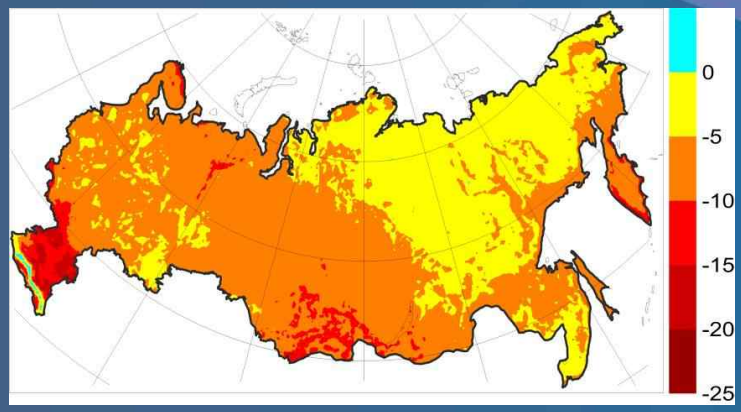
ГЛАВНАЯ
ГЕОФИЗИЧЕСКАЯ
ОБСЕРВАТОРИЯ
им. А.И.ВОЕЙКОВА

CLIMATE CHANGE: RISKS FOR RUSSIAN AGRICULTURE

M.A. Sall, E.I. Khlebnikova, I.A. Sall

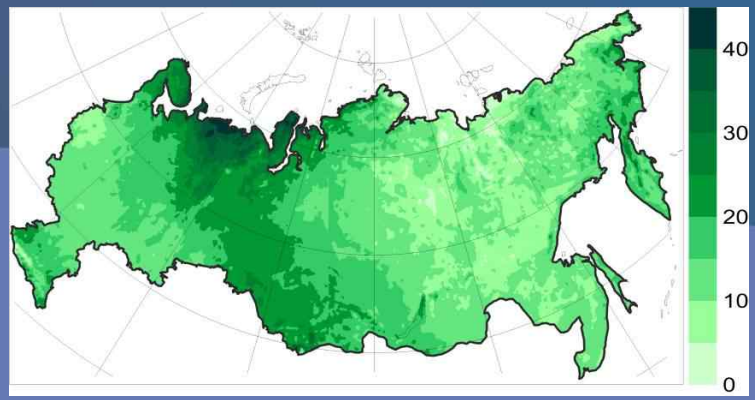
Voeikov Main Geophysical Observatory, Roshydromet, Russian Federation

