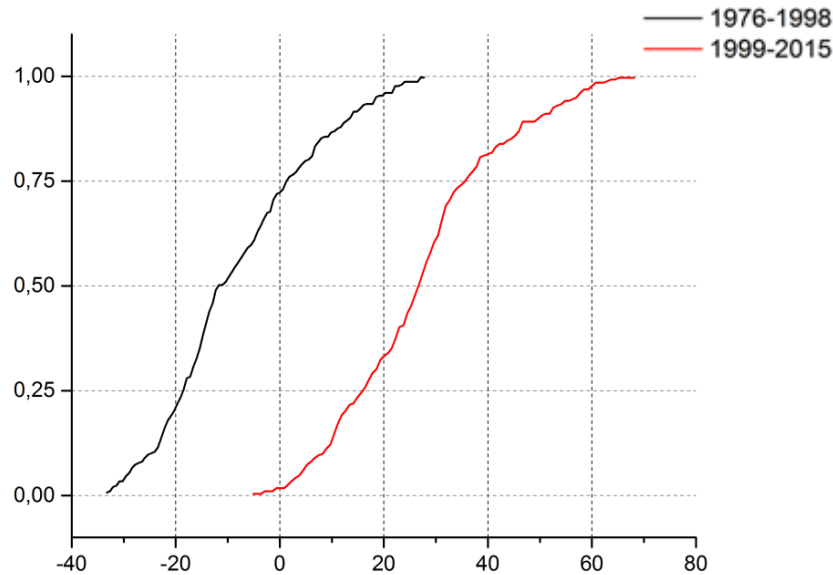
Cold season



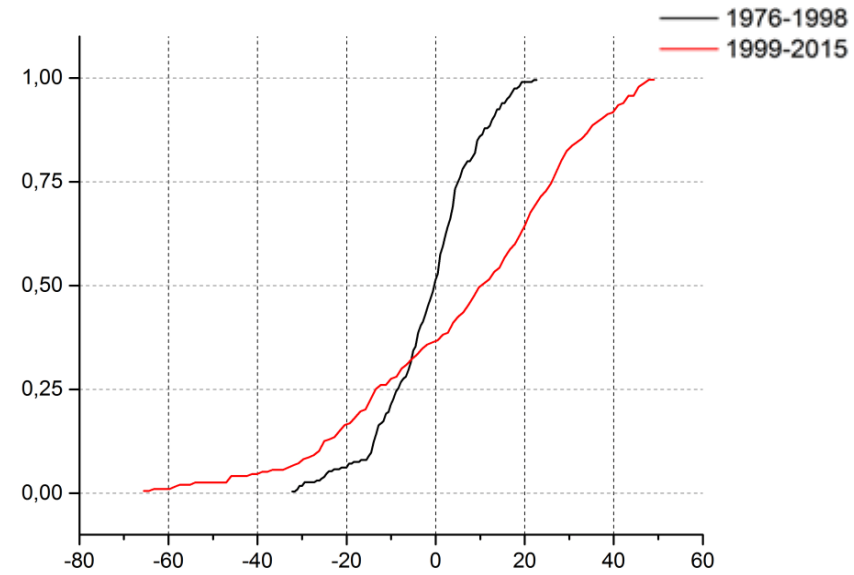
Sample distribution function for precipitation trends

Warm season

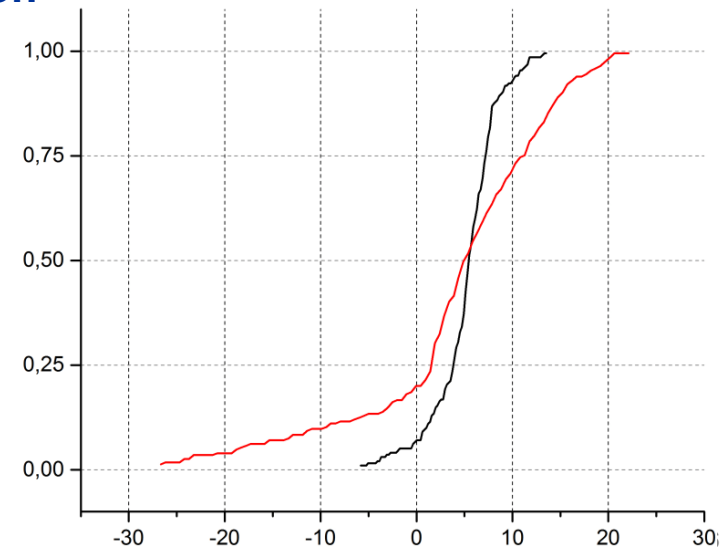
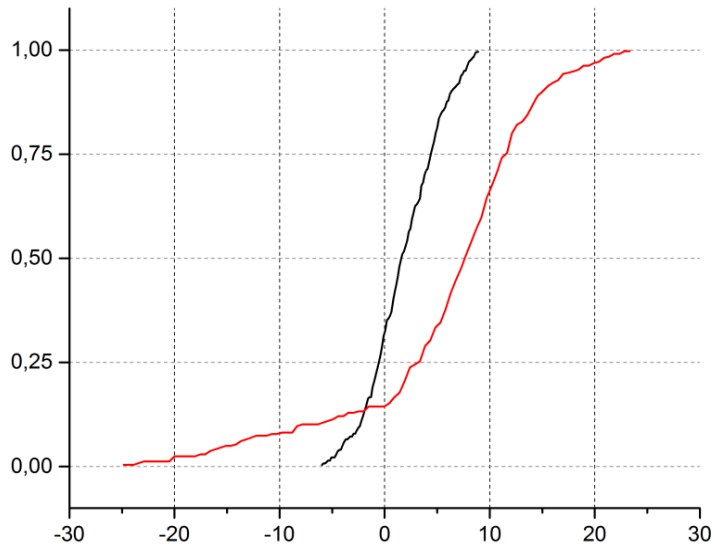
North



