

Towards flood assessment over Eurasian watersheds using RCM and river flow routing algorithm

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7th Study Conference on BALTEX, Borgholm, Sweden, 10-14 June 2013



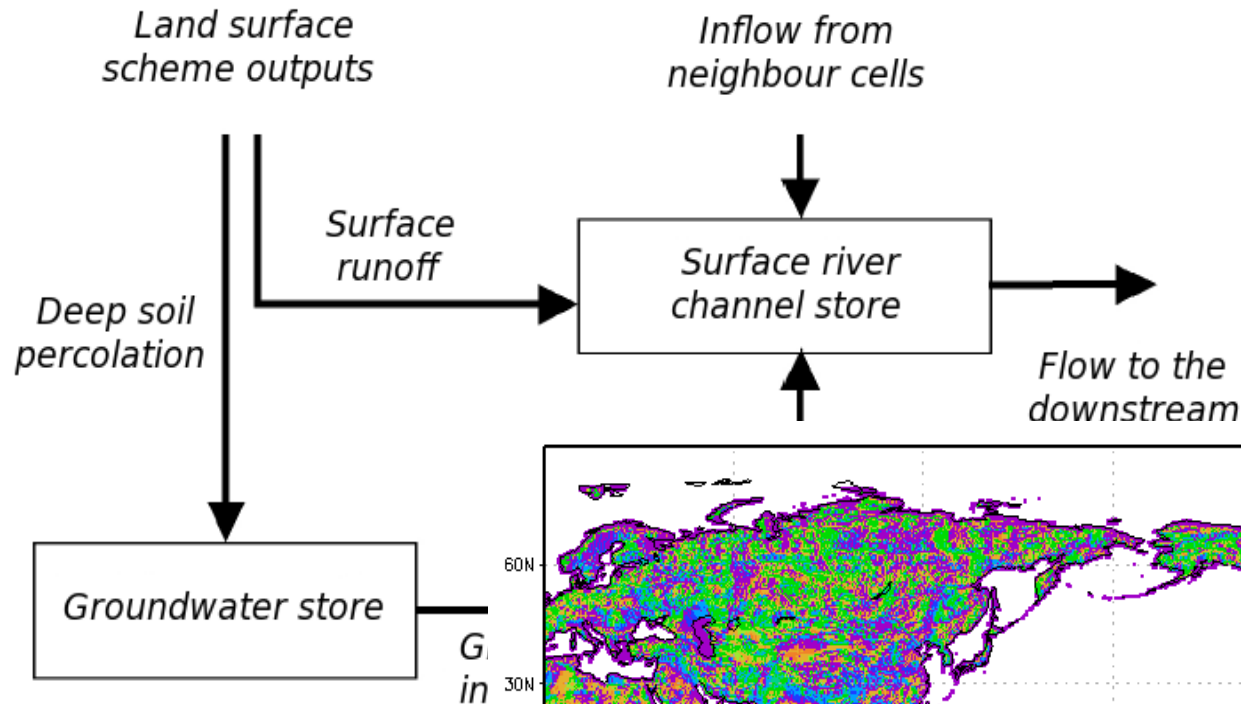
Motivation

- ✓ 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 (RRS) - estimation of frequency and intensity of extreme hydrological events across Russian watersheds



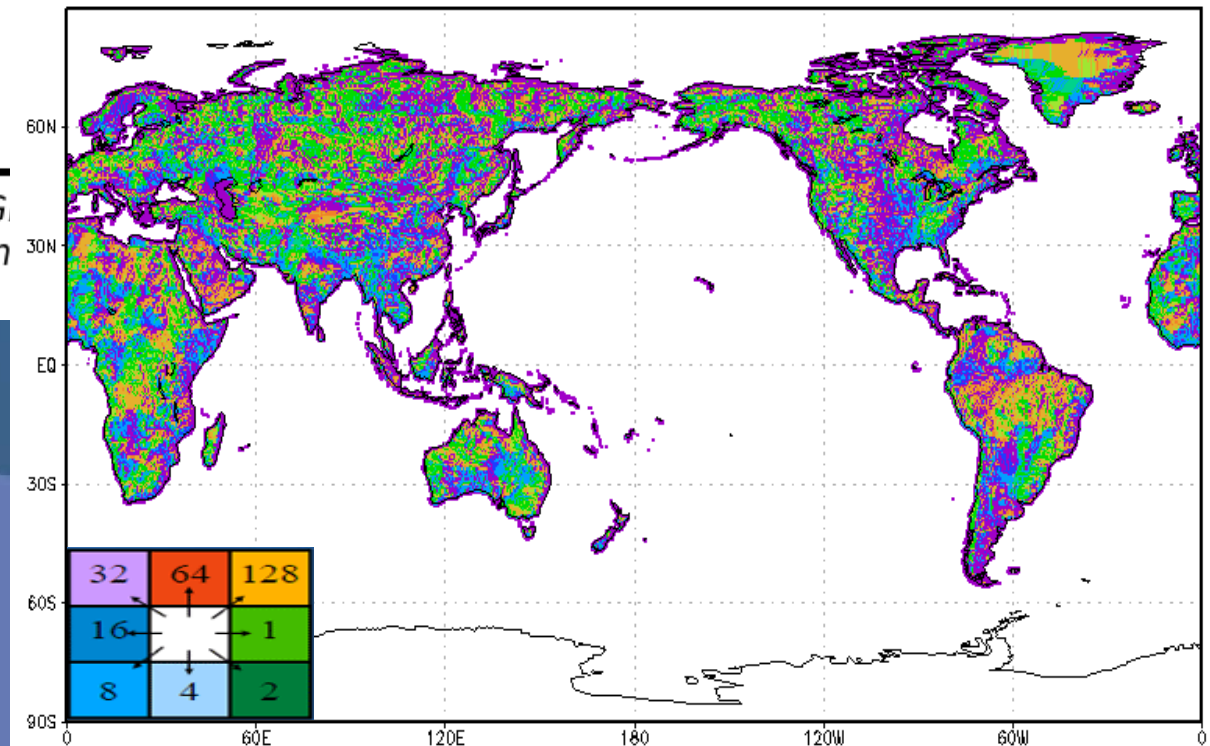
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River flow routing scheme