ГЛАВНАЯ
ГЕОФИЗИЧЕСКАЯ
ОБСЕРВАТОРИЯ
им. А.И.ВОЕЙКОВА

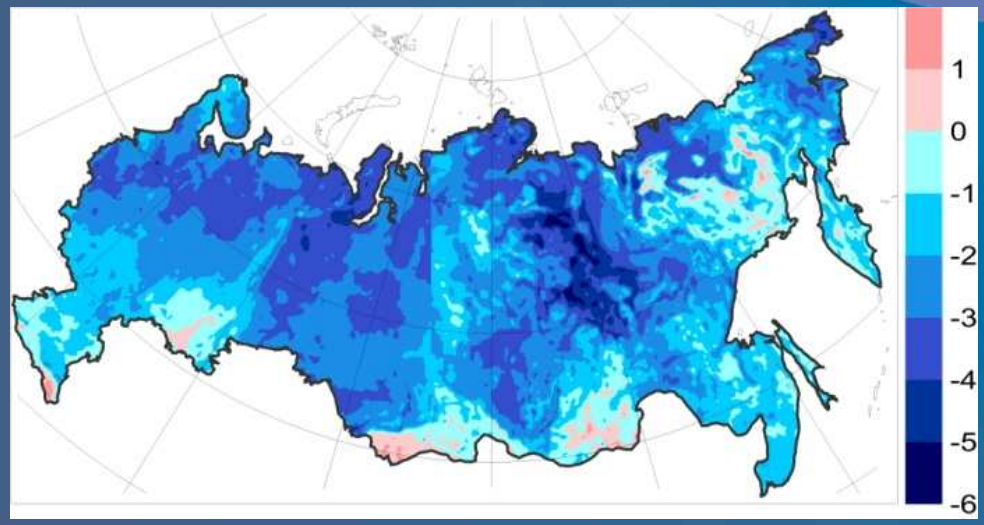


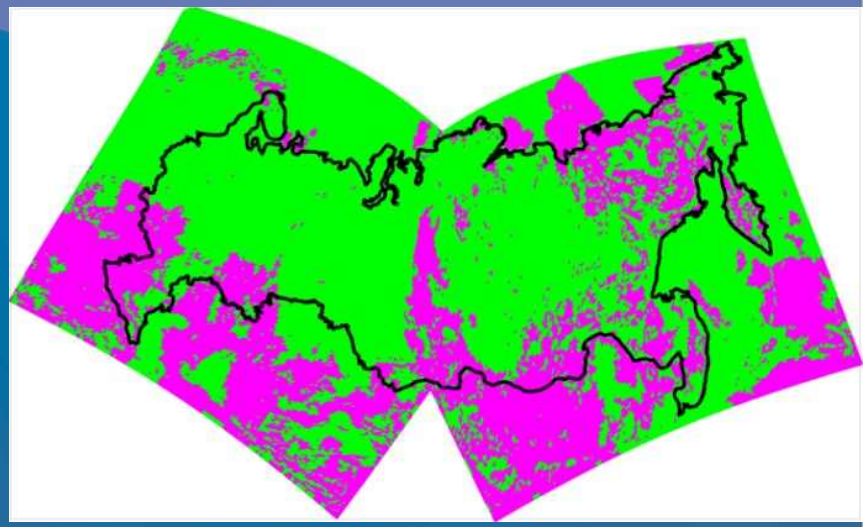
Shift of the date of sustainable spring transition at 0ºC (in days)

Change of the sum of active temperatures (above +10 º C)



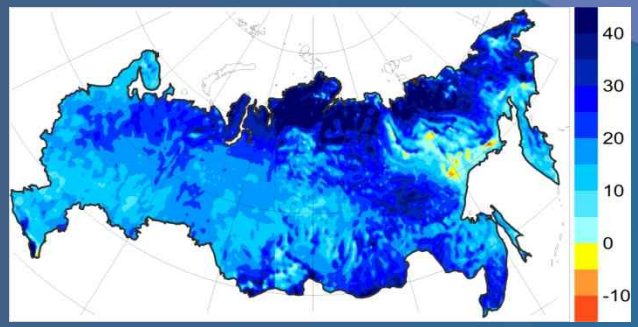
Change of the length of the growing season (in days)

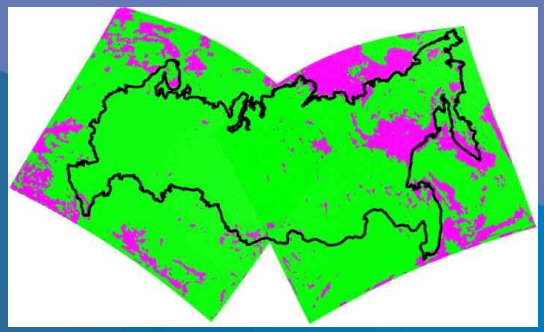




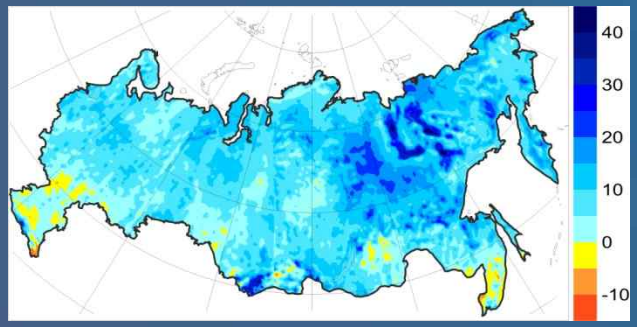
Change in the difference between maximal and minimal mean daily temperature (per year) in ° C to the middle of the 21st century relative to 1981-2000.
Left: assess changes averaged over all the experiments with our model
Right: an indicator of uncertainty estimates (bright pink highlight areas with varying signs of change in different experiments).

