VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

Towards flood assessment over Northern Eurasia using multiscale climate modeling system

Elena Stafeeva, Igor Shkolnik

Voeikov Main Geophysical Observatory, St.-Petersburg, Russia

EuRuCAS Summer School, Repino, Russia, 29 June – 5 July, 2014

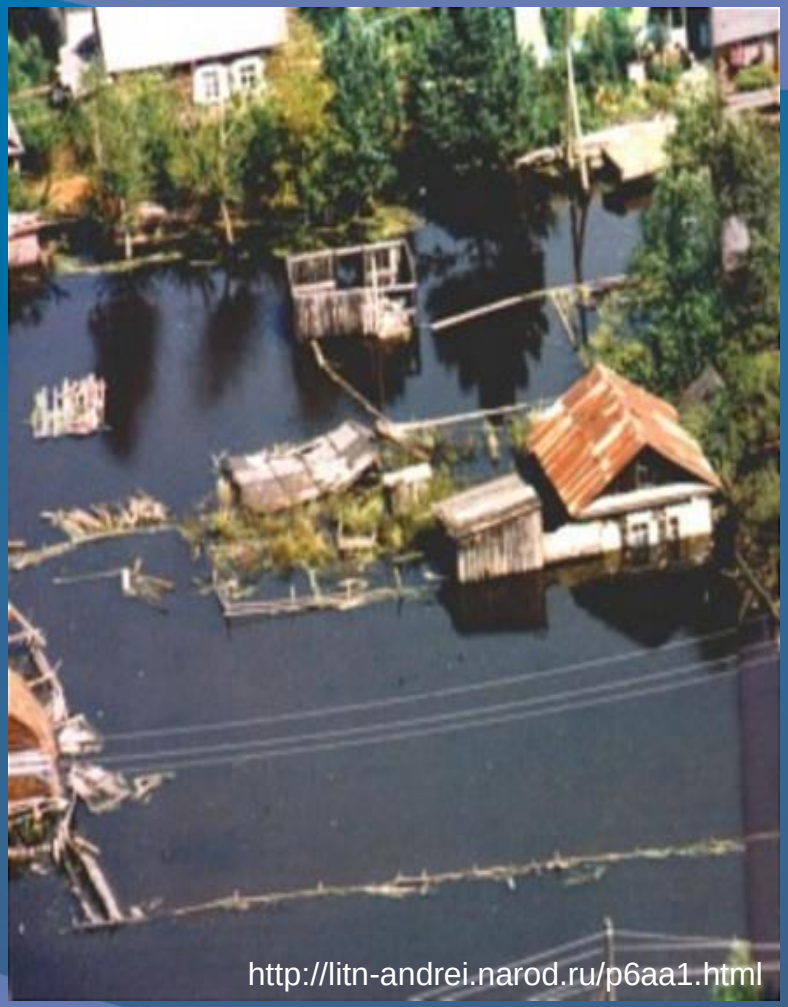
VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

Motivation

✓ Flooding can cause a range of impacts and risks

✓ The global climate change may have serious impacts on the hydrological extremes

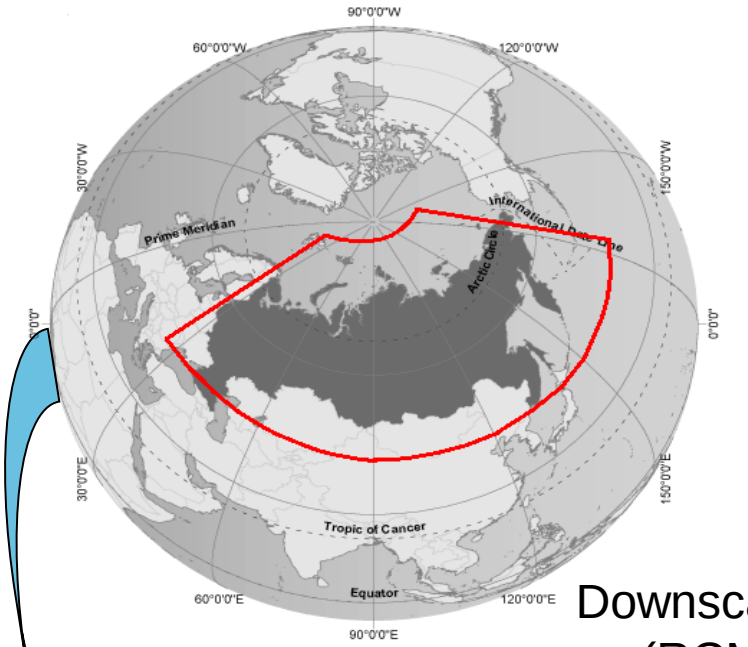
✓ River flow routing scheme (RivRout) - estimation of frequency and intensity of extreme hydrological events across Russian watersheds