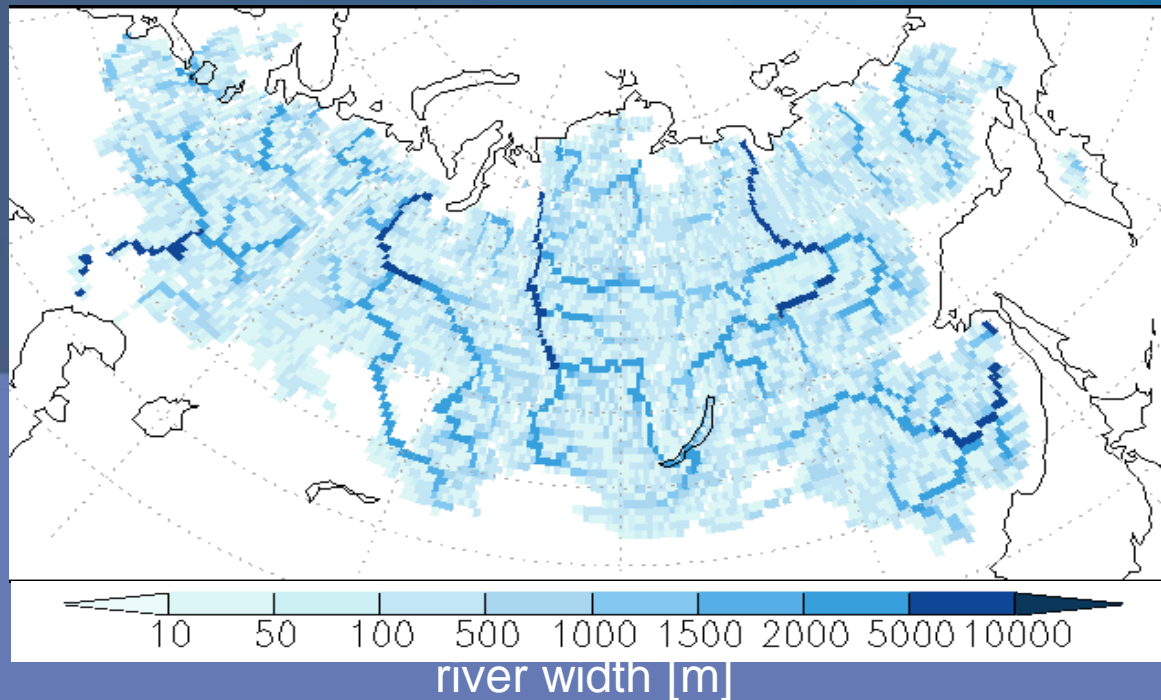
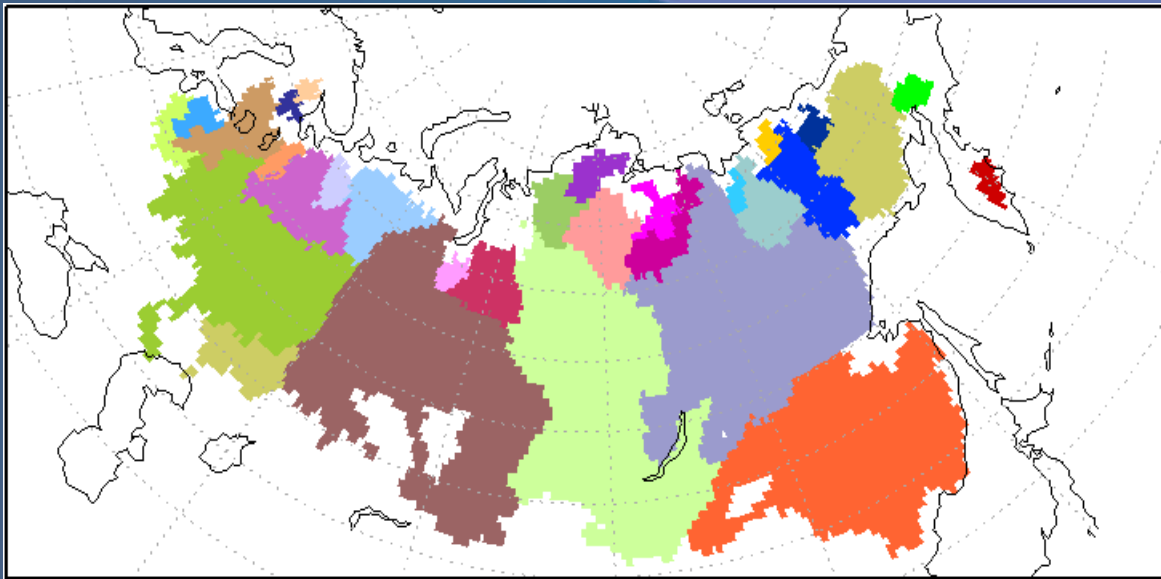
Global drainage direction map