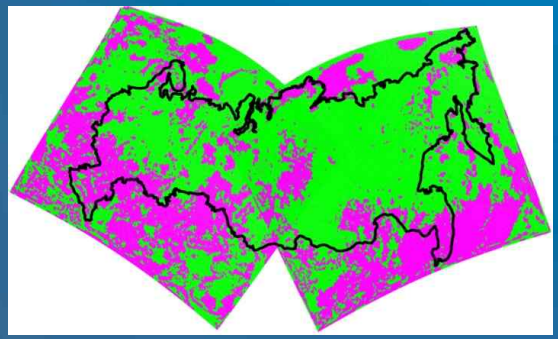
ГЛАВНАЯ
ГЕОФИЗИЧЕСКАЯ
ОБСЕРВАТОРИЯ
им. А.И.ВОЕЙКОВА





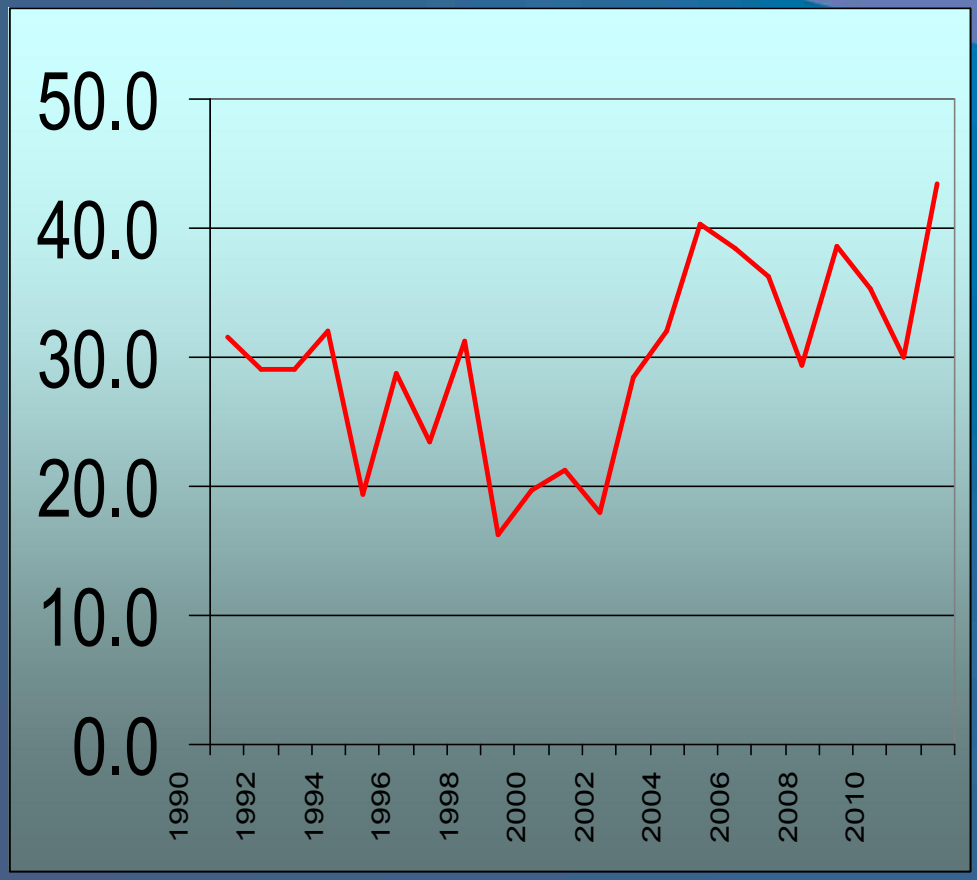
Cold season





Hot season

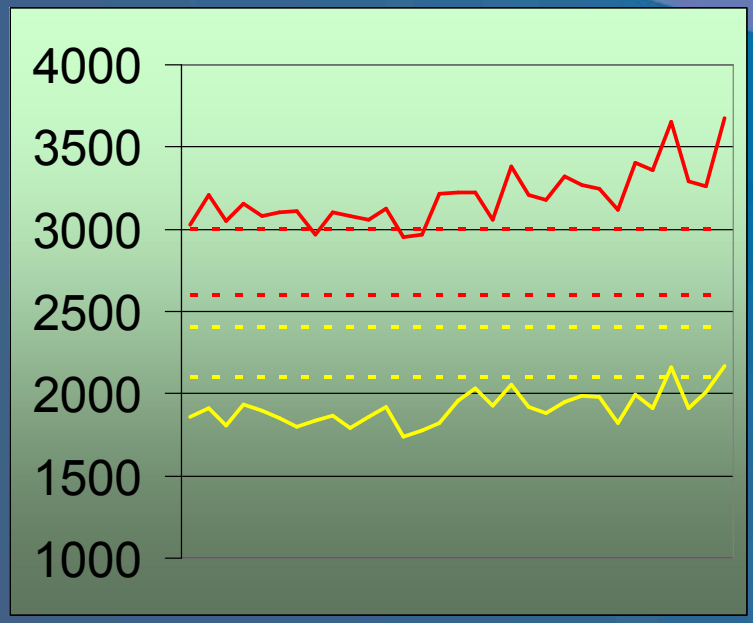
Seasonal change in precipitation (in %)
by mid-21c. relative to the reference interval 1981-2000.
