Modelling water demand and availability scenarios for current and future land use and climate in the Sava River Basin
Abstract:
170 Simulations with the LISFLOOD water resources for 30-year periods with various combinations of land use change and climate change have been evaluated for their impact on the water-food-energy-environment nexus in the Sava river basin. For the Sava river basin, we found in this study that more intense irrigated agriculture does have the potential to increase crop yields considerably, but there are not sufficient water resources available to realise this. Also, if irrigation would be increased drastically, other sectors would be negatively influenced, such as the energy sector (reduced cooling water availability, potentially less water at times produce hydropower), navigation (more frequent and lower low-flows), and the environment (breaches of environmental or minimum flow conditions).
Effects on water resources would be more significant with increased irrigation to increase the crop yield of e.g maize. This would lead to an increase in water demand from 2216 Mm³/year to 3337 Mm³/year. Overall water demand in the Sava basin would further increase to around 6000 Mm³/year if we combine both increased irrigation and climate projections until 2100. The average simulated maize yield could increase from 5.7 tons/ha at present conditions to 9.9 tons/ha in case of increased and optimum irrigation. These substantial increases in irrigation, which would lead to substantial crop yield increases as well, would lead to water scarcity in parts of the Sava basin. Also, there just is not sufficient water to irrigate all areas which are water-limited for crop growth. Existing irrigation plans and irrigating the areas which were previously equipped for irrigation (according to FAO) seems more feasible from a water resources perspective. Flood peaks are projected to remain unchanged as a consequence of projected land use changes until 2050 for the Sava basin. However, with climate change projections we do simulate an overall increase in the flood peaks with 13% for the 2011-2040 period and a 23% increase for the 2071-2100 period. River low-flows decrease moderately for the 2011-2040 scenarios. For the end of the century 2071-2100, lowflow values are projected to moderately increase as compared to the control 1981-2010 climate. Excessive irrigation would result in a severe decrease of the lowflow discharges with 50-60%. As for ecological flows, similar observations can be made. Navigation in the main Sava river may be affected by these trends. Water availability for energy production - hydropower and cooling water for thermal and nuclear power stations - is projected to decrease by an average of 3.3% for 2030 under RCP4.5, whereas RCP8.5 would result in a 1.3% increase. End of the century simulations yield a 17.6% higher Q50 for RCP4.5 and 23.1% higher for RCP8.5. Excessive irrigation could affect the water availability for power production, especially for cooling thermal power stations. Hydropower reservoirs could be turned into multi-functional reservoirs, also serving downstream irrigation needs and flood control, and thus serve multiple purposes.

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