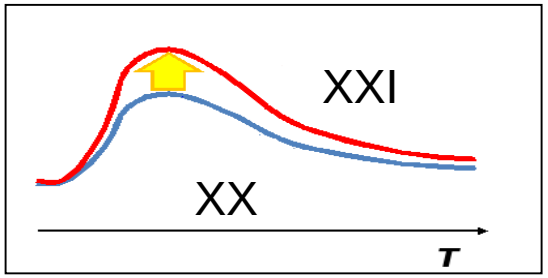


http://litn-andrei.narod.ru/p6aa1.html

VMGO climate models system: global, regional, local

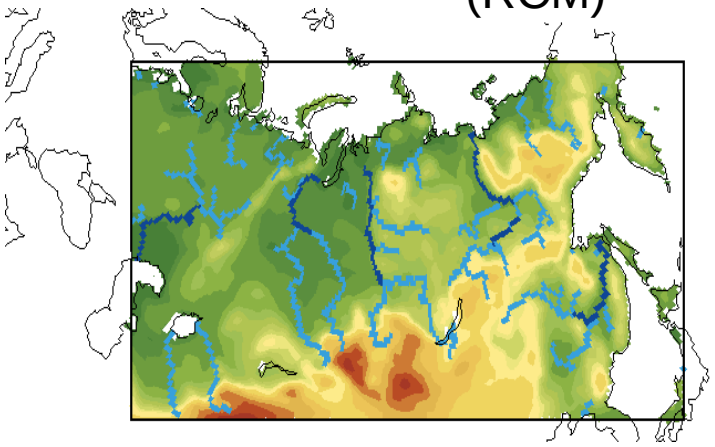
VOEIKOV MAIN GEOPHYSICAL

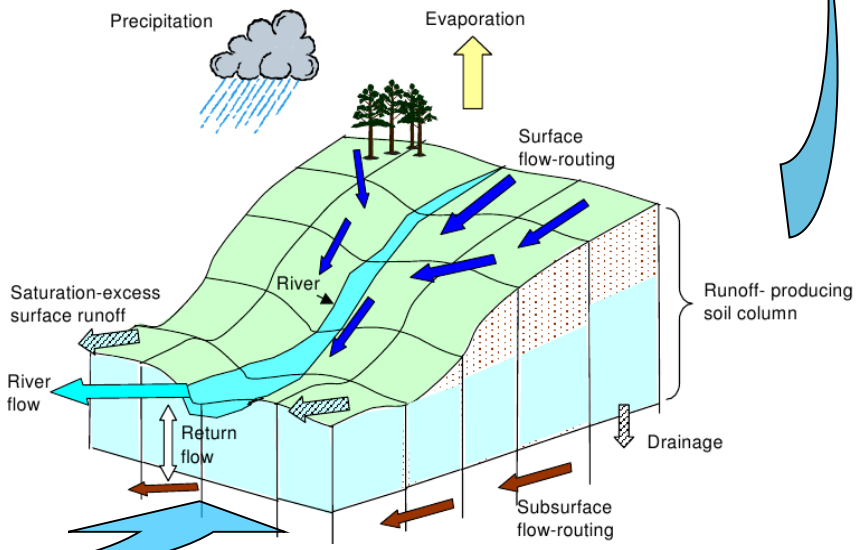




Runoff hydrograph

Downscaling (RCM)





River flow routing

Research Framework

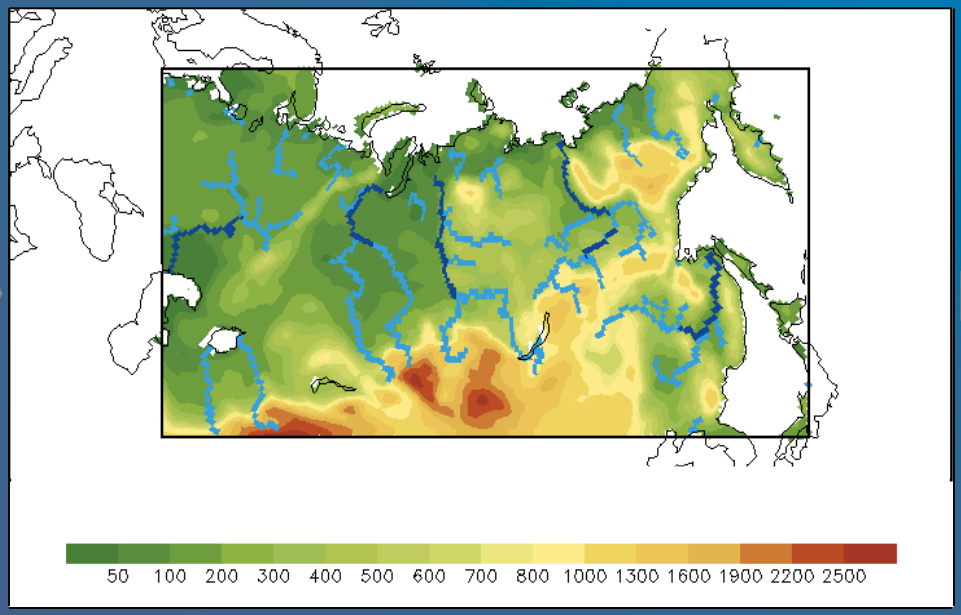
VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

RCM VMGO (resolution 50 km)

Lateral boundary conditions

Reanalysis
ERA-40
1981 - 2000 гг.