Left: the assessment of change, averaged over all the experiments with our model
Right: an indicator of estimation uncertainty (bright pink highlight areas with varying signs of change in different experiments).



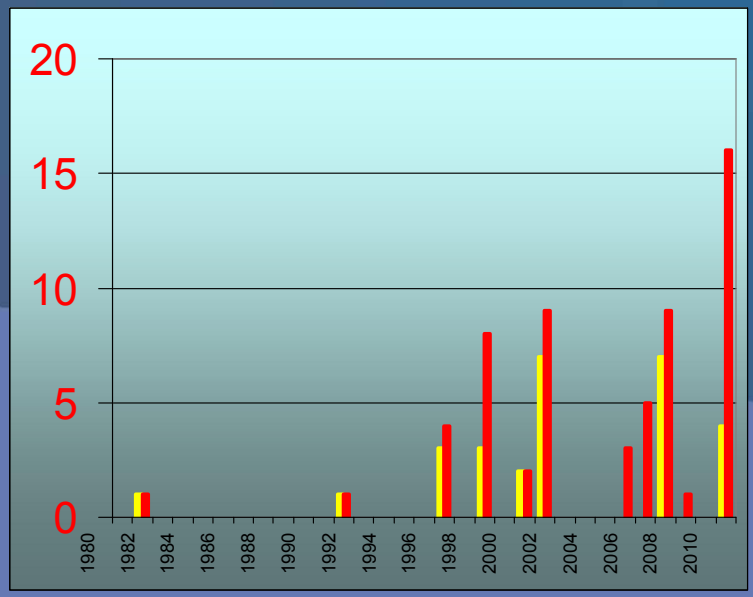
Average maize productivity of land in quintals per hectare (1990-2010)

