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Frequencies of cyclones with different origin within the territory of Belarus and their impact to hydrometeorological conditions

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Basic characteristics of the reanalysis datasets used in this study

Reanalysis	Spatial resolution of output	Spectral/ vertical resolution	Time resolution of output
NCEP/NCAR 1949-2012	2.5° x 2.5°	T62L28	6 hours
ERA–Interim 1979–2012	0.75° x 0.75°	T255L60	6 hours
20 century reanalysis 1949–2012	2° x 2°	T26L28	6 hours



Map of Europe showing the study domains with Belarus in their center and examples trajectories of four types of cyclones with different origin



Meteorological and hydrological stations in Belarus used in the study



Time series of the total number of cyclones located within domain 40–65° N 05–45° E according to different reanalysis





Cyclone numbers statistics (average number of cyclones partitioned by origin) for NCEP/NCAR, Era-Interim and 20 century reanalysis per season (December through February) in three domains.

Domain	05–45° E 40–65° N	20–35° E 48–60° N	23–33º E 50–56º N
Reanalysis	Cyclones Number: Scandinavian/West/North/South (S/W/N/S)		
NCEP/NCAR	3/13/ 8/21	2/8/3/5	1/4/2/3
ERA–Interim	4/16/11/23	1/8/4/5	1/4/2/3
20 century reanalysis	2/8/5/22	1/5/2/4	1/2/1/2

Cyclone characteristics with statistically significant trends (at the 0.05 level) are marked in bold

Tine series and liner trend (statistically significant at the 0.05 level) of North (A) and South (B) cyclones in the first domain (40-65° N and 05-45° E)



Dynamic of air temperature and precipitation in winter



Deviation from the average of the seasonal air temperature in the Baltic Sea basin



Seasonal sums of precipitation in the Baltic Sea basin

Spatial distribution of net change in the monthly precipitation, mm (A), its daily maximum values, mm (B) and duration, hours (C)





Component plots of factors in rotated space for 4 river basins within the territory of Belarus



Spatial distribution of the net streamflow change during the winter season (A) and spring freshet (B), litre s-1 km-2





Frequency of inundations with different grades (according to Nezhihovskiy, 1956)



3 –outstanding with repeatability 1 per 55-100 year;

- 2 large with repeatability 1 per 10-50 year;
- 1 small with repeatability 1 per 5-8 year.

Discussion

- Reanalysis and results
- Domain configuration and result
- Time-series of reanalysis datasets and significances of calculations
- Redistribution of North and South cyclones



Conclusions

- North cyclones that pass in winter along the Northern borders of Belarus, cause precipitation rise and increases of its duration and frequency of maxima. Increase in seasonal precipitation and frequent thaws added to formation of low-water streamflow on the Belorussianrivers instigating higher frequency of winter floods.
- South cyclones influence significantly the hydrometeorological conditions of Belarus. Their number has been drastically reduced. Changes of maximum streamflow over Belarus are more vivid (and statistically significant) in the North. In the Southern half of the country (Polessie), there are no statistically significant changes in precipitation and runoff.



Thank you for your attention!

