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The green water footprint of European croplands

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Adequate supplies of water are essential for human well-being. Global water demand for food production will increase in the coming decades due to increases in population, rising incomes and changing dietary preferences. Agriculture will compete for this scare water supply with industrial, household, and environmental uses and agricultural water use will therefore increase substantially to meet these growing demands. The freshwater required for agricultural production is derived from consumed rainfall (green water) and surface and groundwater sources used for irrigation (blue water). Water deficits in crop production are usually solved by increasing irrigation (i.e. adding blue water). However, on global scales, green water use is 4–5 times greater than blue water use and is a large component of the global water footprint (WF). Crop models used to simulate the green WF do so by calculating evapotranspiration (ET), which is the sum of the water evaporated from the soil or crop surface and transpired from crops and is the water required for crop growth and yield production. ET is the second largest component, after precipitation, of the global terrestrial water cycle, and is one of the most uncertain components of Earth's energy and water balance. In this study, the Aggregated Canopy Model-Evapotranspiration (ACM-ET) model is used to estimate the green WF for European croplands (winter wheat) at half-degree spatial resolution. We use the MODIS leaf area index (LAI) satellite product and atmospheric reanalysis as inputs to the model and evaluate simulated ET against data from global gridded ET products, such as FLUXNET-MTE, GLEAM and MODIS. Our study shows that ACM-ET can be used to simulate the green WF on regional scales and provide information on crop water use relevant to decision making.