South



Cold season

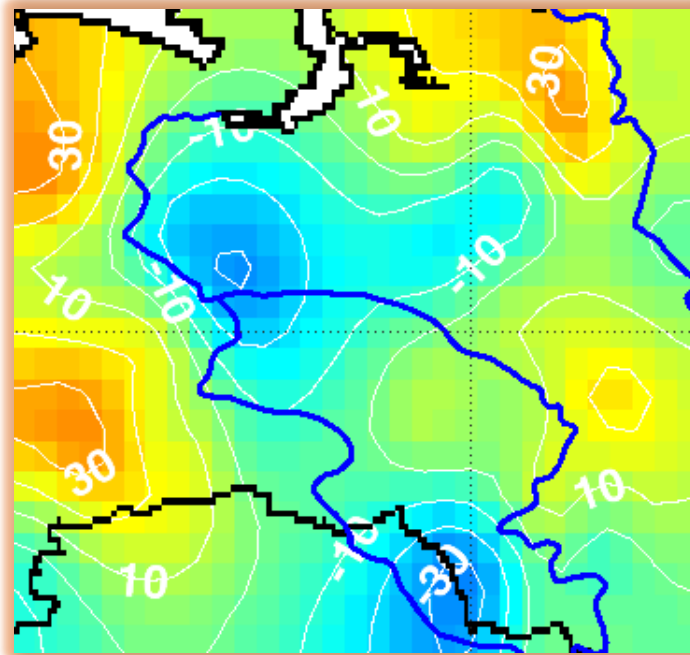


RIHMI-WDC

<http://meteo.ru/data>

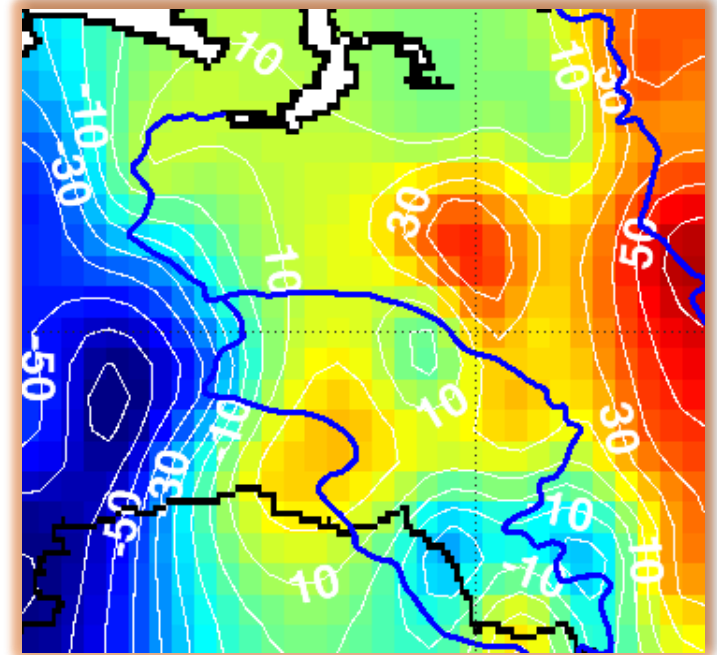
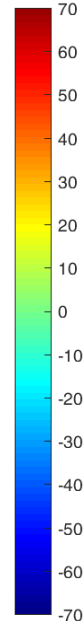
Trends in the amount of precipitation