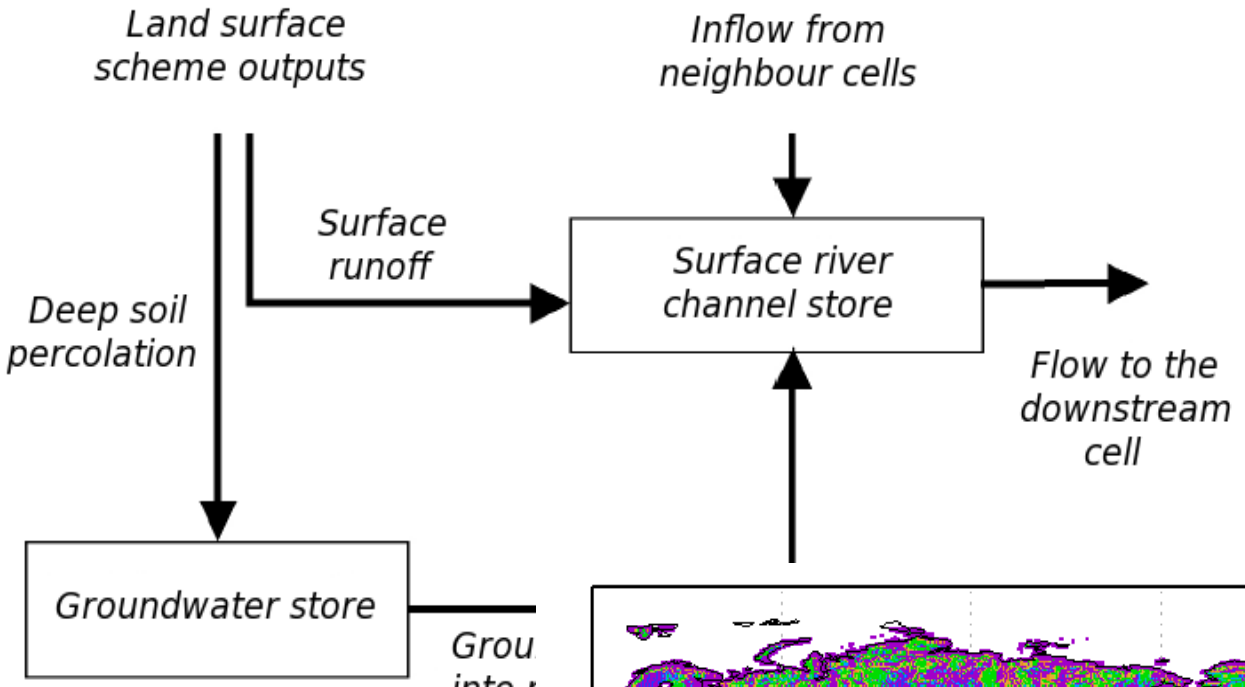
Analysis
SST/ICE



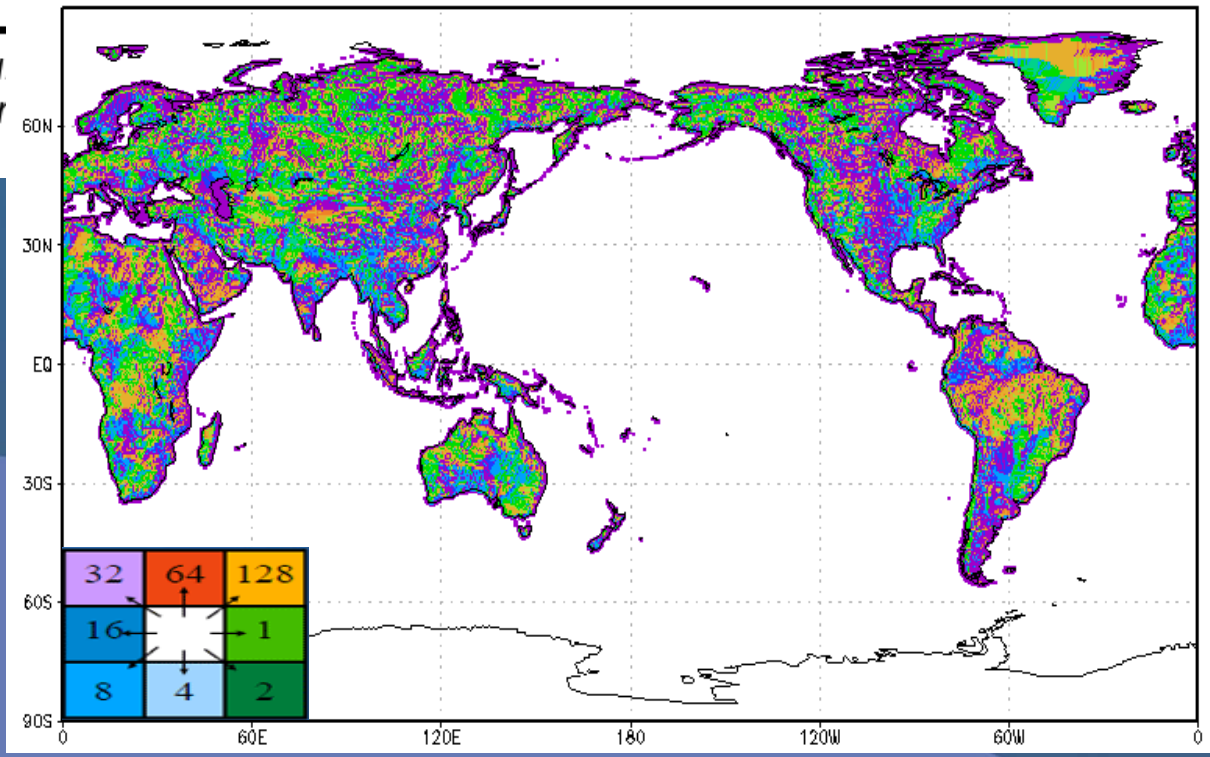
River flow routing

- Interannual water discharge
- Mean discharge hydrograph
- Timing of discharge variations

