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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Optimal water use strategies for mitigating high urban temperatures" *by* Bin Liu et al.

Anonymous Referee #1

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Recent urbanization has been changing the regional climate significantly, and the urban irrigation and road sprinkling not only make the land surface processes more complex, but also influence the urban canopy temperature. Bin Liu et al. did a novel job to optimize the limited water supply between urban irrigation and road sprinkling to get the maximum cooling effects over the Beijing city. The authors introduced the urban irrigation and road sprinkling in the WRF model, estimated the cooling efficiency of urban irrigation and road sprinkling over the urban, suburban and rural areas, and developed an optimal water management scheme to get the largest cooling effects with limited water resource. However, there are still some issues should to be revised before its publication on the HESS journal.

Major comments: 1.Is it appropriate to include the rural areas (outside the sixth ring

road) in the analysis? Although the authors treat the "urban irrigation" as ecological and farmland irrigation, the farmland irrigation in the rural region seems only cools the rural temperature with little influence on the urban temperature. 2.The authors did a good job in introducing the optimal water usage scheme and model development, but the description of the experimental design is confusing. For example, the authors said "Three experiments were conducted to consider no water usage, urban irrigation and road sprinkling". Does it mean only one experiment was conduced with consideration of road sprinkling? If so, how can they separate the cooling effects of urban road sprinkling on the suburban and rural areas (Fig. 8a)? In addition, what does the "A climate summer time periods from 2000 to 2017 were averaged to 4 days which represent the climatic May, June, July and August. And the first day was considered as the spin up period. " mean? Does this mean for each month, only one day simulation forced by climatic boundary condition is performed? 3.The offline experiment using CLM4.5 model was used to "illustrate the cooling effect of urban irrigation and road sprinkling". Does the author also choose the CLM4.5 model in the WRF modeling? Moreover, the offline modeling shows that urban irrigation does not influence the latent/sensible heat significantly over the urban region (within the fifth ring road; Figs. 5a,5c), but the online modeling shows contrary result where clear influence of urban irrigation over urban region (Figs. 10a,10d). How to interpret this? 4.Can the default USGS land use category in the WRF model represent the urban land use in the research region? As is shown in Figure 3, the land use type in the Beijing city is 12$\sim$14. But the urban land use type in USGS category is 1. 5.The current optimization method does not consider the urban extension or land cover change in the future. The author should at least discuss the influence of this neglect on the result.

Minor comments: 1.L134, change "in-situ" to "In-situ" 2.I suggest the authors to give a short description of how to estimate the road sprinkling in section 2.3 and a plot of road sprinkling water use in Beijing in Figure 2. 3.In Table2, the land surface model option is "CLM/NOAH-MP", does this mean the authors performed ensemble simulation using different land surface models? 4."The simulation results showed that urban irrigation

decreased the water table depth due to groundwater extraction ” . Why does the water table depth decrease? If the water is extracted, the water table depth will increase (e.g., from 4m to 5m), and the difference is positive. 5.L205-L215. The author evaluate the WRF simulation by using CLDAS and observation. Does the WRF simulation used here consider the urban irrigation and road sprinkling? And will the incorporation of the above two processes have some improvements on the temperature simulations?

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