1976-1998



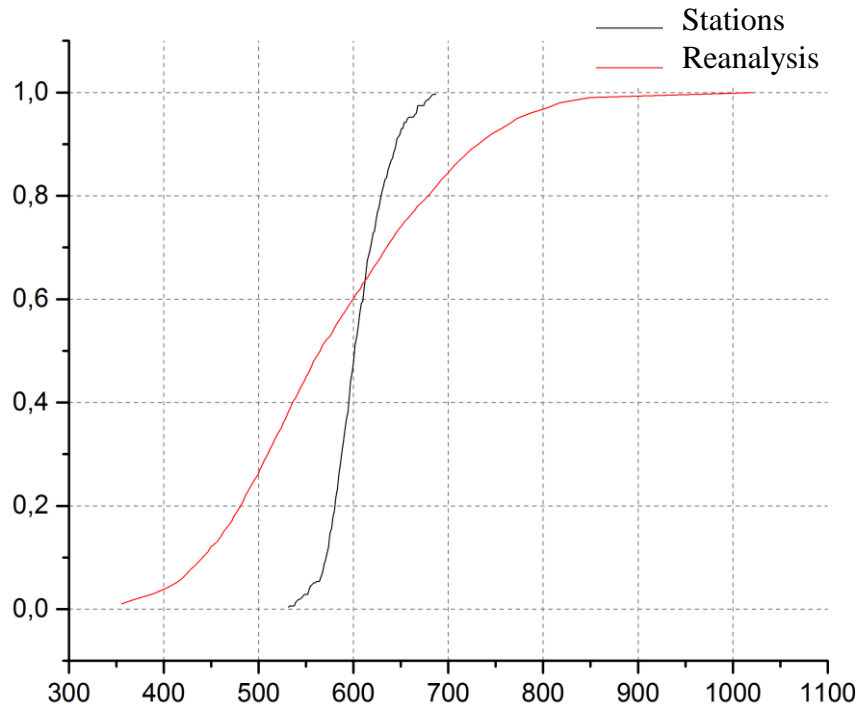
1999-2015

mm/decade

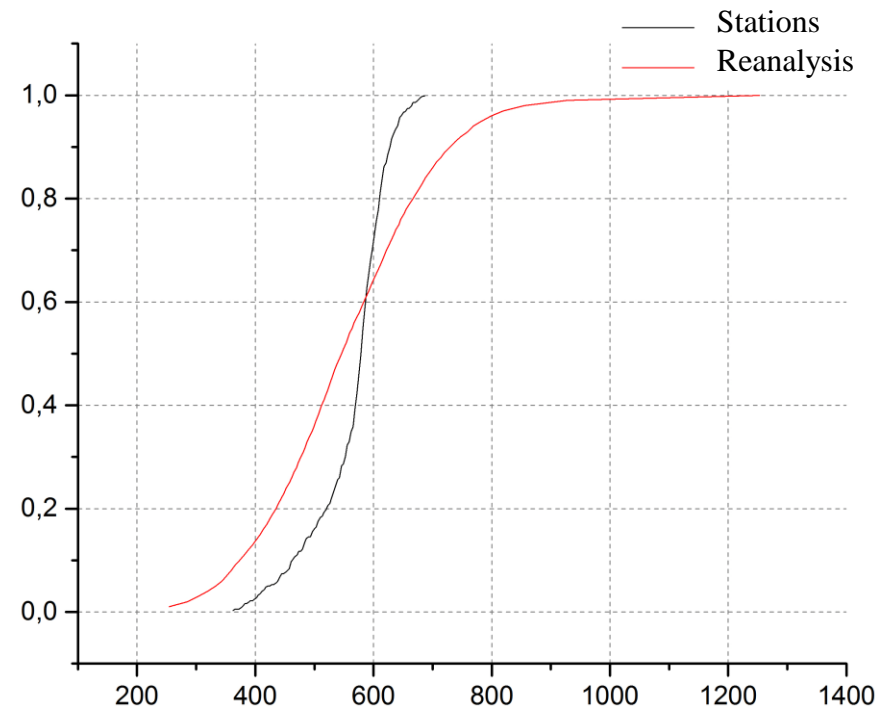


Sample distribution function for amount of precipitation

North



South



1999-2015

ERA Interim

<http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

RIHMI-WDC

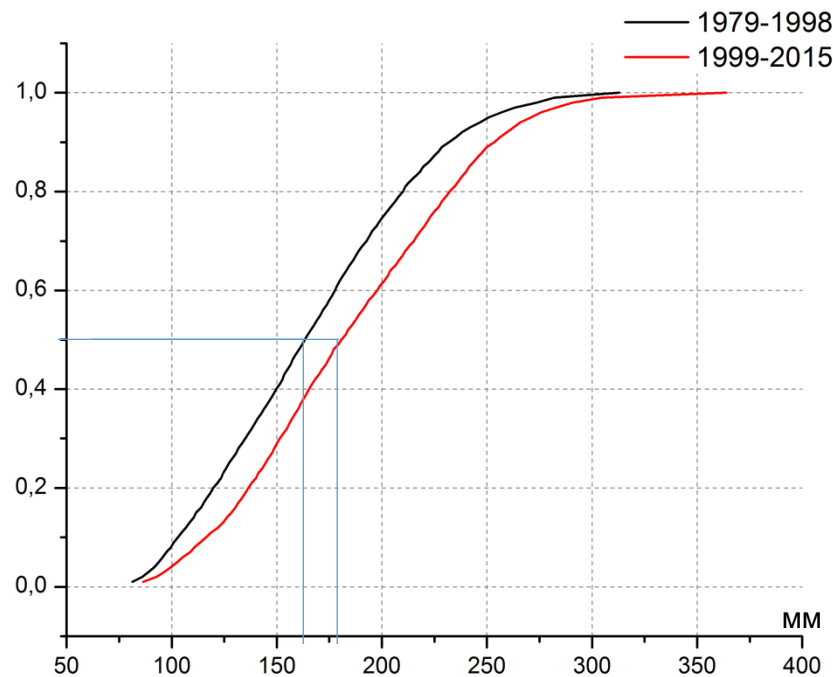
<http://meteo.ru/data>

Sample distribution function for amount of precipitation

Warm season

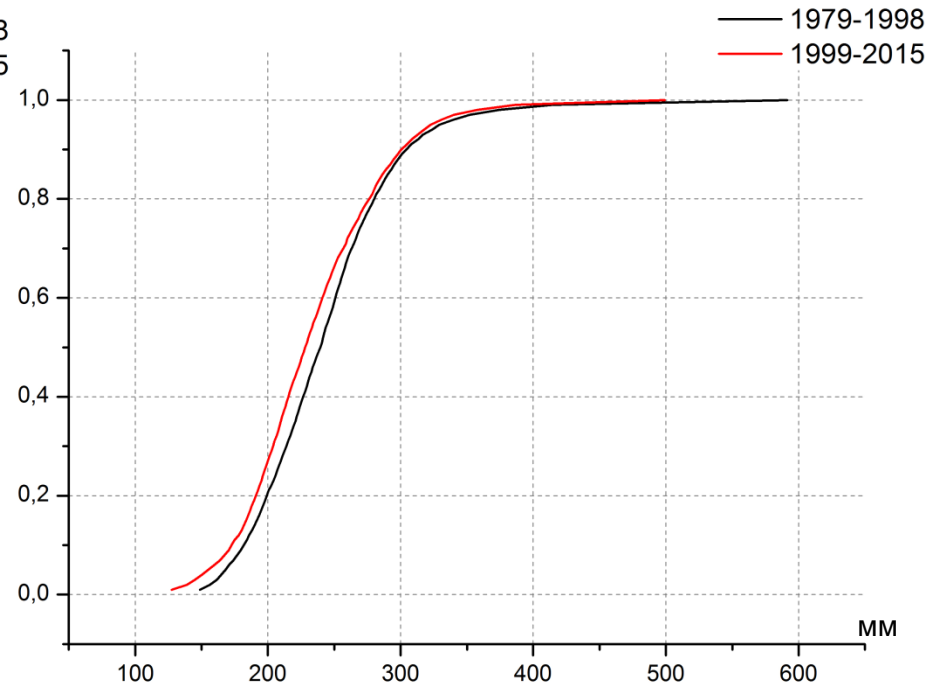