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY



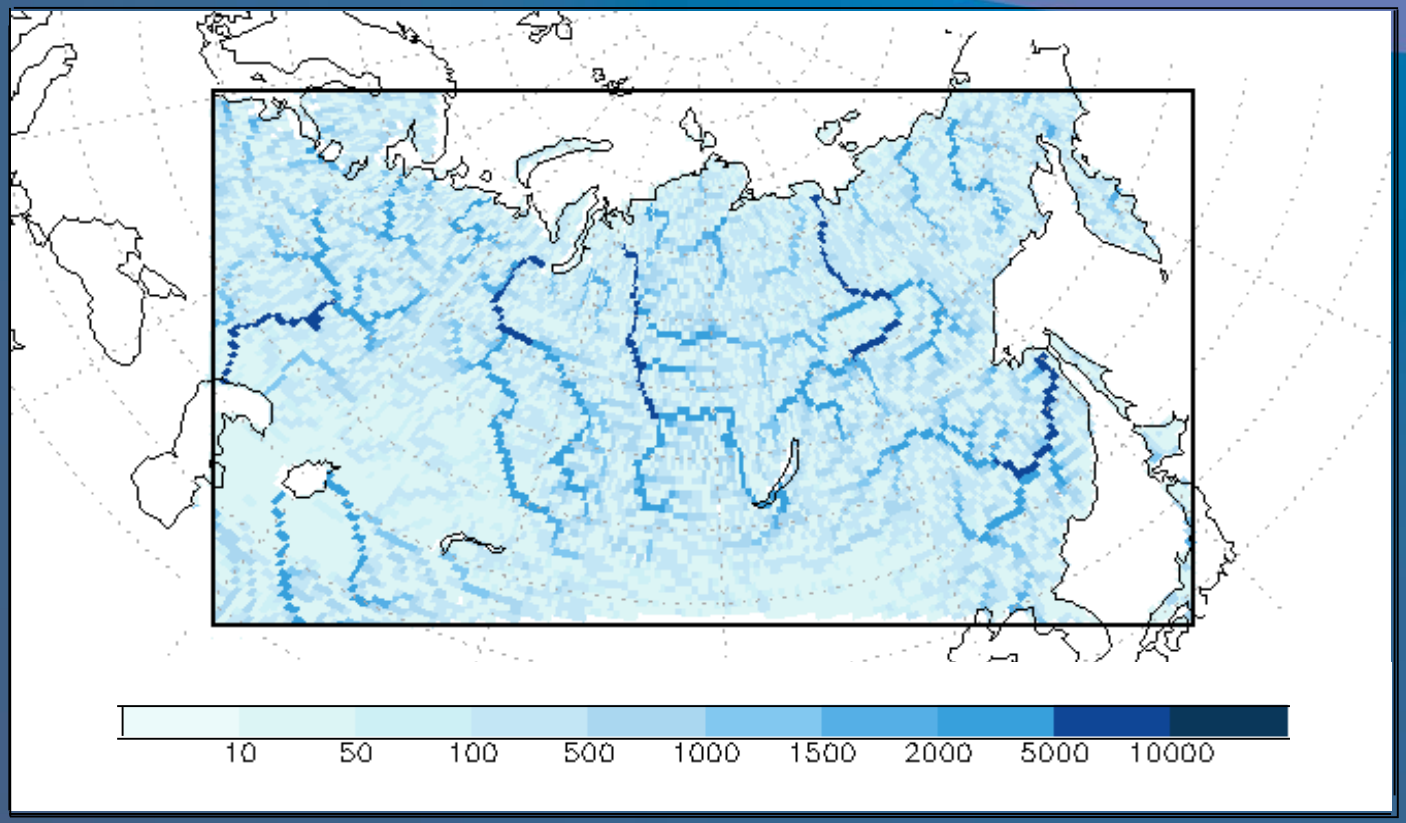
River flow routing scheme (Lucas-Picher, 2010)



Global drainage direction map (Döll and Lehner, 2002)

Simulated river network for the watersheds covered by RCM

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

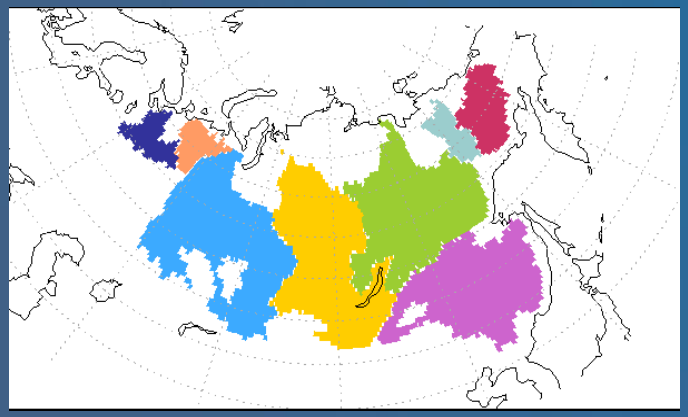


The river width W is obtained using a geomorphological relationship between width and mean annual discharge Q (Arora et al., 1999)

