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Occasional floods on the Russian Plain: types, frequency and conditions for the origin in the face of changing climate

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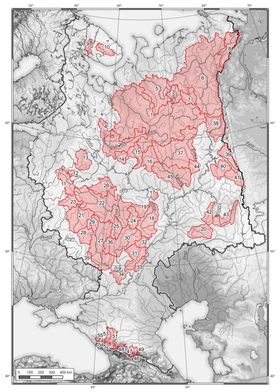
MAIN GOAL: to estimate various characteristics of occasional flood peaks with different genesis for period before and after epoch of climate change

OBJECTIVES:

- To adopt hydrograph separation scheme for 55 watersheds and to calculate characteristics of snowmelt, rain and mixed occasional floods on European part of Russia
- To analyze spatial patterns for evaluated parameters (runoff depth, maximum unit discharge, dates of maximums, total runoff, number of peaks)
- To identify tendencies in different flood types dynamics during last 70 years of hydrological observations



DATA:

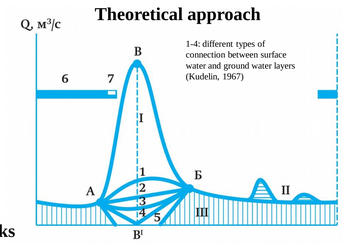
- Daily discharge for 55 representative watersheds for 1945 - 2017
- Daily NOAA-CIRES 20th Century Reanalysis V2 (1945-1978) and ERA-Interim Reanalysis data for temperature and precipitation
- Similar hydrograph separation algorithms, realized in international practice (software: BFI+, FlowComp, WHAT, RC)

1 Principal scheme of hydrograph separation

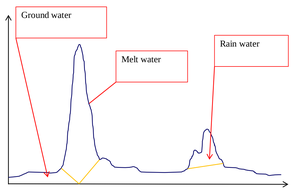
Assumed mechanisms

- Zero ground water input during the day of the Q max
- Linear interpolation of ground water discharge from start to the end of seasonal flood wave
- Well-pronounced seasonal flood wave (> 50 % of the runoff)
- Uncertain form of seasonal flood wave with overlapping rain
- Stable summer-autumn low flow period
- Autumn occasional flood period

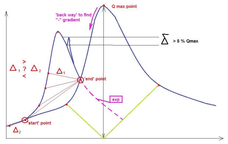
Theoretical approach



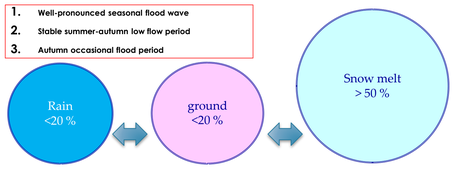
East-European type of water regime



Separation of mixed peaks overlapped on the main seasonal-flood wave



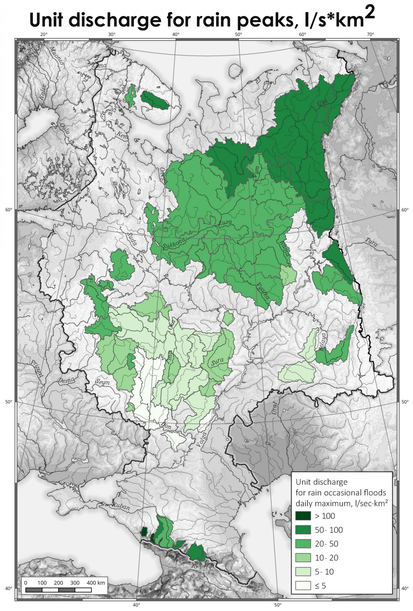
1. Well-pronounced seasonal flood wave
2. Stable summer-autumn low flow period
3. Autumn occasional flood period

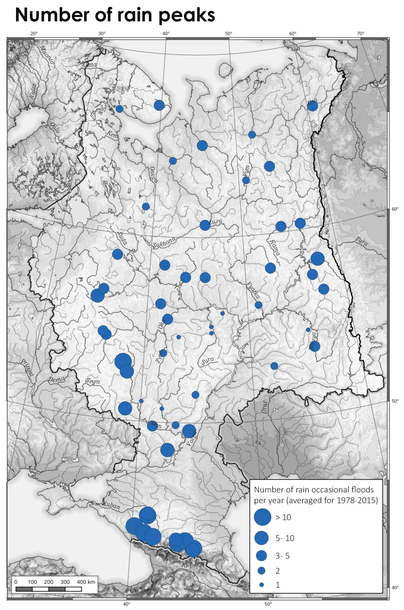


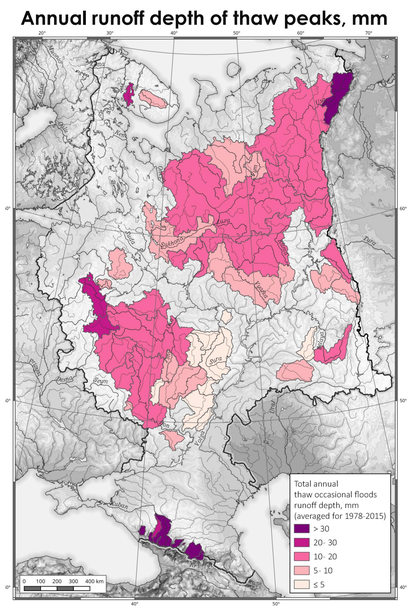
Assumed classification of occasional floods:

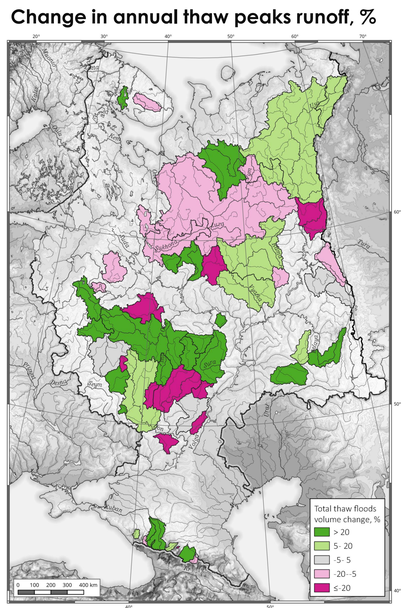
- Thaw peaks during cold period
- Mixed peaks during cold period
- Mixed peaks overlapping on the rise of main seasonal flood wave
- Rain peaks overlapping on the decline of main seasonal flood wave
- Rain floods during warm period

2 Spatial patterns in different peak flow characteristics on the Russian Plain



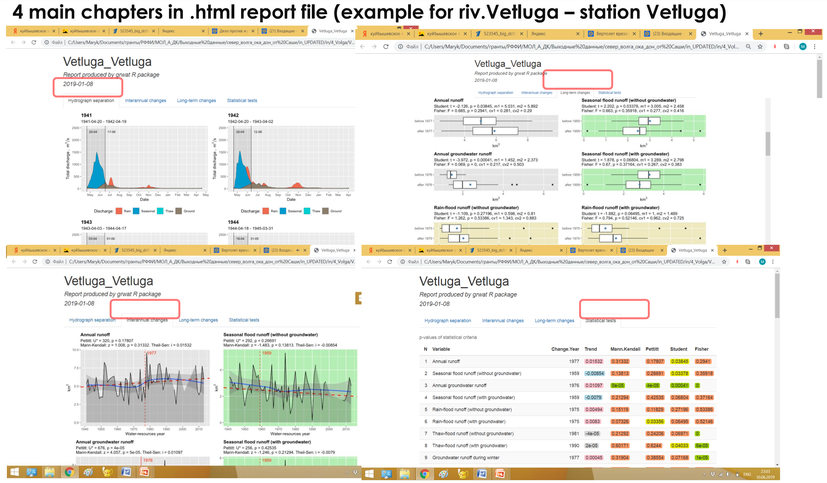






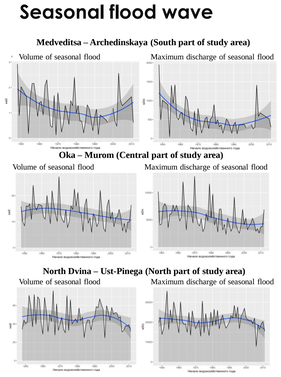
3 Visualization of the results: .html report file

4 main chapters in .html report file (example for riv.Vetluga – station Vetluga)



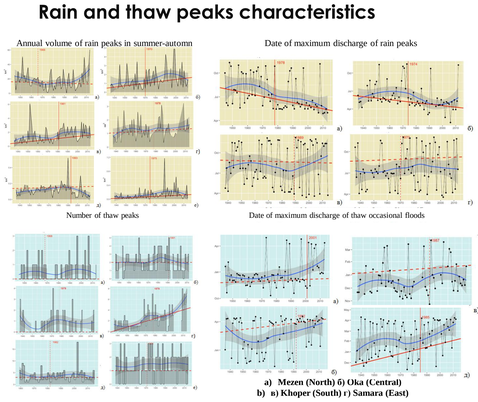
4 Intra annual and long-term changes of main hydrological parameters

Seasonal flood wave



Basically for all sites volume of seasonal flood decreased as well as snow melt maximum

Rain and thaw peaks characteristics



a) Mezen (North) б) Oka (Central)
в) Khoper (South) г) Samara (East)

Volume all of occasional rain peaks rise mostly and the dates of rain flood maximum in last 40 years have tendency to observed in all seasons. Number of thaw floods rise as well as their dates switch to later period

5 Conclusions

- Increase in number of rain and thaw peaks during winter and summer-automn low flow season
- West-East distribution in maximum unit discharge with highest rates in foothills of Ural and Caucasus
- Maximum discharge of rain peaks comparable with main seasonal snow melt peak
- Increase in runoff volume during rain and thaw peaks (for some years it is higher then volume of snow melt wave)
- Obvious hydrograph transformation