Max to min of productivity ratio for 1990-2010

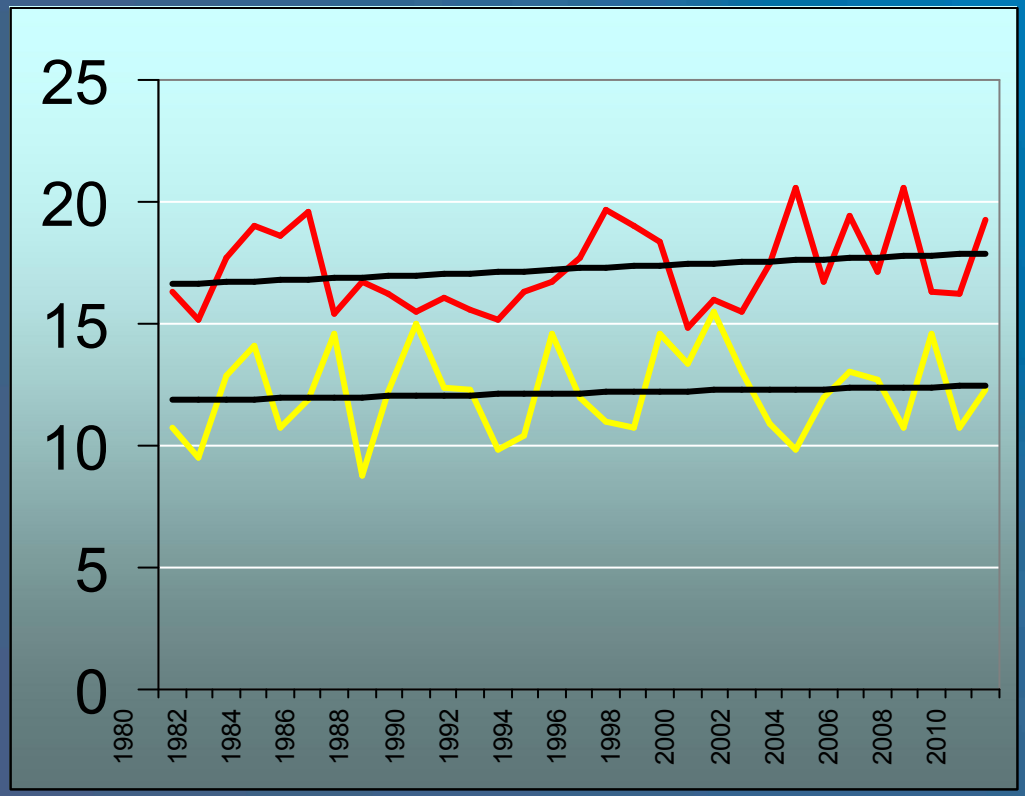
Maize	2,7
Millet	2,3
Rice	2,3
Rye	2,1
Buckwheat	2,0
Barley	1,9
Wheat	1,8
Oat	1,6
Potato	1,5



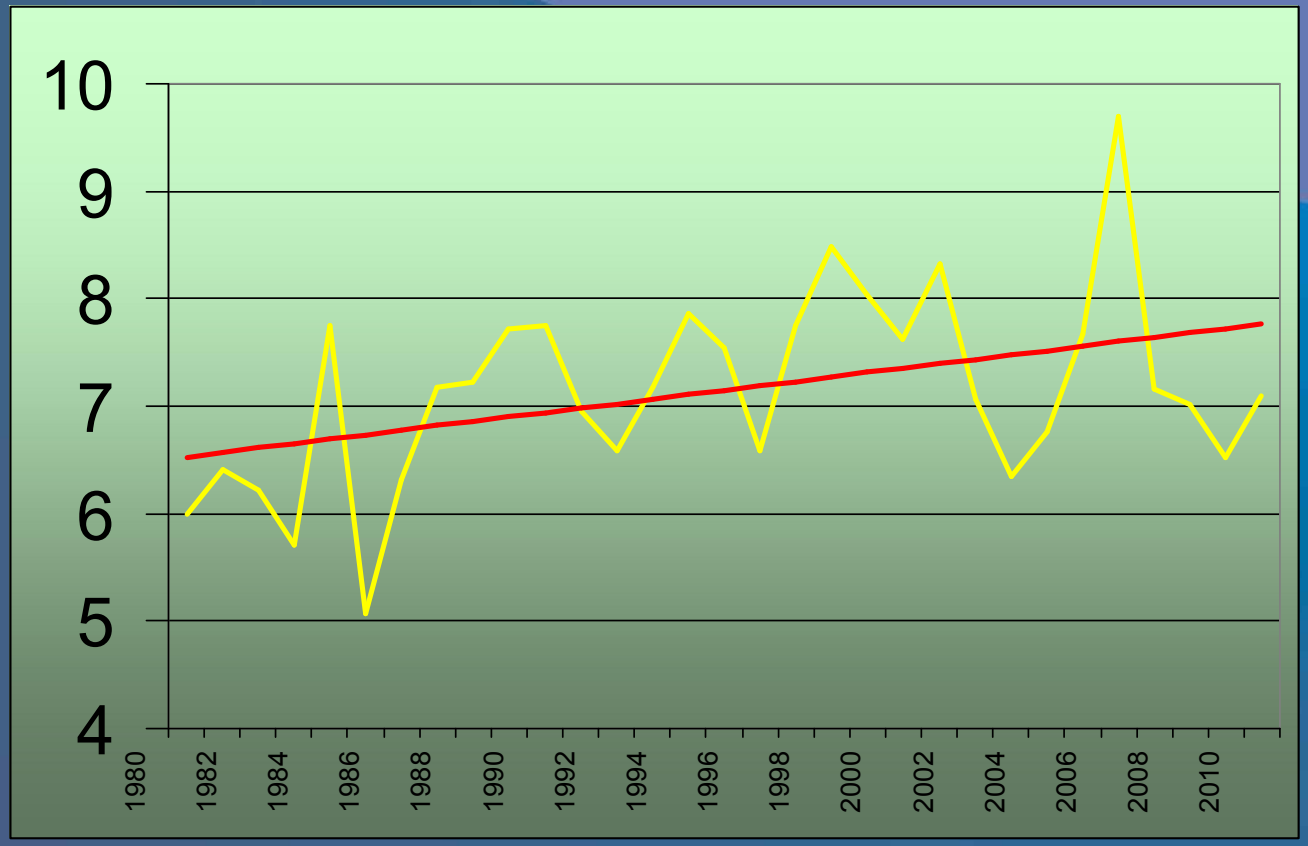
Sums of active temperatures (>10ºC) for May-July and May-September (growing periods of short-term and long-term maize) for 1980-2010