(Döll and Lehner, 2002)





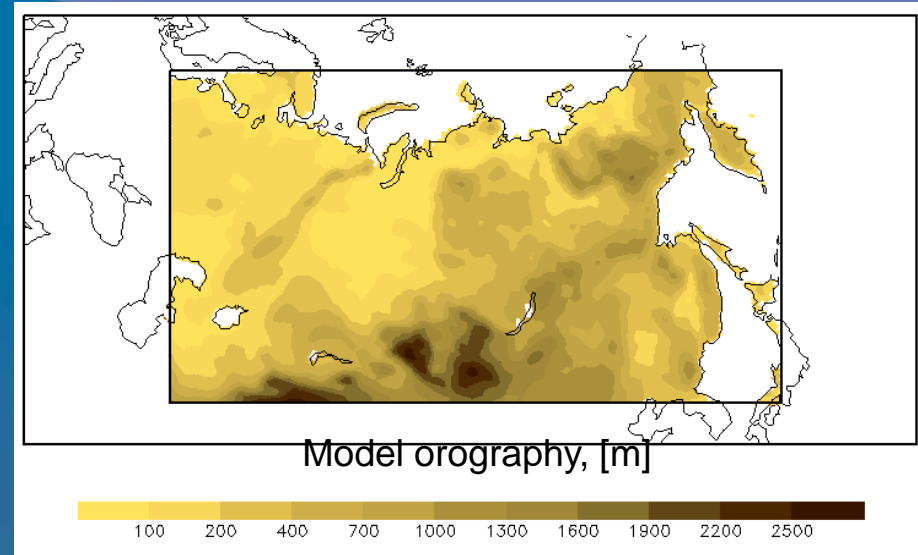
Watersheds covered by RCM



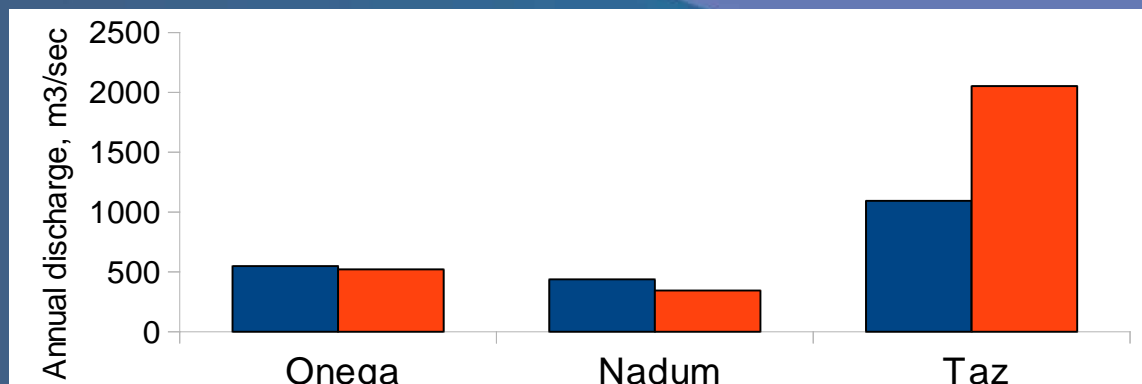
Simulated river network for
the watersheds of Russia
(resolution $0.5^\circ \times 0.5^\circ$)

