EGU2020-993
https://doi.org/10.5194/egusphere-egu2020-993
EGU General Assembly 2020

The influence of the spatial distribution of agricultural conservation practices on hydrological balance variables in a small basin

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SWAT is perhaps the most widely-used basin-scale hydrological model discussed in modern literature. SWAT is typically used to model large basins (100+ km^2) and has even successfully modeled basins at continental scales. Regardless of the typical scale that SWAT is used, SWAT has been shown to adequately model various hydrological processes at smaller scales, but this application is much less common in the literature. The aim of this study is to utilize SWAT+ in a small (<1 km^2) agricultural basin (Nucice) approximately 30 kilometers southeast of Prague, Czechia to determine the effects of various spatial distribution patterns of agricultural conservation practices (no/reduced tillage, crop residues, cover crops, etc.) and their respective impacts on projected runoff, soil water retention, and evapotranspiration.

We were able to successfully calibrate our SWAT+ model for the Nucice experimental catchment from 2014 through part of 2018 using discharge data and estimating ET via remote sensing. After successful calibration, we implemented 4 scenarios to analyze the effects of implementing agricultural conservation practices: 25% continuous in upper 50% of basin, 25% fragmented in upper 50% of basin, 25% continuous in lower 50% of basin, and 25% fragmented in lower 50% of basin.

The adaptation pattern of agricultural conservation practices has significant and disproportionate effects on various hydrological balance parameters. Since it is rare that a single farmer manages an entire basin, this study shows that widespread adaptation of agricultural practices is necessary to maximize water conservation within a landscape. We intend to upscale this study (100+ km^2 basins) and to compare basins across multiple climates to determine if these effects are universal.

This research has been supported by project H2020 No. 773903 Shui, focused on water scarcity in European and Chinese cropping systems.