North

Convective precipitation



~10%

Large-scale precipitation



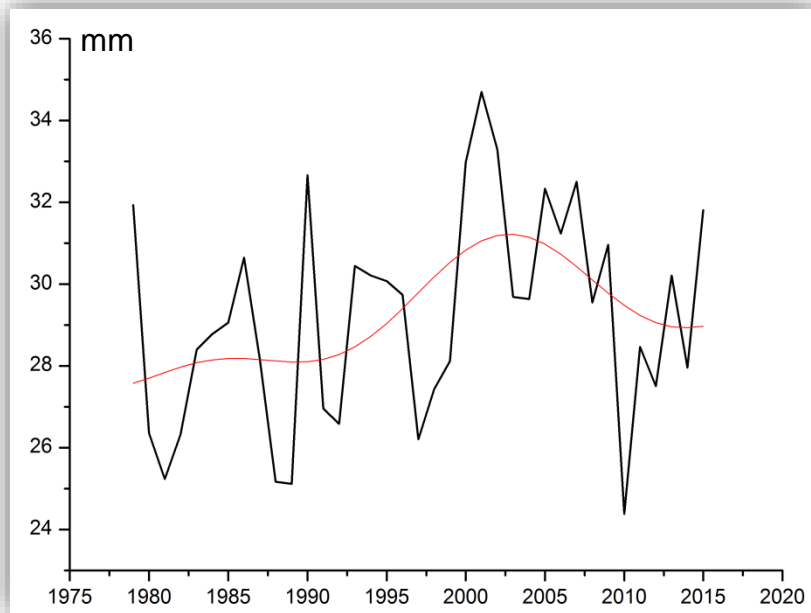
ERA Interim

<http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

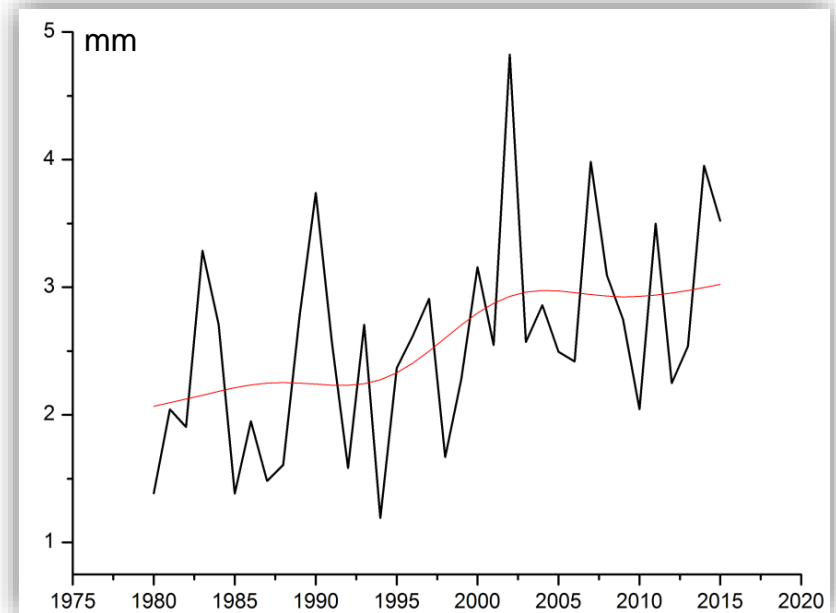
Temporal variability

Convective precipitation

Warm season



Cold season



Smoothing by LPF

1976-1998: $0,31 \pm 0,90$ mm/decade

1999-2015: $-2,12 \pm 1,21$ mm/decade

1976-1998: $0,17 \pm 0,31$ mm/decade

