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Exstreme Hydrological Events - Drought and Flood in Context of Changing Climate

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Abstract: There is a little reason to doubt today that the planet is undergoing alarming climate change. In the recent thirty or so years except the natural shortage of streamflow in the summer and autumn, water resources are aggravates additionally both from human activities and from the climate change impact. As the indication of climate changes impact has been ascertained since 1982, this year is suggested as a shift point year in Bulgaria. The very heavy drought period of about twenty years (1982-2000) has manifested over all territory in Bulgaria. The water resources generated during this dry period is about 40% less than the normal. After the longest drought period in the hydrological observation history, a few very heavy floods occurred in Bulgaria between February and August in 2005, 2006 and 2007 years. They caused massive losses of livestock and immense damages to the infrastructure and economic activities. The houses of hundreds of people were flooded.
The aims of this paper are to present the similarity and difference of the concepts for both extremes floods and drought, and also to present the potential impact of climate change on hydrological extremes for decades further.
Therefore, three types of synoptic situations causing floods and two types of atmosphere circulations usually created climatologic drought over Bulgaria have been described. The multi-yearly variation of the precipitation during the period 1904-2007 has been analyzed. Among the 104 years annual precipitation's sums, 9 very heavy (over 800 mm) annual sums have been detached. Five of them have been occurred during the last fifteen years, i.e. the frequency of the floods has increased drastically to 34 % for the last period. As a distinguished from the usual heavy rains ($Q \geq 30$ mm/24 h)., these in 2005 have longer durations. The number of days with heavy rains in this year is picking out from the rest. It has been fond that the number of days with heavy rains has increased during the last fifteen years. The water resources of the country, generated in this very wet 2005 year amounted to 27391x10 6 m 3, which corresponds to 13% Probability of occurrence.
The impact of climate change have been evaluated by transferring changes of precipitation and temperature, as output variables from regional climate change models, to hydrological models. Two climate models HadCM2 and ECHAM4 have been selected and used from the MAGICC/SCENGEN package (Models for the Assessment of Greenhouse-gas Induced Climate Change/ SCENario GENerator) because they are produced in Europe and are the most suitable for the European conditions. These models were applied to the real data of two representative basins: of the Osam river (in North Bulgaria-continental climate) and the Struma river (in South Bulgaria - Continental-Mediterranean climate). The flow of both the rivers is strongly influenced by human activities, what imposes a naturalization of the flow to be determined.
The analysis of the potential impact of climate change on the flow of two representative Bulgarian rivers showed decreasing of the runoff. The degree of the decrease of runoff varies regarding the assumed time horizons, but exhibits acceleration towards 2100. The second order tributaries will be dry towards 2050, 2100. The magnitude of runoff decrease changes from north to south. Moving in the direction of seasonal horizons, the discharge during the summer will be rapidly decreased (most significantly in July and August) according to the results used by the HadCM2 model. Since ECHAM4 models mark high values of precipitations in July and August, floods will be in these months. During the other seasons, the runoff will gradually decrease. The size of decrease of low flow will be greater according to the HadCM4 scenario.
Keywords: drought ,flood, hydrological extreme events, water resources management