MGO RCM

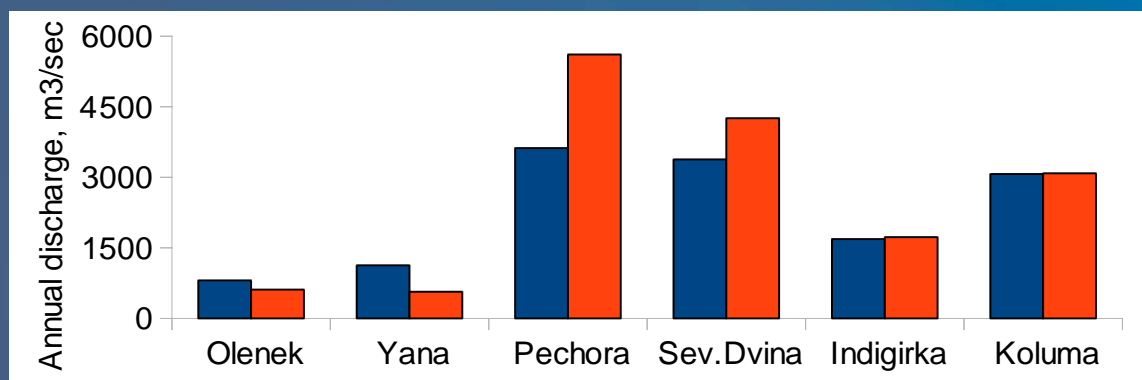
- 161×91 grid points (50 km resolution)
 - 25 levels in the vertical
 - Full physical package from MGO AGCM
-
- A series of climate simulations spans 20yr slices (1981-2000)
 - Driven by ERA-40, NCEP, JRA reanalysis and SST/IC analysis
 - Focus is on the characteristics of hydrological regime:
 - annual mean water discharge at the river mouths
 - mean monthly hydrograph at the river mouths
 - number of days with high flows



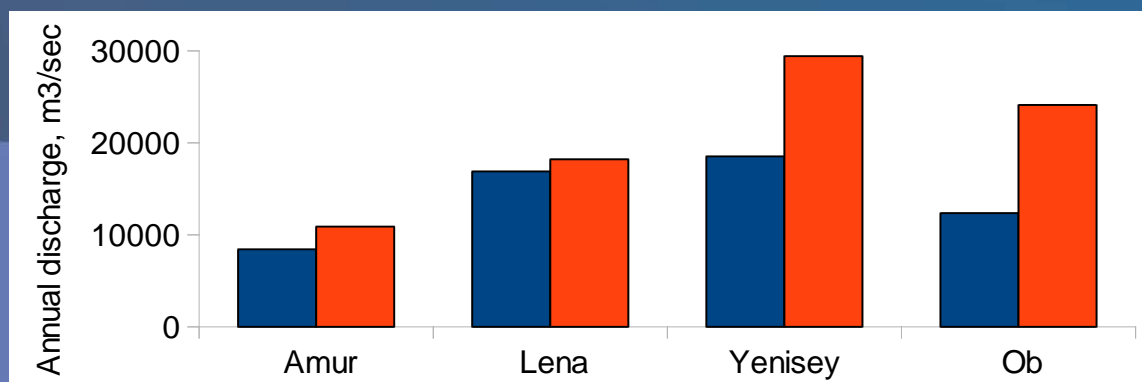
Annual mean water discharge



Small watersheds
($S_q < 200$ th. km²)