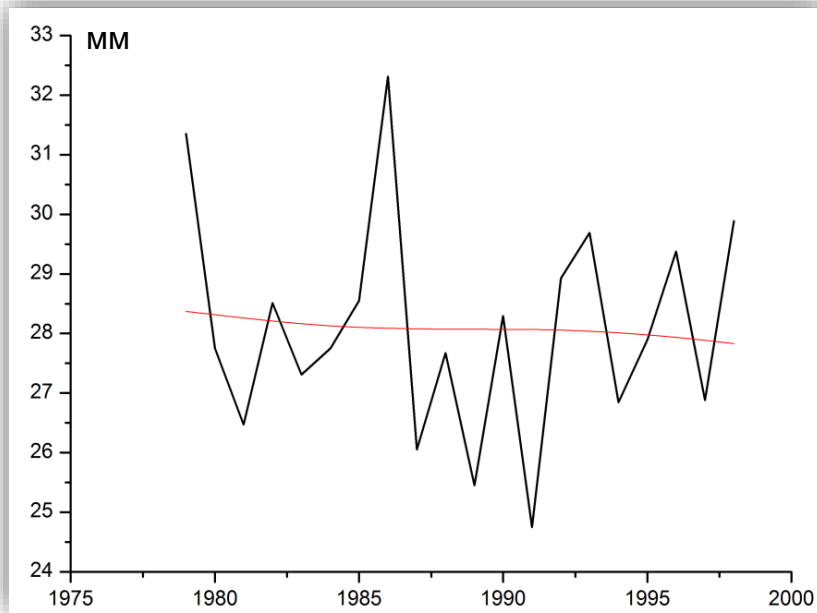
1999-2015: $0,12 \pm 0,38$ mm/decade

West Siberia

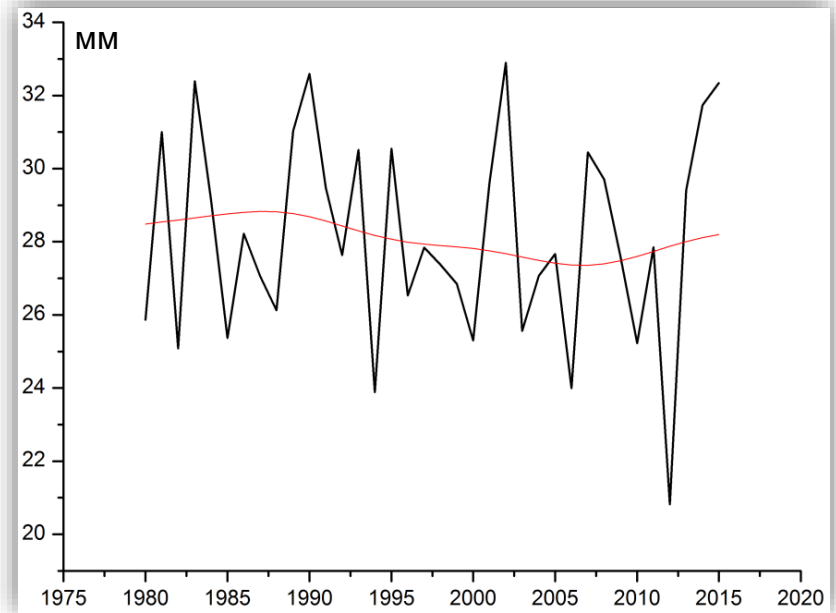
Temporal variability

Large-scale precipitation

Warm season



Cold season



Smoothing by LPF

1976-1998: $-0,19 \pm 0,74$ mm/decade

1999-2015: $-0,65 \pm 1,27$ mm/decade

1976-1998: $-0,15 \pm 1,10$ mm/decade

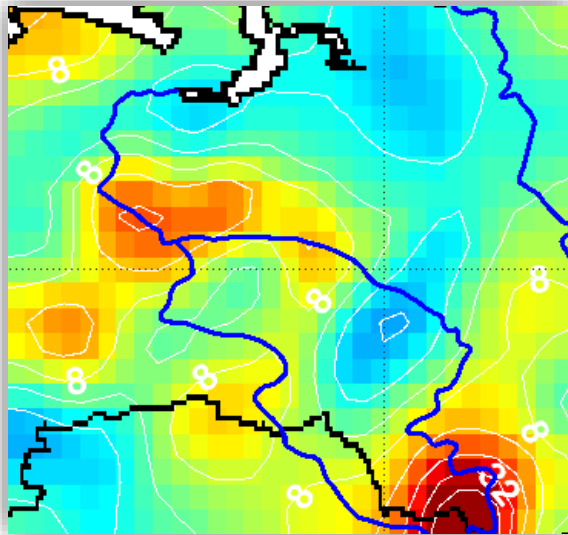
1999-2015: $0,90 \pm 1,61$ mm/decade

West Siberia

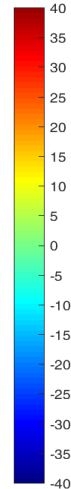