$$W = kQ^b$$

Annual mean water discharge

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

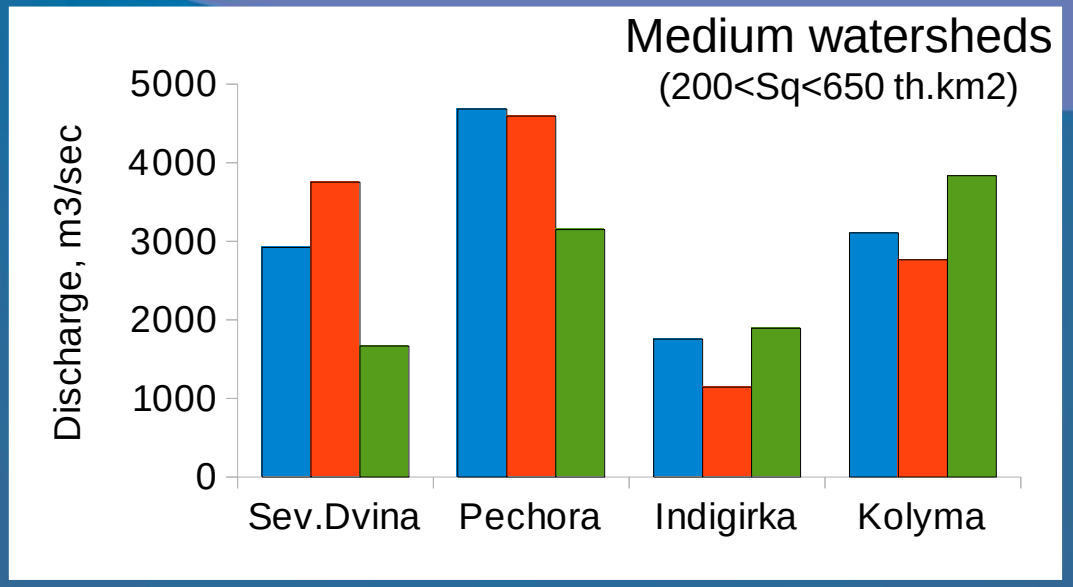


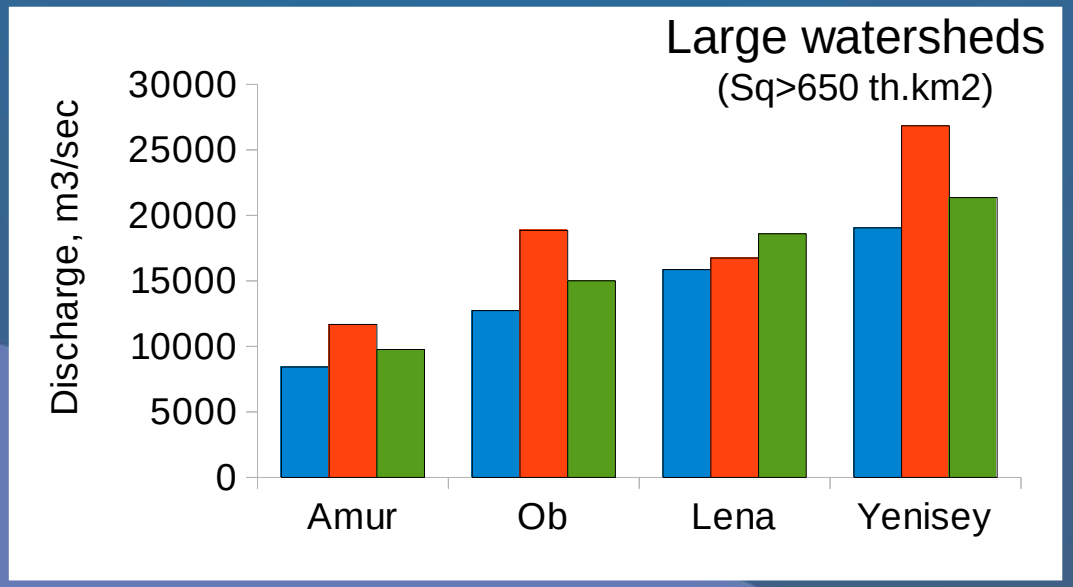
- Observations*

- RCM

- reanalysis CFS

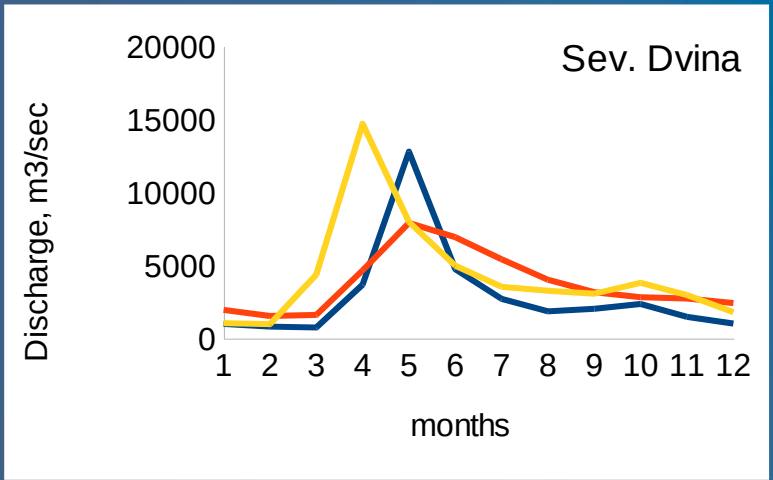
* Observation data:
The Global Runoff Data Center, Koblenz, Germany