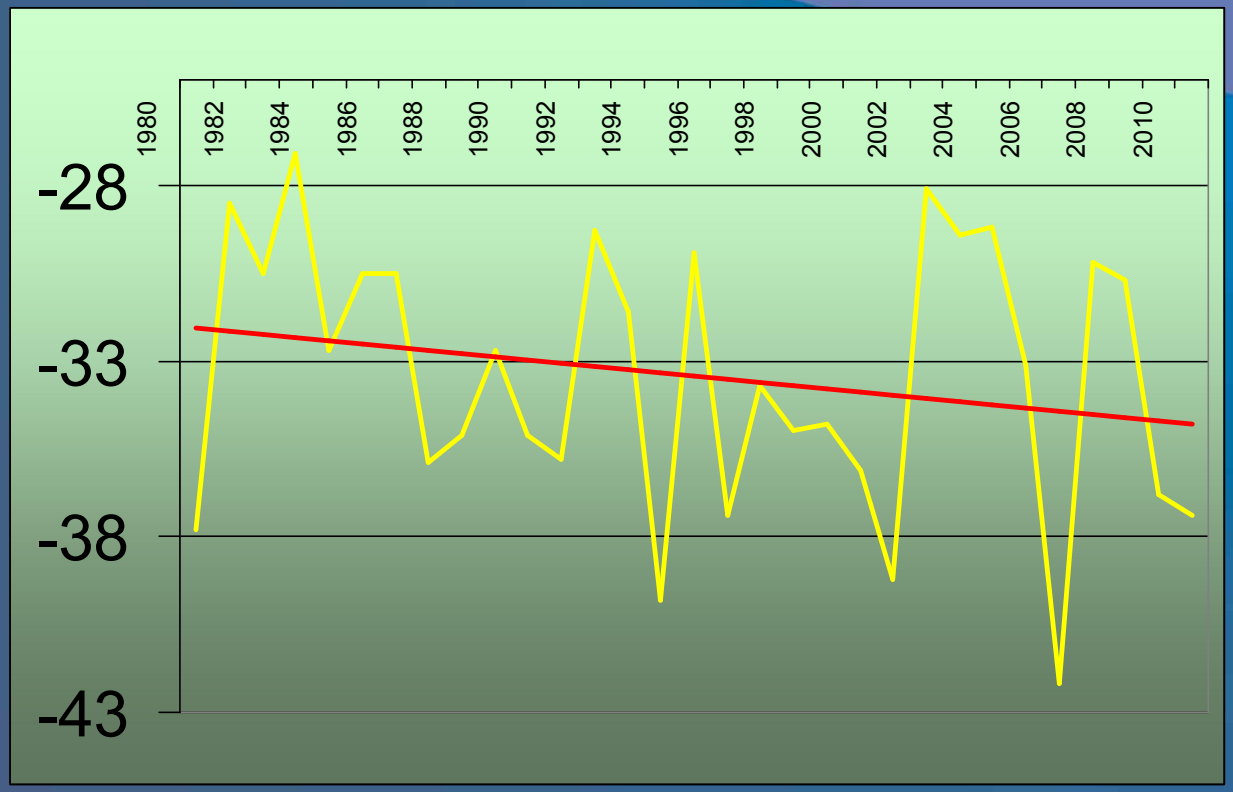
Numbers of days with average temperature >30°C for May-July and May-September for 1980-2010