Trends in warm season

Convective precipitation

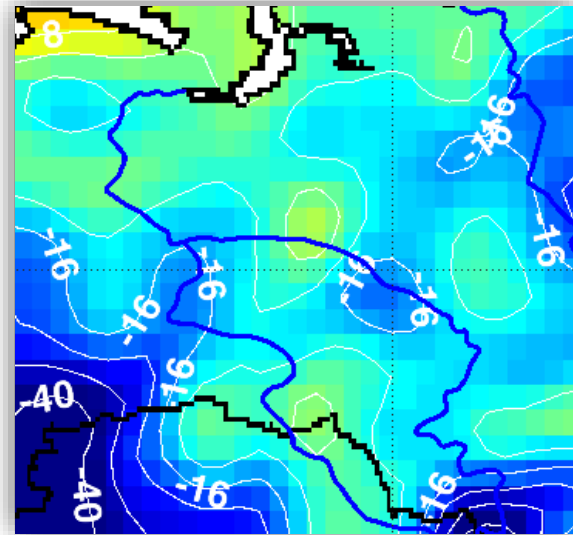
1979-1998



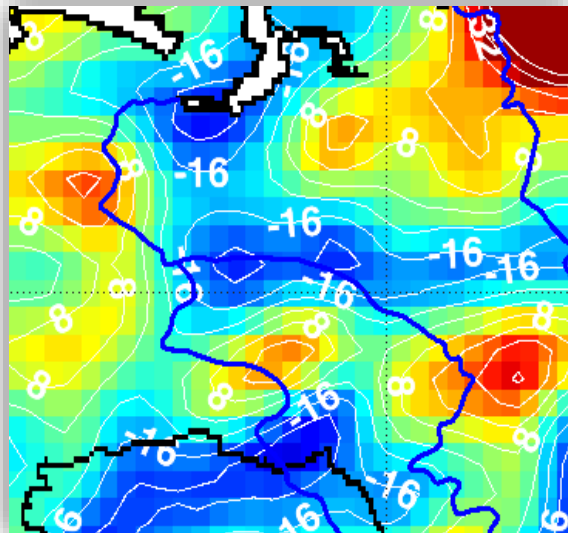
mm/decade



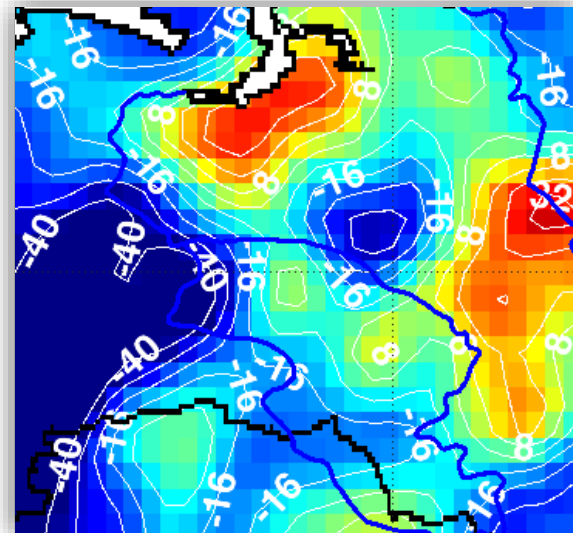
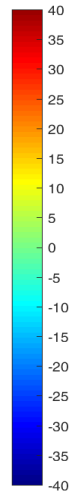
1999-2015



Large-scale precipitation



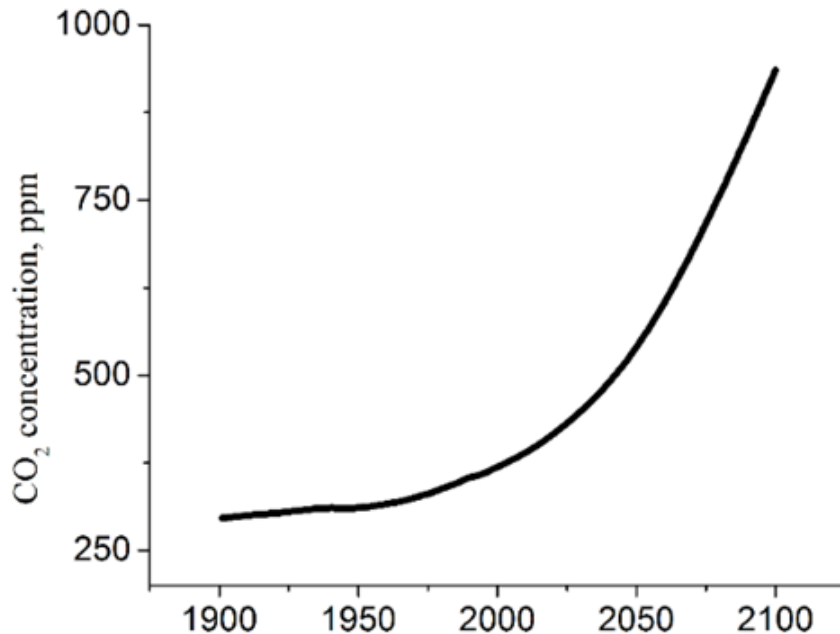
mm/decade



Model

“Planet simulator”

Global large-scale climate model of intermediate complexity
(Fraedrich K. et al., 2005)



