Modeling irrigation effects on the regional climate in the "Greater Alpine Region" using a newly developed parameterization

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Irrigation is a common land use practice to adapt agriculture to unsuitable climatic conditions. It is highly relevant to ensure food production. Due to the growing population and its food demand in the future, as well as due to climate change, the irrigated areas are expected to increase globally. Therefore, it is important to understand the effects of irrigation on the climate system. Irrigation of cropland alters the biogeophysical properties of the land surface and the soil. Due to the land-atmosphere interactions, these alterations have the potential to affect the atmosphere directly or through feedback processes. Various studies point out that the effects of irrigation, like temperature reduction, are particularly pronounced on local to regional scales where they bear a mitigation potential to regional climate change.

This study aims to investigate the effects of irrigation on the regional climate. To model these effects, we developed and implemented a new flexible irrigation parameterization into the regional climate model REMO. In our setup, REMO is interactively coupled to the mosaic-based vegetation module iMOVE, enabling the calculation of irrigation effects and feedbacks on land, vegetation, and atmosphere. Multiple simulations for specific climatic conditions with and without the new irrigation parameterization are conducted on 0.11° resolution for the “Greater Alpine Region”, which includes some of Europe’s most intensively irrigated areas like the Po valley in Northern Italy. The differences between these simulations are analyzed to identify and quantify irrigation effects on atmospheric processes.

The new irrigation parameterization will be introduced and the analysis of the irrigation effects on the regional climate in the “Greater Alpine Region” will be presented.