Coupling automatic calibration method in Noah-MP model for improving estimating irrigation assumption by combining with census data

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Human activities affect the terrestrial water and energy cycle due to human-induced land use/cover change. Agricultural development is among the most significant forms of land-use change. Quantifying irrigation amount is a great challenge in simulation based on insufficient census data and unrealistic irrigation processes. Here, we use census data and the most realistic parameterization incorporated into the Noah-MP land surface model to reproduce the irrigation assumption over the North China plain using a commonly used calibration method introduced by Duan et al 1994, called the SCE-UA. First, we provide an assessment on three different irrigation area maps regarding prefecture level census data: (1) GMIA, (2) MODIS, (3) Meier et al.2018. Therefore, the GMIA map is selected as the irrigation model input in this study. Following this analysis, we calibrated three parameters (irrigation triggering point, flood irrigation loss, and flood application rate factor) in the flood irrigation module and improves the simulated irrigation water amount in agreement with census data at prefecture level. Compared with no irrigation simulation, soil moisture increased much, followed by evapotranspiration and runoff. And the soil moisture mainly increased in deep soil moisture, and the runoff mainly increased in the subsurface runoff. Also, irrigation mainly increased latent heat flux and decreased sensible heat flux, while soil heat flux changed little. Therefore, this study contributes to quantitatively understanding the irrigation impacts on the component of the water and energy cycle from realistic perspectives, which helps improve the water resource management.