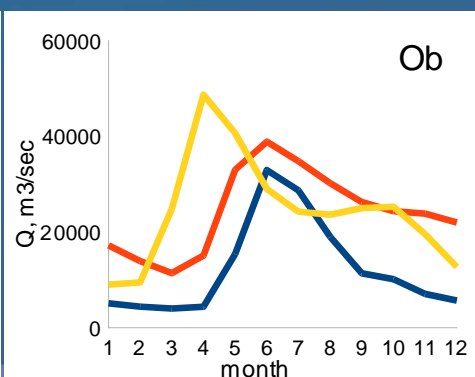
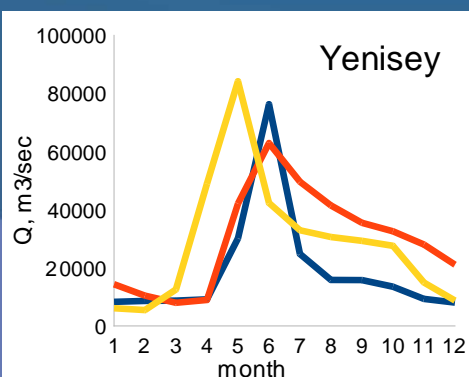
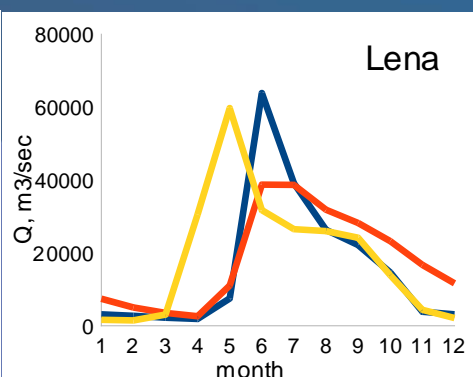
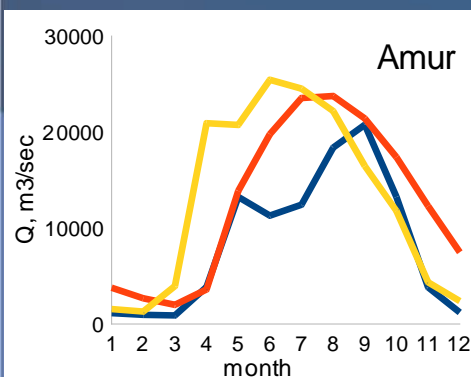
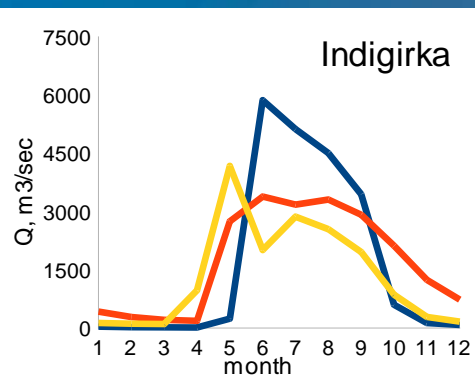
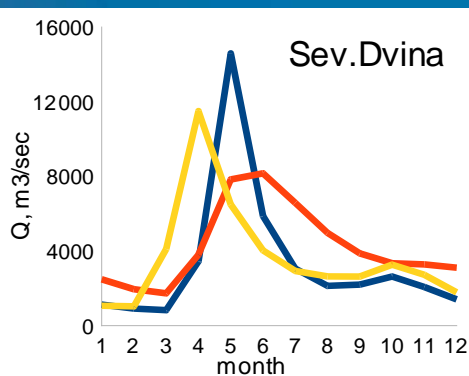
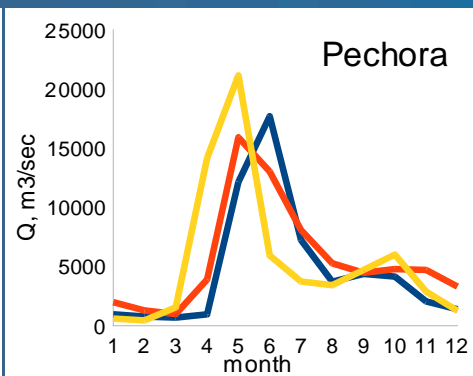
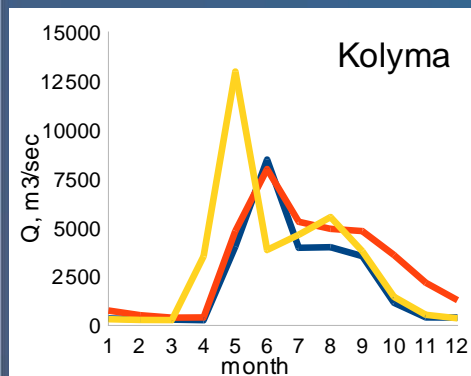
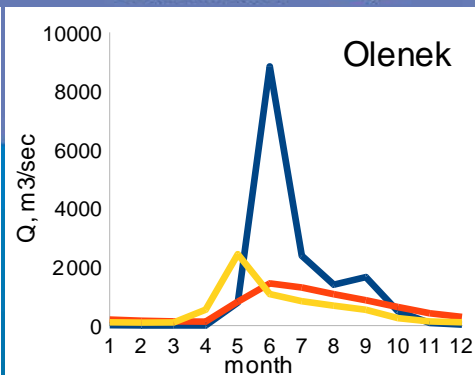
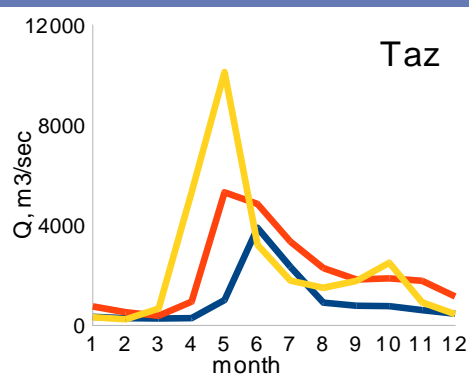
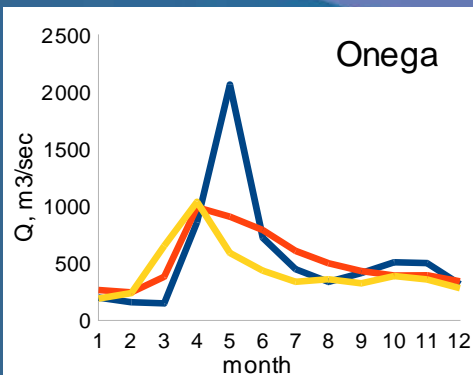
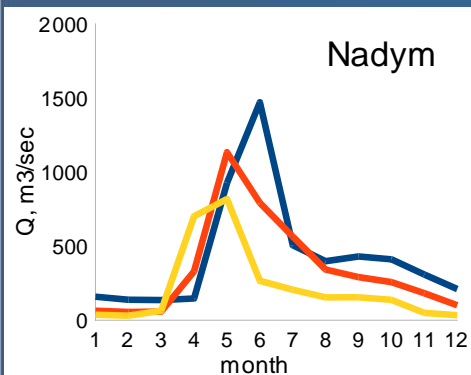
Medium watersheds
($200 < S_q < 650$ th.km²)