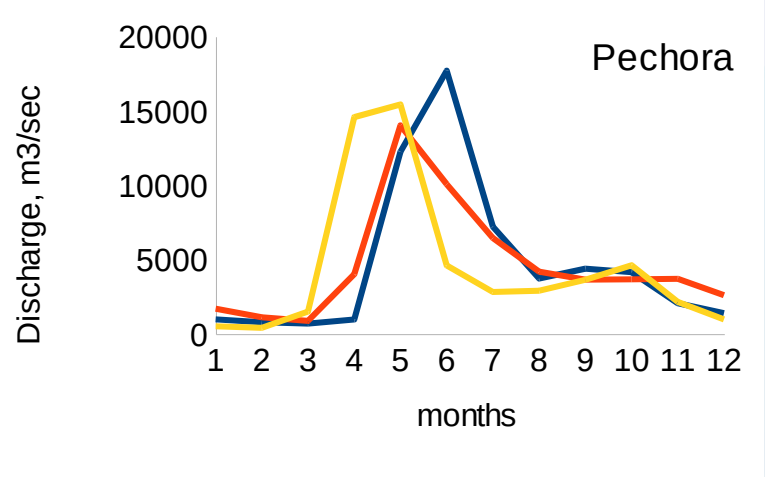


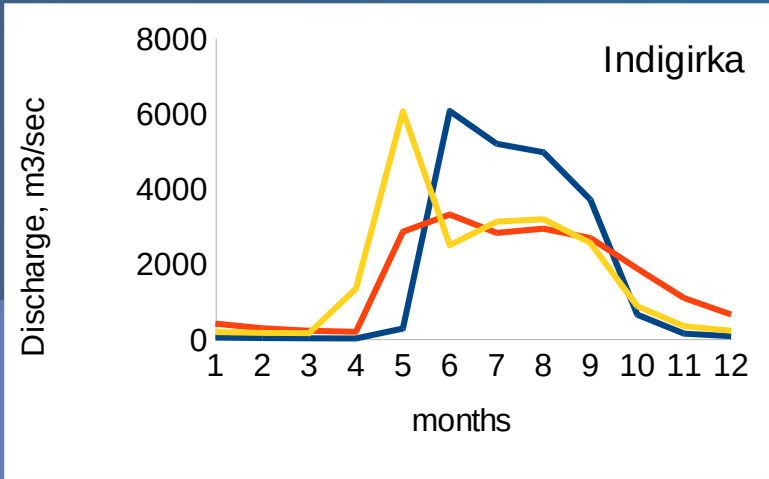


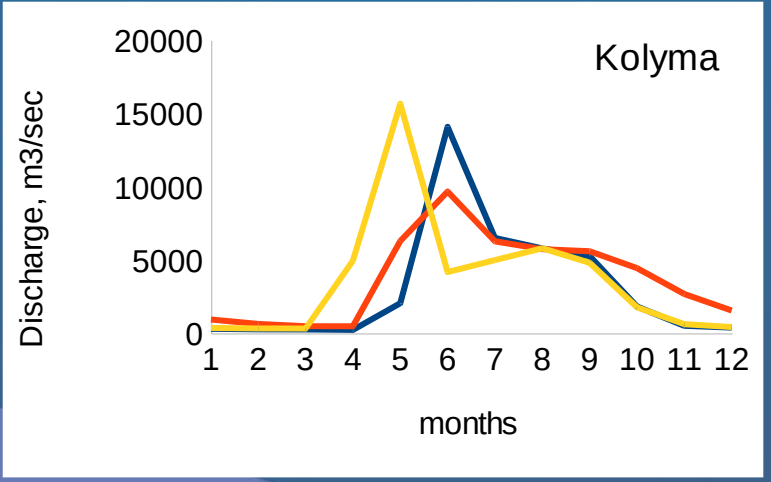
Mean hydrographs

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY





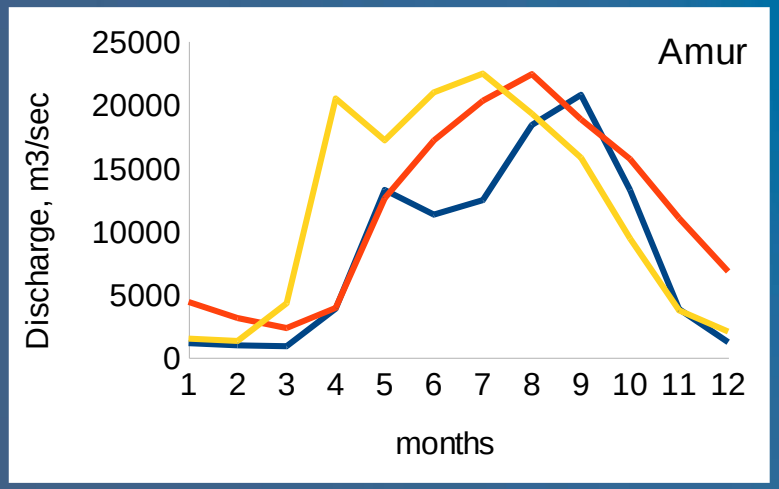


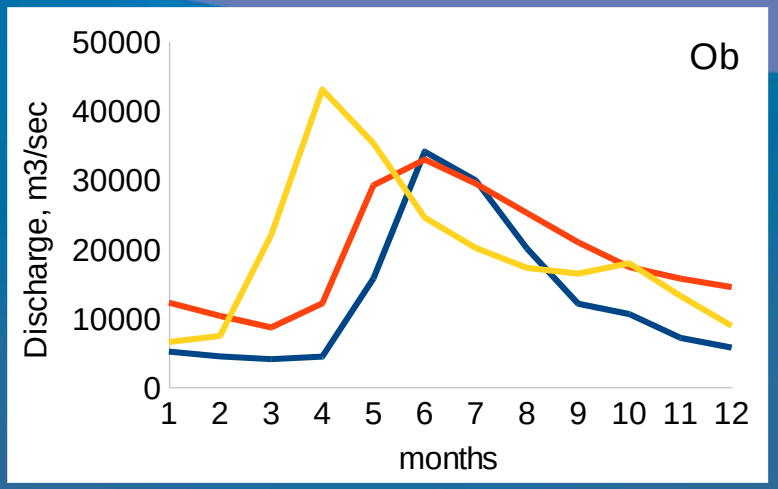


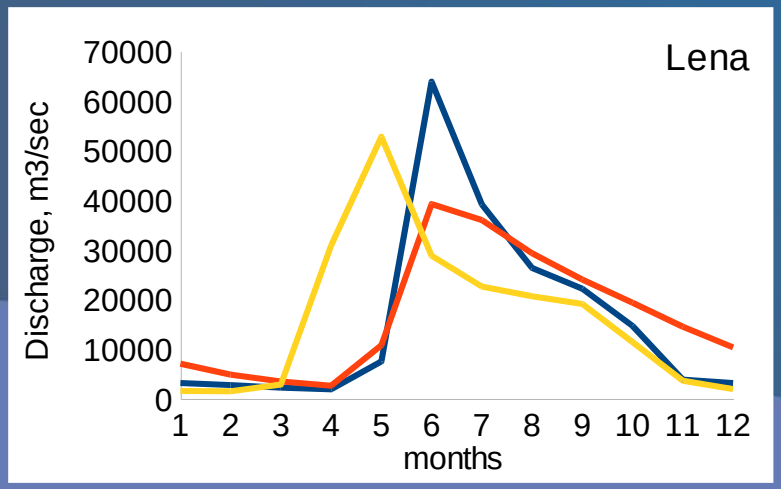
observations with RivRout without RivRout

