Geophysical Research Abstracts
Vol. 14, EGU2012-10526-1, 2012
EGU General Assembly 2012

Sustainable Water Resources Management of small catchments under climate change: New Approaches at the Fredersdorfer Mühlenfließ, Germany

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Water budgets of many catchments in north-east Germany have experienced a drastic change throughout the last decades. Intensive alteration in land and water use, combined with climatic changes has led to considerably less groundwater recharge. Due to the relative small amount of water stored, particularly small catchments are considered to be vulnerable for environmental loss as a consequence of low flow episodes. Climate scenarios for this region suggest continuing changes like increasing evapotranspiration rates during summers and changes in the seasonal pattern of precipitation, leading to an increase in the likelihood of low and high flow conditions. In addition, suburban population growth and arising anthropogenic influences like increasing water consumption are expected to aggravate low flows during summer. Water management of small catchments in this region do not consider these changes. Therefore, new concepts including a variety of measures to deal with episodic droughts and floods have to be developed in order to preserve the integrity of these rivers as ecosystems as well as a resource for the future. Prerequisite for such new concepts has to be a detailed analysis of the hydrological system at hand and the processes which led to the current conditions.

At the Fredersdorfer Mühlenfließ river located north–east of Berlin, Germany, recurrent episodes with no discharges for several weeks during summer as well as overall decreasing discharges have been observed in the last decade. The study aims at the exploration, evaluation, installation and monitoring of possible counter-actions to this development. A systems analysis concept is developed focusing on identifying and modelling the dominant hydrological processes that control the flow dynamics. A high-resolution monitoring program of ground and surface water forms the basis for successive data analyses and interactive hydrologic modelling. Data analyses including hydraulic and hydrochemical parameters will be done using linear and non-linear ordination methods like Principal Component Analysis or Isometric Feature Mapping. Findings of the data analyses will be used to build a groundwater model in order to capture the flow dynamics based on the processes identified. Furthermore, simulations of past and future hydrological developments in combination with the results on dominant processes will be used to develop possible measures, stabilising the flow conditions at the Fredersdorfer Mühlenfließ.