Large watersheds
($S_q > 650$ th.km²)

■ - observations ■ - with RRS

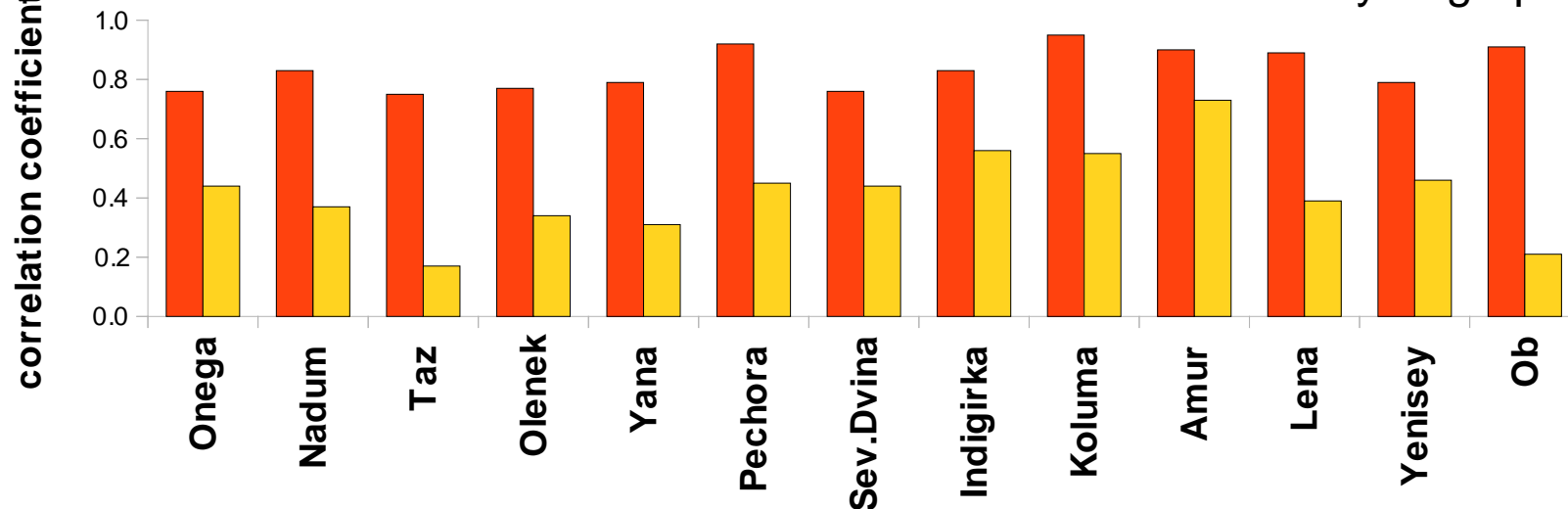
Mean hydrographs



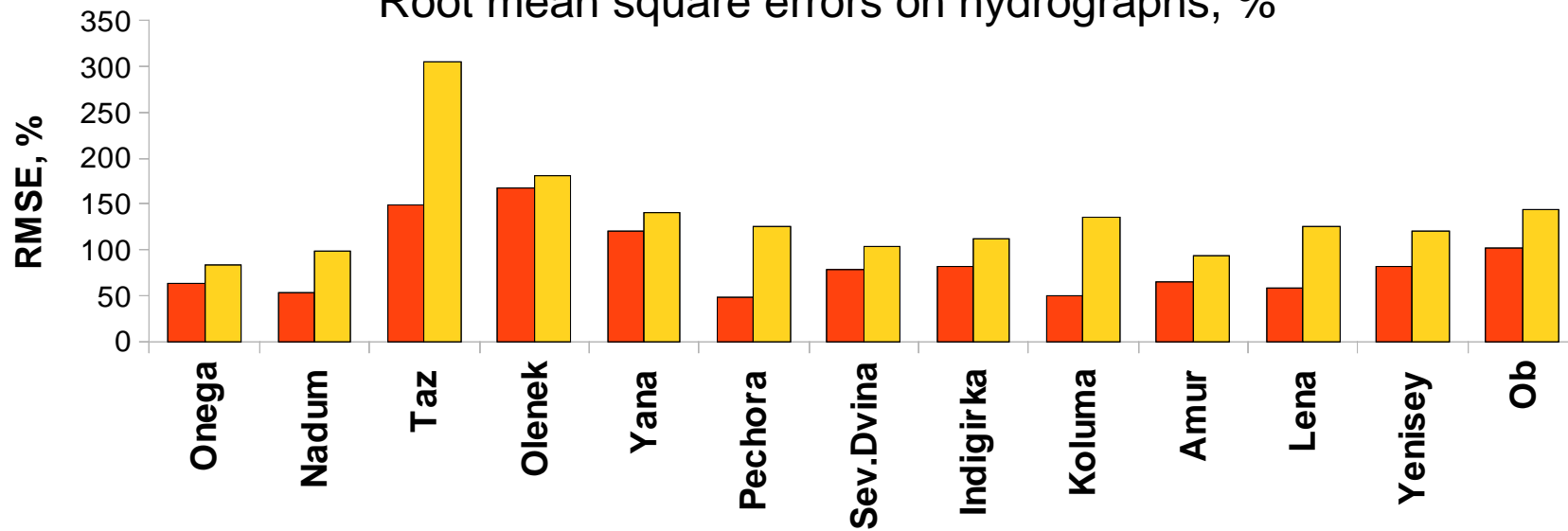
— observations — with RRS — without RRS



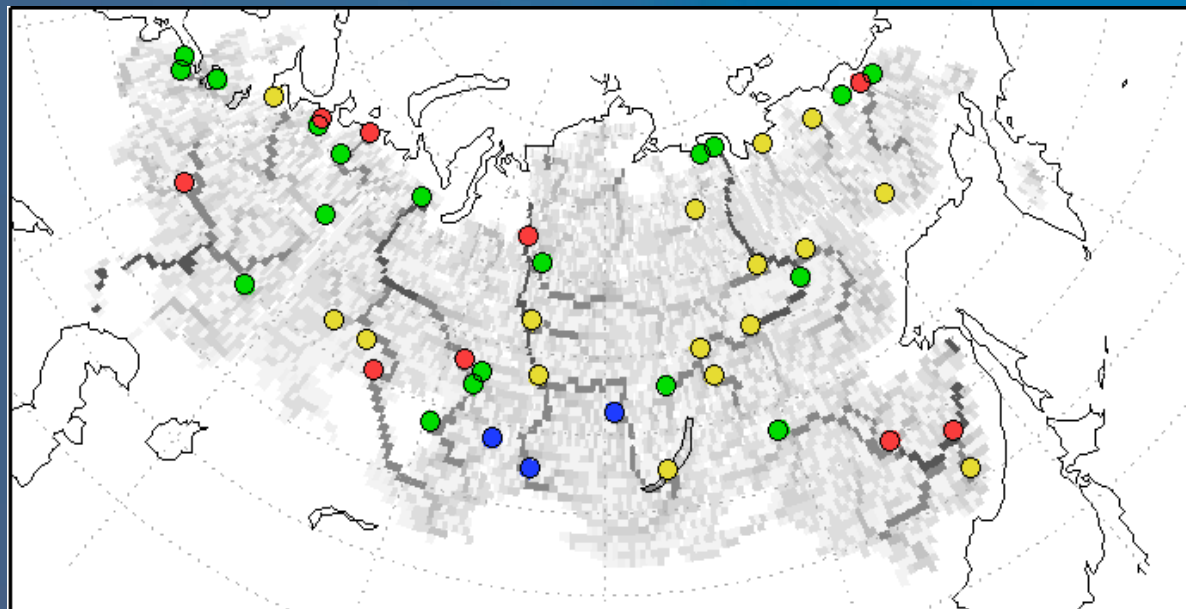
Correlation coefficient between simulated and observed hydrograph



Root mean square errors on hydrographs, %

 with RRS without RRS

Correlation coefficients of the monthly mean anomalies of discharge with observations

