

Model projections of extreme runoff (floods) in Siberian rivers basins

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Significant variations of hydrological regime have been noted during the XX century in different regions. Strong floods during last years are associated with largest Siberian rivers, including Lena, Yenisei and Ob rivers. These rivers have extended basins from the middle to the polar latitudes in the Siberian regions with a large warming during last decades. It is necessary to estimate future changes of extreme runoff and floods probability in the Ob, Yenisei and Lena rivers basins due to possible climate changes in the XXI century.

Water cycle changes in the Siberian rivers basins, including rivers runoff, from transient runs of coupled general circulation model ECHAM4/OPYC3 (Oberhuber 1993; Roeckner et al. 1996) and IAP RAS climate model (CM) of intermediate complexity (Petoukhov et al. 1998; Handorf et al. 1999; Mokhov et al. 2002) for the period 1860-2100 are analyzed (Mokhov and Khon 2002). Changes of greenhouse gases in the atmosphere in these numerical experiments were taken from observations for the 1860-1990 period and according to the IS92a scenario (Houghton et al. 1992) for the 1991-2100 period. For IAP RAS CM simulations with change only CO₂ content in the atmosphere are analyzed. The annual-mean river runoff was characterized by a difference between annual-mean precipitation and evaporation on river watersheds. Model simulations were compared with observations for the Ob (1930-1994), Yenisei (1936-1995) and Lena (1935-1994) rivers runoff (e.g., Duemenil et al. 2000).

Figure 1 shows cumulative distributions of normalized runoff (normalized to the maximum value in the XX century) of the Lena (a), Yenisei (b) and Ob (c) rivers from ECHAM4/OPYC3 simulations for XX (thin curve) and XXI (thin dashed curve) centuries as a whole in comparison with observations (bold curve). The bold dashed curves display the appropriate cumulative distributions from simulations for the period with available observations in the XX century. These cumulative distributions were compared with similar distributions from the IAP RAS CM simulations.

According to the ECHAM4/OPYC3 simulations the maximum Lena and Yenisei rivers runoff in the XXI century as a whole can be larger on 30% and 19% respectively in comparison to the XX century. The probability of exceeding in the XXI century of the XX century maximum runoff was found from the ECHAM4/OPYC3 simulations to be about 7% and 11% for the Lena and Yenisei rivers, respectively. No significant changes of the extreme Ob river runoff between XX and XXI centuries (as a whole) have been noted from the ECHAM4/OPYC3 simulations.

According to the IAP RAS CM simulations the maximum Lena, Yenisei and Ob rivers runoff in the XXI century as a whole can be larger on 60%, 13% and 37% respectively in comparison to the XX century. The probability of exceeding in the XXI century of the XX century maximum runoff was found from the IAP RAS CM simulations to be about 38%, 5% and 15% for the Lena, Yenisei and Ob rivers, respectively.

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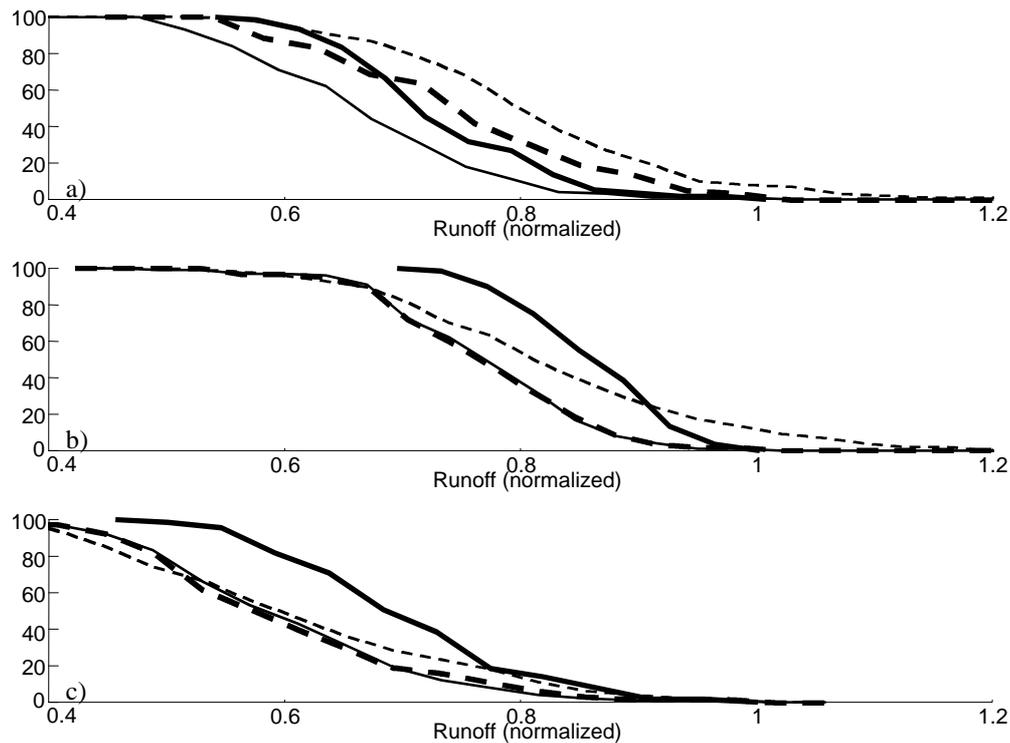


Fig.1.

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