Average temperatures of April and May (the best date for maize planting – 1st of May)



Standard deviation of Jan-Feb seasonal temperature (for Omsk region) for 1980-2010



Minimal temperature of Jan-Feb (for Omsk region) for 1980-2010

Subjective risks

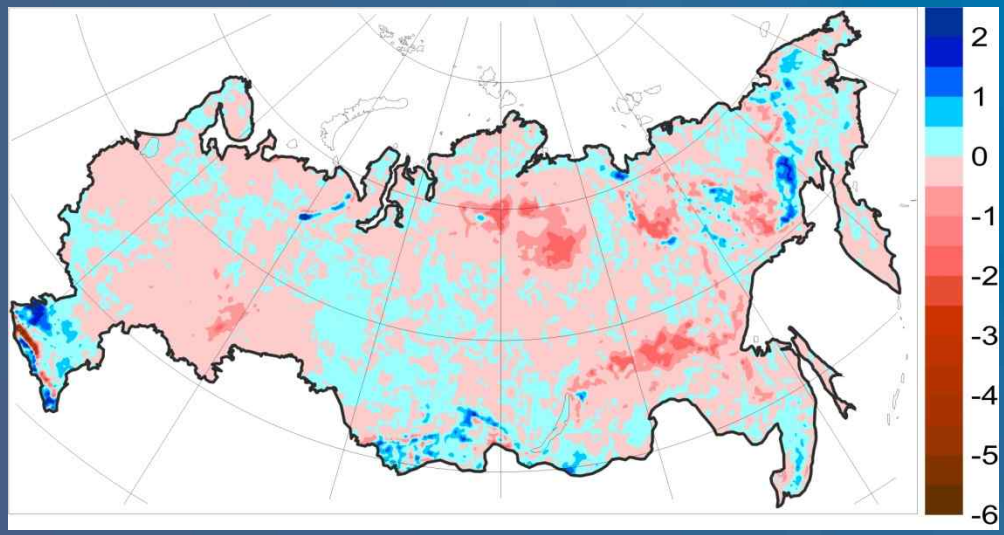
ГЛАВНАЯ
ГЕОФИЗИЧЕСКАЯ
ОБСЕРВАТОРИЯ
им. А.И.ВОЕЙКОВА

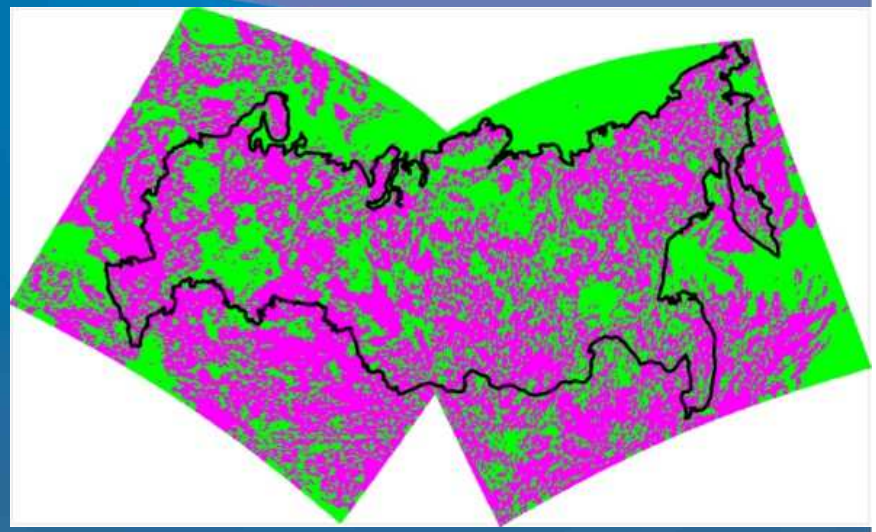
GAPS

- Statistics
- Agro physicists
- Agronomists

Objective risks

Risks of tendency	Risks of sub-tendencies	Risks of variability

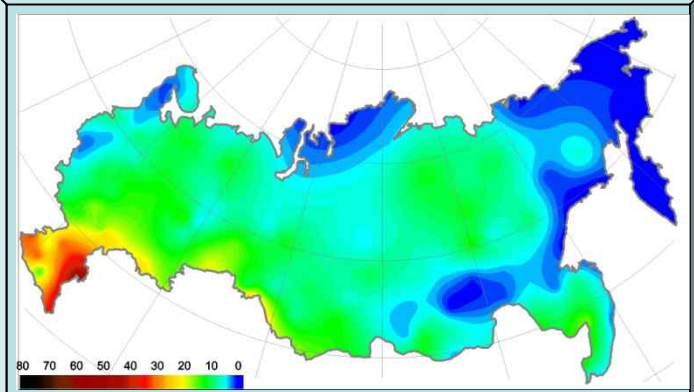


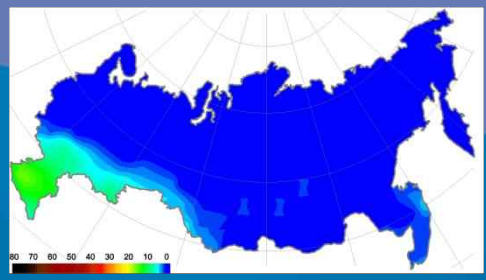


Left: change in the number of frost in the growing season (in days).
Right: an indicator of estimation uncertainty (bright pink highlighted areas with varying signs of change in different experiments).