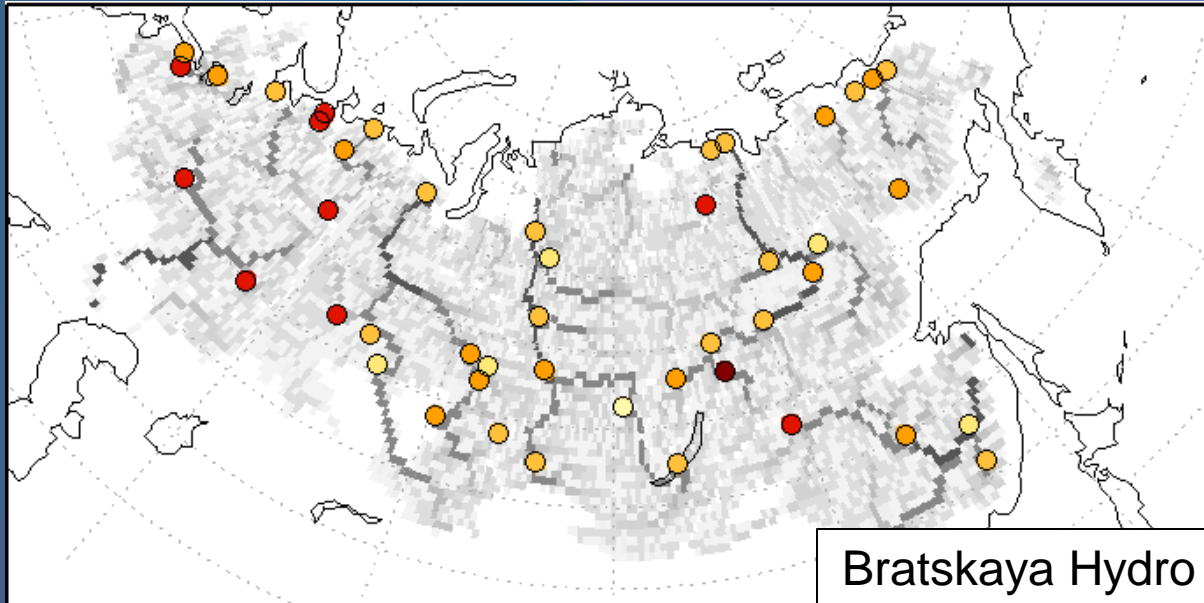


- -0.2 .. 0.0
- 0.0 .. 0.2
- 0.2 .. 0.4
- 0.4 .. 0.6

Observation data: The Global Runoff Global Centre, Koblenz, Germany

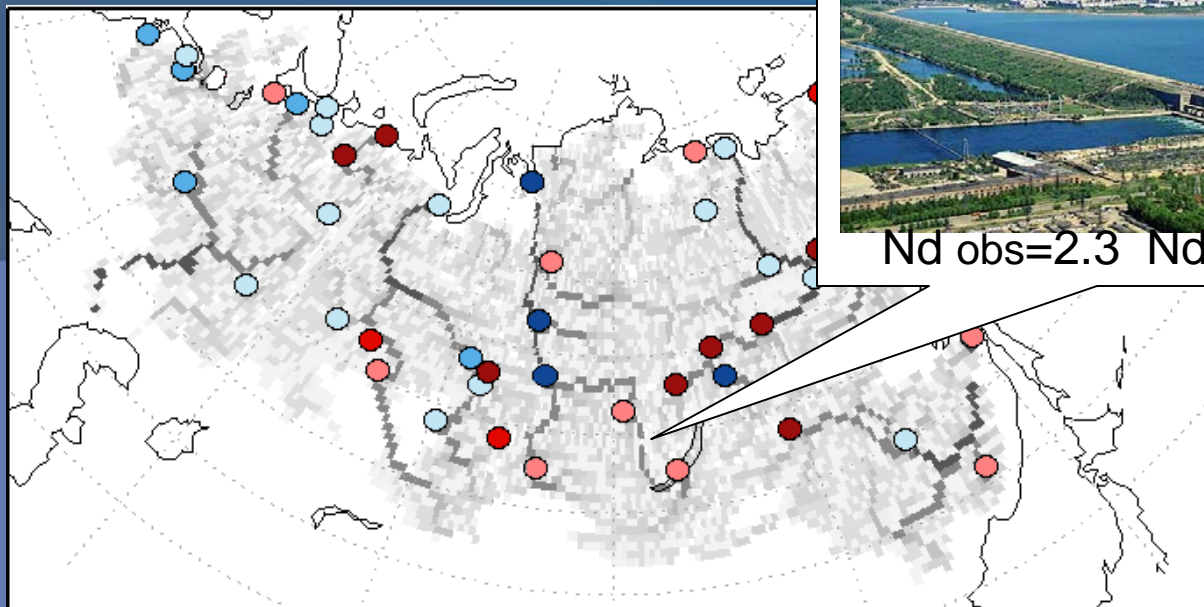
Annual number of days with extreme discharge

Observations



- 0 .. 5
- 6 .. 10
- 11 .. 15
- 16 .. 20
- 21 .. 25
- > 25

Model - observations



Bratskaya Hydro Power Plant



Nd obs=2.3 Nd mod=12.5

20 %
) %

- 0 % .. + 20 %
- + 20 % .. + 40 %
- > + 40 %

- ✓ The validation of the river flow routing scheme coupled with RCM driven by reanalyses 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.



Thank you for attention