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

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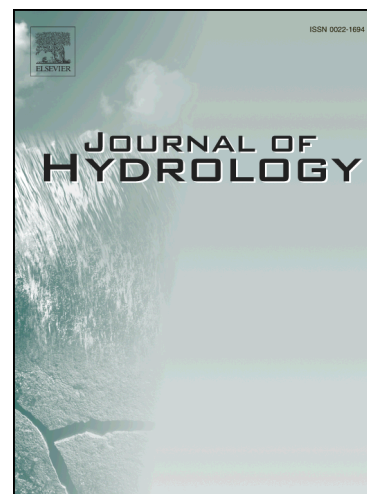
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1 **Climate change reduces water availability for agriculture by decreasing non-evaporative irrigation**  
2 **losses**

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9 **Abstract**

10 Irrigation efficiency plays an important role in agricultural productivity; it affects farm-scale water  
11 demand, and the partitioning of irrigation losses into evaporative and non-evaporative components. This  
12 partitioning determines return flow generation and thus affects water availability. Over the last two  
13 decades, hydrologic and agricultural research communities have significantly improved our understanding  
14 of the impacts of climate change on water availability and food productivity. However, the impacts of  
15 climate change on the efficiency of irrigation systems, particularly on the partitioning between  
16 evaporative and non-evaporative losses, have received little attention. In this study, we incorporated a  
17 process-based irrigation module into a coupled hydrologic/agricultural modeling framework (VIC-  
18 CropSyst). To understand how climate change may impact irrigation losses, we applied VIC-CropSyst  
19 over the Yakima River basin, an important agricultural region in Washington State, U.S. We compared  
20 the historical period of 1980 -2010 to an ensemble of ten projections of climate for two future periods:  
21 2030-2060 and 2060-2090. Results averaged over the watershed showed that a 9% increase in evaporative  
22 losses will be compensated by a reduction of non-evaporative losses. Therefore, overall changes in future  
23 efficiency are negligible (-0.4%) while the Evaporative Loss Ratio (ELR) (defined as the ratio of  
24 evaporative to non-evaporative irrigation losses) is enhanced by 10%. This higher ELR is associated with  
25 a reduction in return flows, thus negatively impacting downstream water availability. Results also indicate  
26 that the impact of climate change on irrigation losses depend on irrigation type and climate scenarios.

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