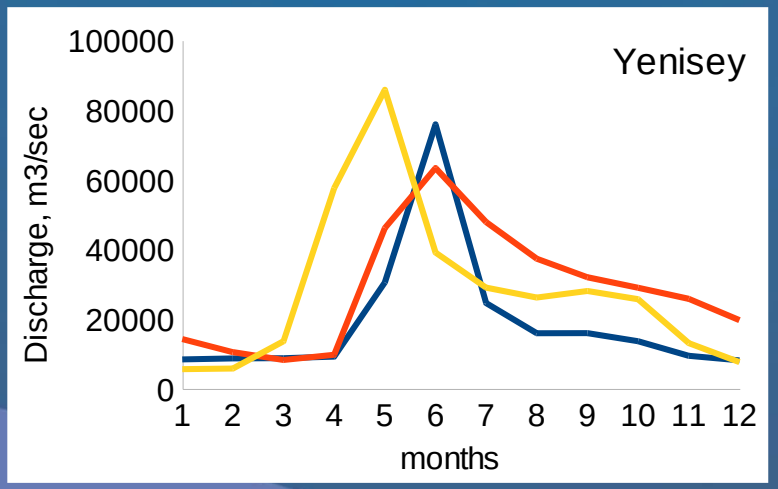
Mean hydrographs

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY



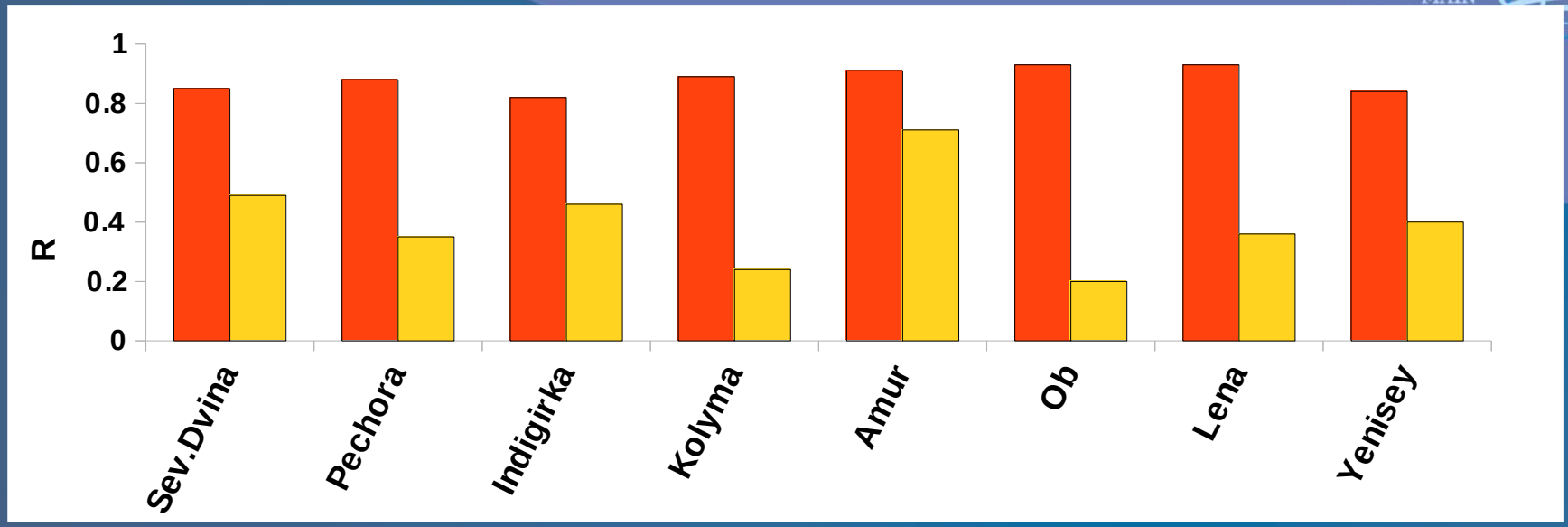




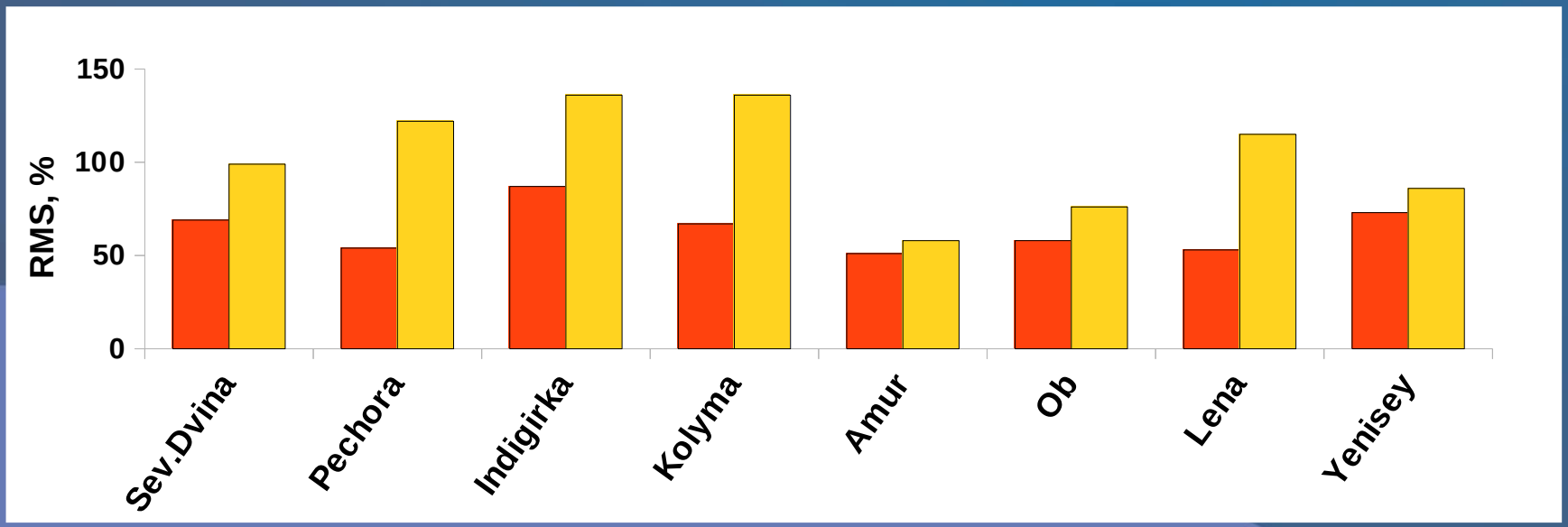


observations with RivRout without RivRout

Correlation coefficient between simulated and observed hydrograph



RMS between modeled and observed hydrograph

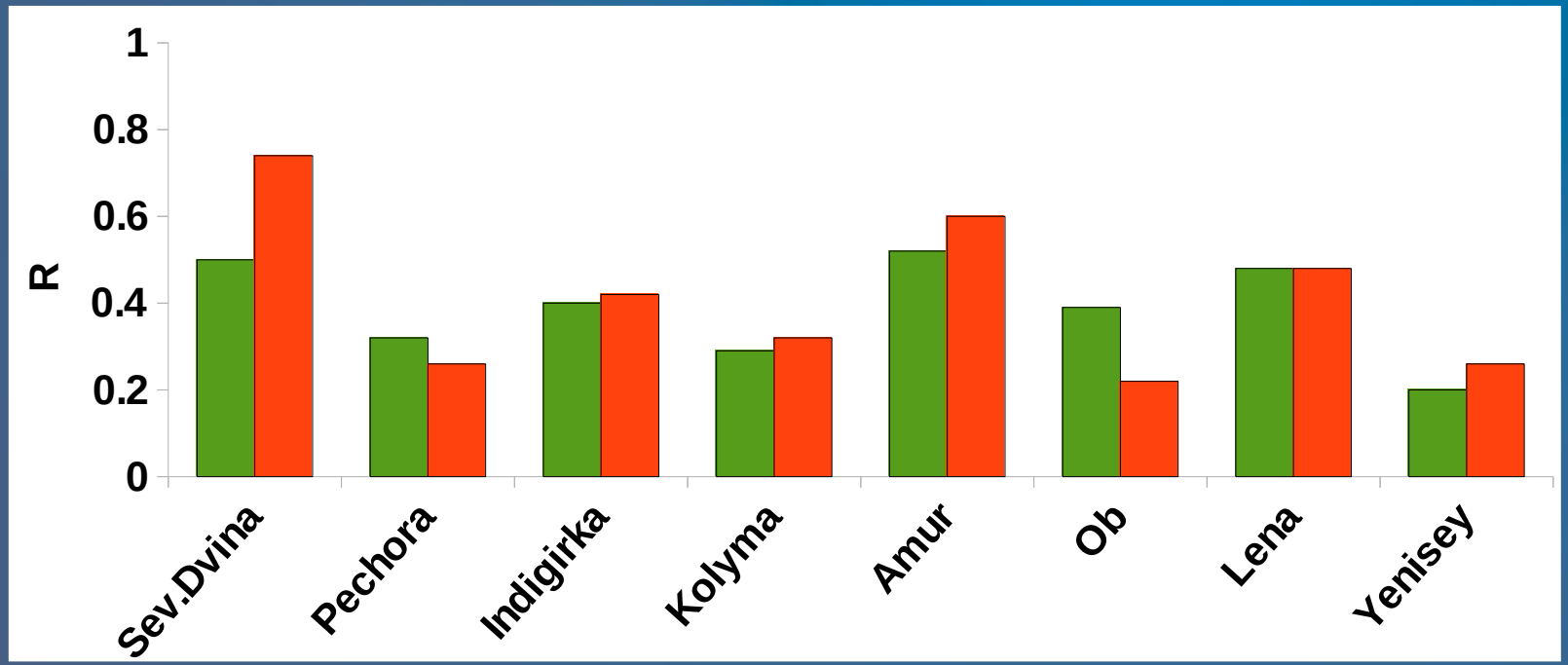


- with RivRout

- without RivRout

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

Correlation coefficients of discharge mean monthly anomalies



- between reanalysis CFR and observations

- between RCM+RivRout and observations

Summary

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

✓ The validation of the river flow routing scheme coupled with RCM driven by reanalysis has been carried out.

✓ The simulated daily river discharge estimates at the stations locations are in reasonable agreement with observations, notably in the plain regions. The larger disagreement can be found in the mountains where simulated discharge is affected by significant precipitation errors.

✓ The scheme is valid for use in the assessment of the expected flood changes under global warming across the watersheds of the northern Eurasia.

VOEIKOV
MAIN
GEOPHYSICAL
OBSERVATORY

Thank you for attention!