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Estimating future water scarcity in two European river basins under different integrated climate, land use and water management scenarios

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Access to water is undoubtedly the crucial environmental factor for human well-being and survival and an important resource to most economic activities. In many parts of the world, long-term overexploitation has led to a serious decline of water quality and quantity which consequently has become a dramatic threat to aquatic and terrestrial ecosystems. Climate projections point to a deterioration of the situation in the future.
Climate change together with changes in land and water use poses a problem particularly in areas already suffering from water scarcity as it is the case in the Mediterranean region. For decades, the bulk part of freshwater has been used for agriculture, particularly for irrigation, providing food security not only at local scale but also beyond national boarders for the whole of Europe. Negative effects caused by unsustainable water use are already visible. Estimating the current and future water availability is therefore of major importance.
The EU-FP7 GLOBAQUA project deals with the effects of multiple stressors on aquatic ecosystems under water scarcity. In this context, a set of integrated scenarios has been developed for possible futures, allowing to design effective management and adaptation strategies to alleviate water stress. The scenarios take into account both climate change and socio-economic developments including changes in water management.
Both aspects of Global Change were implemented in the land use change modelling with iCLUE. Downscaled climate model data from three different General Circulation Model (GCM) and Regional Climate Model (RCM) combinations originating from the EURO-CORDEX project were used to estimate the uncertainty of the climate projections. Future land use maps for the year 2050 were simulated for two of the GLOBAQUA scenarios: The MYOPIC represents a combination of IPCC's Representative Concentration Pathway (RCP) 8.5 and the Shared Socio-economic Pathway (SSP5). The SUSTAINABLE scenario combines RCP 4.5 and SSP1. The iCLUE modelling was carried out for two river basins located in the Mediterranean: the Ebro, located in NE Spain draining an area of 85,000 km^2, and the Evrotas on the SE Peloponnese with approx. 2,400 km^2.
The final land use maps served for the derivation of spatially distributed water use maps. They are based on sectoral water statistics and in case of the Ebro also on plans regarding the expansion of irrigated areas published in the River Basin Management Plans (RBMP). For distributing the water uses spatially, the demands of various sectors were linked to different land use classes. The results were compared with future evapotranspiration maps obtained from the EURO-CORDEX climate projections. By this means, it is possible to estimate the availability of water for the two scenarios. The presentation highlights the conclusions for an adaptivemanagement of water resources in the study areas.