



Water scarcity and economic damage in Europe: regionally relevant simulations from 2000 to 2050

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Water availability is unequally distributed across Europe. Where certain regions experience a surplus of water, other areas have limited water availability which causes economic damage to the water using sectors such as households, industries or agriculture. Future changes in climatic and socio-economic conditions are expected to further increase the competition for available water that is already present in Europe. This means there is an increasing need for models that are able to simulate this multi-sectorial system of water availability and demand and incorporate the socio-economic component required for robust decisions and policy support. We present our modelling study which is focused at providing regionally relevant pan-European water scarcity and economic damage simulations. First we developed regionally relevant pan-European water demand simulations for the household and industry sector from 2000 up to 2050. For the household sector we developed a model to simulate water use based on water price, income and several other relevant variables at NUTS-3 level (over 1200 regions in Europe). Alternatively, we modelled industrial water use based on regionally downscaled water productivity values at the national level for ten sub-sections of the NACE (Nomenclature of Economic Activities) classification for economic activities. Subsequently we used scenario projections of our explanatory variables to make scenario simulations of water demand from 2000 up to 2050 at pan-European scale with unprecedented spatial and sub-sectorial detail. In order to analyze the European water use system we integrated these water demand scenarios into the hydrological rainfall-runoff model called LISFLOOD (Distributed Water Balance and Flood Simulation Model), which incorporates a vegetation module for the simulation of crop yield and irrigation water demand of the agriculture sector. We simulated river discharge and groundwater availability for abstractions of water using sectors across Europe from 2000 up to 2050 at 5km grid level for multiple climate and socio-economic scenarios. This allowed us to identify regions with water scarcity problems from the recent past up to 2050 and quantify the economic damage that can be attributed to the limited water availability. Results showed several regions where substantially more water is extracted from the system than what would be sustainable into the future. Furthermore, we analyzed how changing water prices or relocation of economic activities could reduce future water scarcity problems and decrease the related economical damage. We found that for some regions, relatively small measures already could have a positive impact on water scarcity problems.