Scenario

1700-2005: “Historical simulations” CMIP5

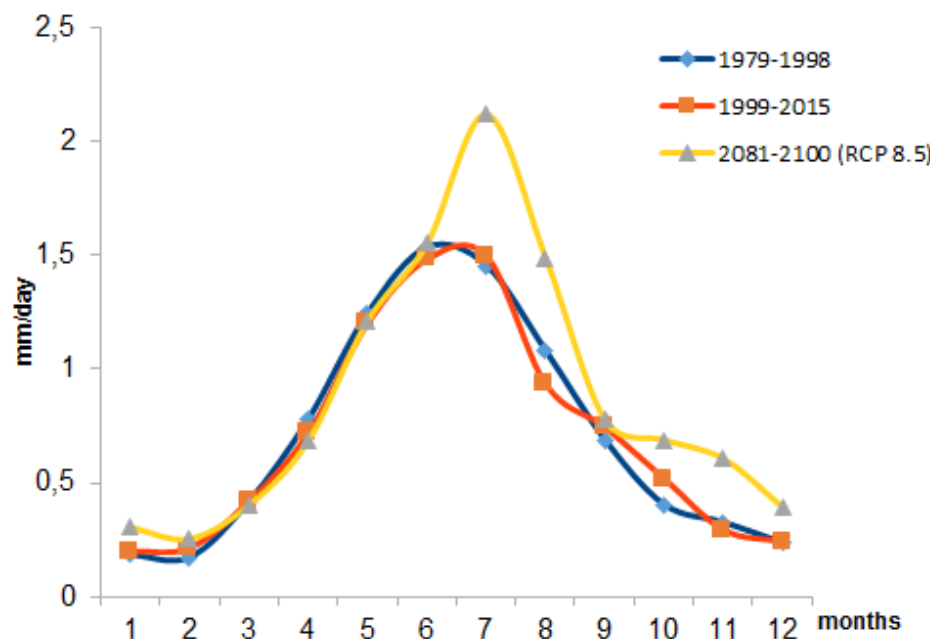
XXI: RCP 8.5

Concentration of the carbon dioxide
in the atmosphere

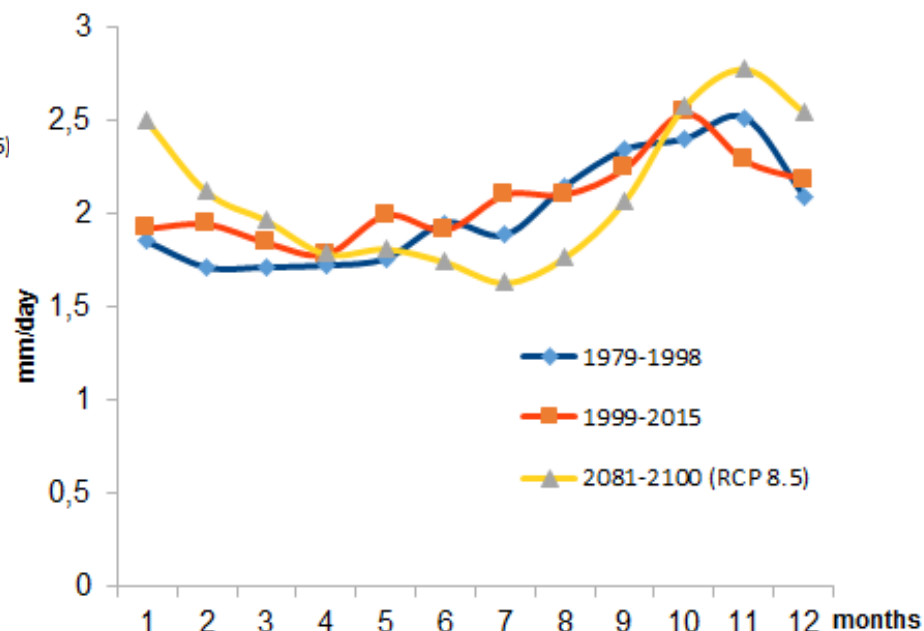
Annual distribution of precipitation in West Siberia

