Extreme Precipitation in Northern Eurasia from Observations and Model Simulations

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Characteristics of the daily precipitation (total precipitation, rain intensity, wet day probability and heavy precipitation) for different regions of Northern Eurasia in the XX-XXI centuries are investigated. Daily station data from the RIHMI (Razuvayev et al., 1993), gridded observational data from the CRU (New et al., 2000), data of the ERA-40 reanalysis (Simmons et al., 2000) and simulations with two generations of the global climate models ECHAM4/OPYC3 (Roeckner et al., 1996; Oberhuber, 1993) and ECHAM5/MPI-OM1 (Roeckner et al., 2003, Marsland et al., 2003) are analyzed (see also Semenov and Bengtsson, 2002, Voss et al., 2002, Mokhov et al., 2003, Mokhov et al., 2005).

In particular, estimates of the regional extreme precipitation changes have been made for basins of major Eurasian rivers, such as Volga, Ob, Yenisei and Lena rivers. A general increase of precipitation intensity is found for the all rivers basins from observations and simulations with ECHAM4/OPYC3 in the 20th century (Table1).

Table 1. Relative trends of precipitation intensity from the observational data CRU and simulations with ECHAM4/OPYC3 (1901-1996), %/100 years.

Basins	Winter	Summer	Annual	Winter	Summer	Annual
	CRU			ECHAM4/OPYC3		
Volga	1.6	4.4	3.1	3.1	2.3	5.3
Ob	4.4	2.1	2.9	0.1	8.0	5.0
Yenisei	6.2	0.1	1.8	4.4	7.0	5.1
Lena	8.7	3.5	3.4	6.3	3.8	4.5

According to observations the increase of precipitation intensity is the most significant for the Siberian rivers basins during wintertime of the 20th century (Table 1). Model results show significant enhancement of precipitation intensity and heavy precipitation (exceeding the 90% quantile) for the rivers basins during the 21st century (Fig.1, 2) with the most significant increase for the Siberian rivers basins in winter (Fig.1b, d). There are significant differences in tendencies of changes of wet day probability for the rivers basins during the 21st century: with a general increase in winter (Fig.1c) and a decrease in summer (Fig.2c).

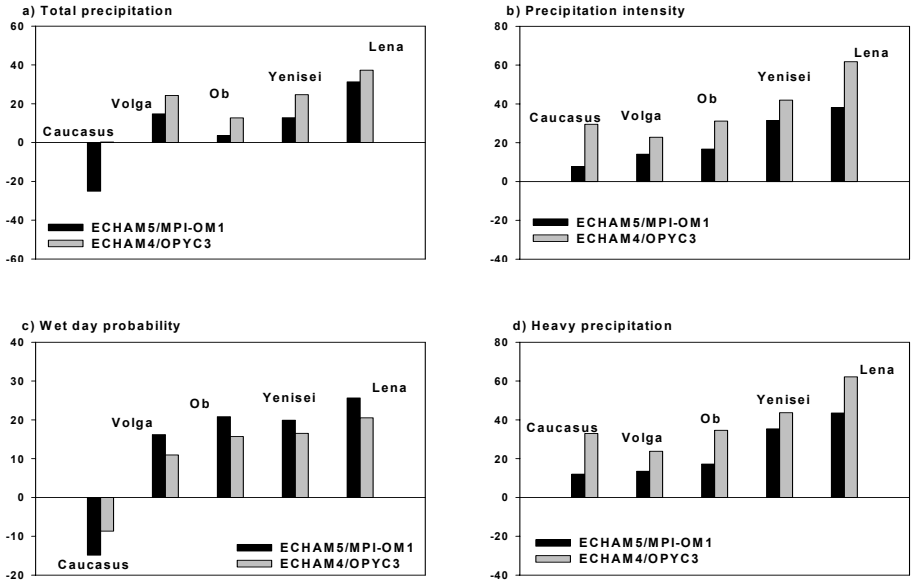

Figure 1. Relative trends for winter season: total precipitation (a), precipitation intensity (b), wet day probability (c) and upper 10% quantile (d) simulated by the ECHAM4/OPYC3 and ECHAM5/MPI-OM1 in the climate change experiment (1% greenhouse gases increase), %/100 years.

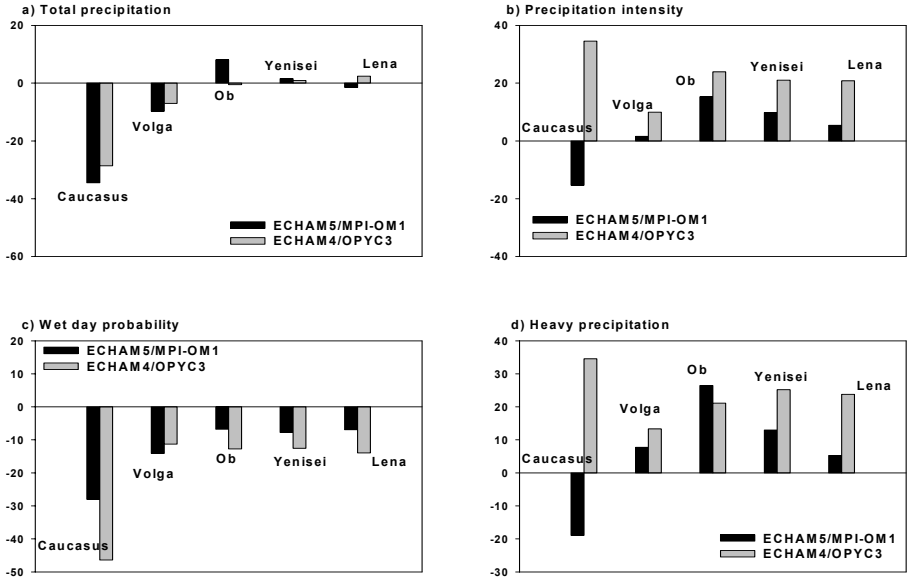

Figure 2. Same as in Figure 1 but for summer season.

Estimates of change of the extreme daily precipitation in Caucasian region from different data sets and models simulations are quite contradictory for summer season. For winter season model simulations show an increase of precipitation intensity (Fig.1b) and a decrease of wet day probability (Fig.1c) for Caucasian region during the 21st century.

In general, the model results show intensification of precipitation and its extreme values for the different regions of Northern Eurasia in the 21st century. According to observations and reanalysis the increase of the precipitation intensity already took place in the 20th century.

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