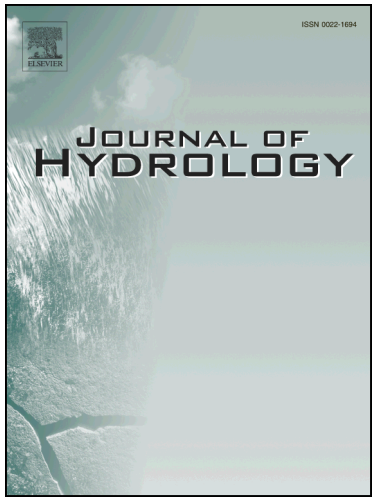

Research papers

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Keyvan Malek, Jennifer Adam, Claudio Stockle, Troy Peters

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Climate change reduces water availability for agriculture by decreasing non-evaporative irrigation losses

Keyvan Malek[1], Jennifer Adam[1], Claudio Stockle[2], Troy Peters[2]

[1]Department of Civil and Environmental Engineering, Washington State University.

[2] Department of Biological Systems Engineering, Washington State University.

Corresponding author: Keyvan Malek (keyvan.malek@wsu.edu), Jennifer Adam (jcadam@wsu.edu)

Abstract

Irrigation efficiency plays an important role in agricultural productivity; it affects farm-scale water demand, and the partitioning of irrigation losses into evaporative and non-evaporative components. This partitioning determines return flow generation and thus affects water availability. Over the last two decades, hydrologic and agricultural research communities have significantly improved our understanding of the impacts of climate change on water availability and food productivity. However, the impacts of climate change on the efficiency of irrigation systems, particularly on the partitioning between evaporative and non-evaporative losses, have received little attention. In this study, we incorporated a process-based irrigation module into a coupled hydrologic/agricultural modeling framework (VIC-CropSyst). To understand how climate change may impact irrigation losses, we applied VIC-CropSyst over the Yakima River basin, an important agricultural region in Washington State, U.S. We compared the historical period of 1980 -2010 to an ensemble of ten projections of climate for two future periods: 2030-2060 and 2060-2090. Results averaged over the watershed showed that a 9% increase in evaporative losses will be compensated by a reduction of non-evaporative losses. Therefore, overall changes in future efficiency are negligible (-0.4%) while the Evaporative Loss Ratio (ELR) (defined as the ratio of evaporative to non-evaporative irrigation losses) is enhanced by 10%. This higher ELR is associated with a reduction in return flows, thus negatively impacting downstream water availability. Results also indicate that the impact of climate change on irrigation losses depend on irrigation type and climate scenarios.