North

Convective precipitation



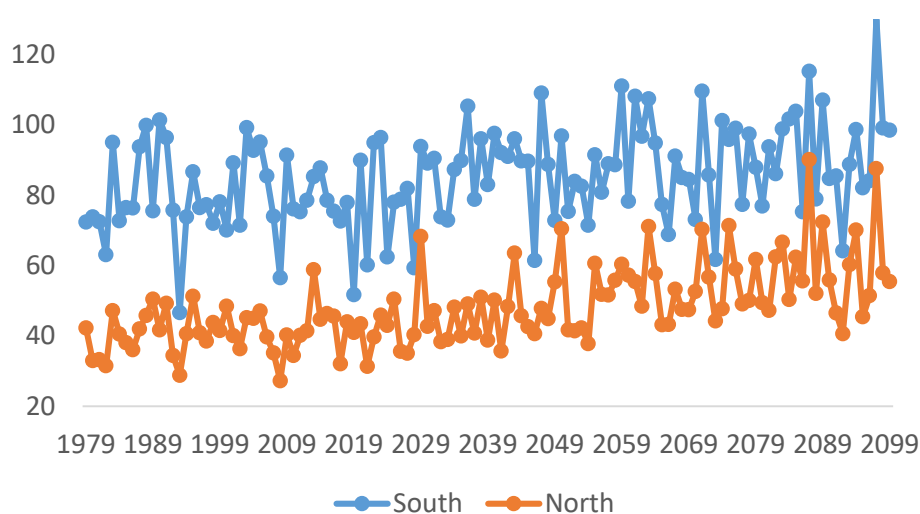
Large-scale precipitation



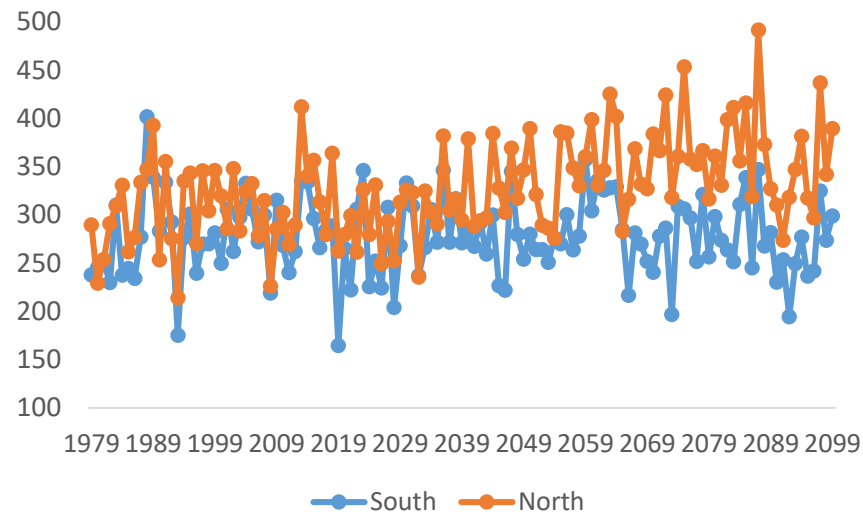
Temporal variability

Cold season

Convective precipitation



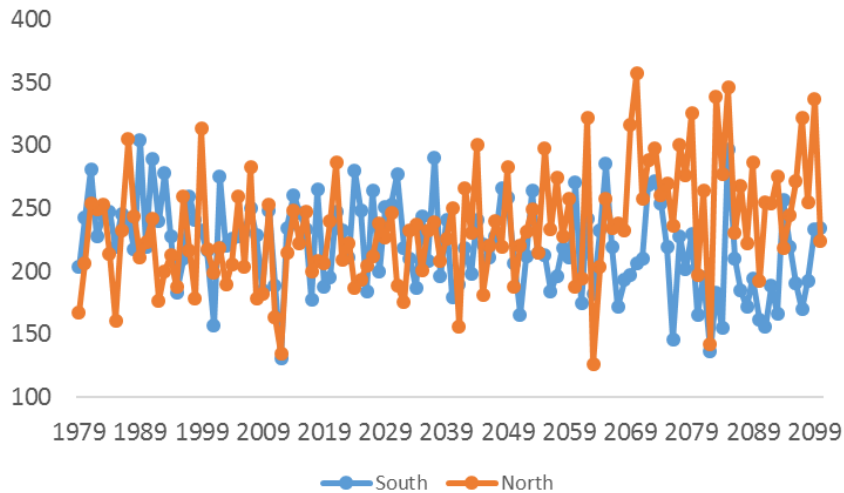
Large-scale precipitation



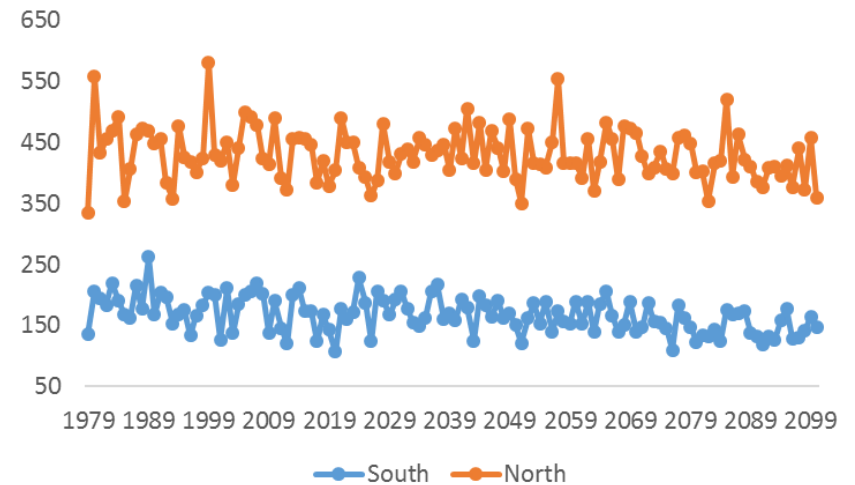
Temporal variability

Warm season

Convective precipitation



Large-scale precipitation



Results

- The tendency to decrease of precipitation in the period of 1979-1998 is replaced by the tendency to its increase in the period of 1999-2015. The most significant rise is observed in the northern part of West Siberia over warm period.
- There is a meridional type in spatial distribution of positive and negative trends over the territory: increase of atmospheric precipitation – along the east boundary of the region and its decrease – along the west one.
- In the beginning of XXI century in warm season in the north the area of convective precipitation increased by 10%. Large-scale precipitation characteristics didn't change from one period to another. Statically significant tendencies are confirmed by numerical model results.
- According to the results of numerical model, it could be expected a significant increase in total amount of convective precipitation in summer in the north.

Thank you for attention!