Geophysical Research Abstracts
Vol. 12, EGU2010-12346, 2010
EGU General Assembly 2010

An experience of accounting subgrid effects in the distributed model of runoff generation

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Application of the physically based model of runoff generation developed at Water Problems Institute of RAS is presented. The model is based on the finite-element schematization of the river basin. To describe the subgrid effects, we proposed that some parameters inside of finite elements are gamma-distributed. To assign the coefficient of spatial variation of these parameters, we used empirical relationships or apply scaling of gamma-distribution parameters based on the statistical self-similarity theory.

The hypothesis of statistical self-similarity was applied for snow water equivalent spatial fields and for log of saturated hydraulic conductivity of soils. To test the hypothesis of statistical self-similarity for snow cover, the snowpack measurements at the river basin areas from 16000 to 100000 sq. km in five different physiographic regions of Russia were analysed. It was shown that the semi-variograms of snow water equivalent for all these regions have a power structure and the fractal dimensions varies from 2.67 to 2.92. The numerical experiments were carried out to estimate the sensitivity of runoff hydrographs to fractal dimension of the snow water equivalent fields.