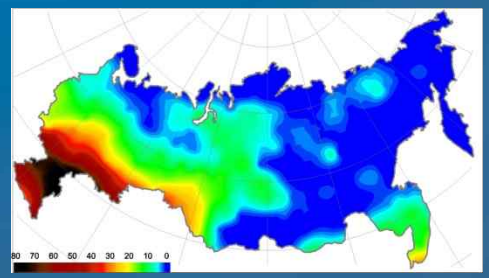
ГЛАВНАЯ
ГЕОФИЗИЧЕСКАЯ
ОБСЕРВАТОРИЯ
им. А.И.ВОЕЙКОВА

Real data

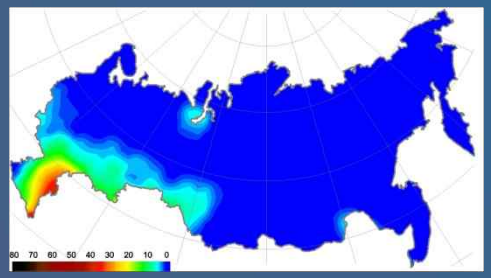




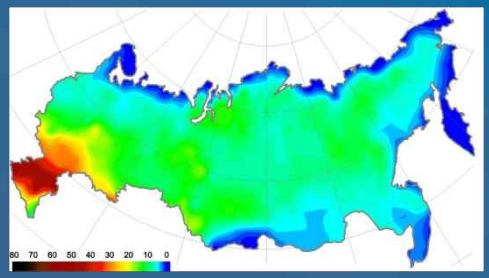
NCAR_PCM



CCSR_ME



ECHO



GFDLCM21

Maximal length of the continuous drought type terms for 1971–2000.
Right: red – agricultural regons

Multiple effects of climate change on agriculture on the vast and widely diversed territories of Russia, necessitate the development and implementation of the adaptation programs with detailed regional perspective. The ongoing change of some most important characteristics of the regional climate, gives ample reason to believe that Russia is growing short of adaptation. The delays in the adoption means a significant increase in the costs of adaptation in the nearest future.

Thank you!