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Assessment of Agricultural Damages of Future Extreme Flooding in Cambodia

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Introduction

The Mekong River Basin is a largest transboundary river basin in Southeast Asia traveling across six countries: China, Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. This river is one the most vulnerable zone to be affect by climate change and dam development. These effects have become the global environmental and socioeconomic issues which have impact on changing the river hydrology and flood characteristics in the downstream of river basin. The study on flood-related damages under climate change and dam construction is still limited in the MRB.

Therefore, this study aims to evaluate the potential impacts of future climate change and dam construction on agricultural damages on extreme flood events in the Cambodian floodplain of the Lower Mekong Basin (LMB).

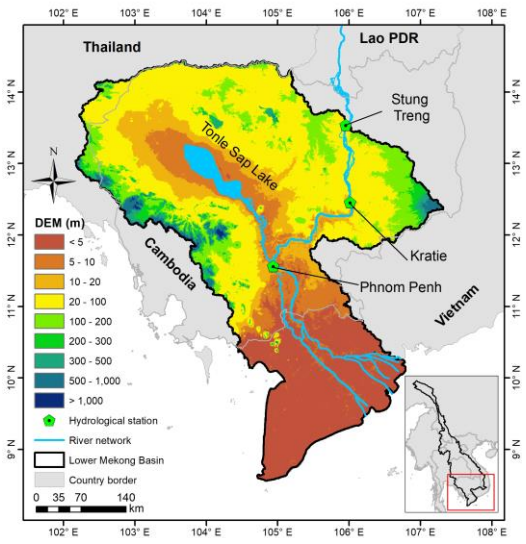

Fig. 1 Location of Cambodian floodplain

Method

This study used a coupled distributed rainfall-runoff and inundation model (RRI, Sayama et al., 2015) to simulated flood hazards in the MRB. The model was set up with spatial resolution of 2.5 arc-minutes (4,613 m) for the whole MRB and 60-arc-seconds (1,832 m) for the flood inundation in the Cambodian floodplain in the LMB. The RRI model was calibrated and validate by the previous studies (Try et al., 2020).

The climate change dataset was taken from a large ensemble Database for Policy Decision-Making for Future Climate Change (d4PDF) which consists of 100-ensemble for present climate (1950-2010) and 90-ensembles for future projections (2051-2110) under increasing of 4K. Moreover, this study investigated the impact of dam construction from 126 dams in the whole MRB (all six countries), and their operation rule is considered as hydropower generation. The calculation of agricultural economic damage during the growing period (September-November) was performed using the following equation:

Economic Damage Value = Rice Yield × Damage Area × Yield Loss (eq. 1)

Results

The results of agricultural flood damages in the Cambodian floodplain was summarized in Table 1. The extreme flood events in the LMB were investigated from the d4PDF dataset as input into the RRI model. The flood extent of 10-year, 50-year, and 100-year return periods (see more detail in Try et al.,

(2020)) showed an increase of 12%, 14%, 17% for under climate change impact; and 7%, 10%, 14% under integrated impact from climate change and dam construction. The estimated agricultural damages in the Cambodian floodplain for the present climate were approximately 160, 210, and 240 million US$ for 10-, 50-, and 100-year return periods, respectively. Under climate change effect alone, the change in agricultural damages would increase by 32%, 38%, and 39%. In comparison, the integrated impacts from climate change and dam construction would reduce these rates to 17%, 24%, and 31% for flood event in 10-, 50-, and 100-year, respectively.

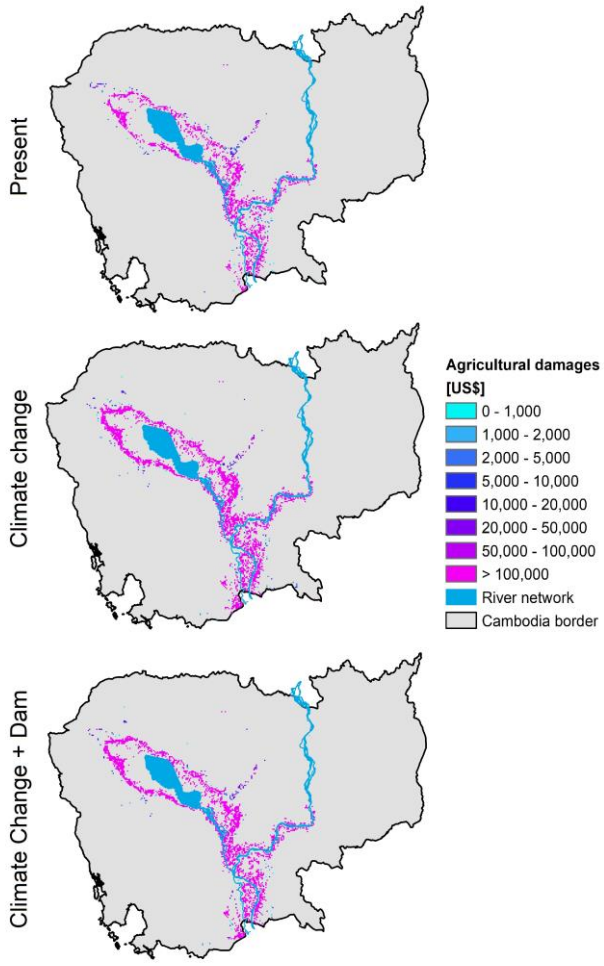

Fig. 2 Spatial distribution of flood agricultural damages for flood event of 50-year return period

Table 1. Estimated agricultural damages in present (HPB), climate change (CC), and integrated climate change and dam (CC+Dam)

Extreme event	Climate scenario	Agricultural damage [M US$]
10-year	HPB	160.35
	HFB (CC)	211.15 *(+32%)*
	HFB (CC+Dam)	188.05 *(+17%)*
50-year	HPB	210.26
	HFB (CC)	289.25 *(+38%)*
	HFB (CC+Dam)	260.77 *(+24%)*
100-year	HPB	239.69
	HFB (CC)	332.21 *(+39%)*
	HFB (CC+Dam)	314.87 *(+31%)*

Conclusions

In conclusion, the results from this study indicated a potential increase in agricultural damages in the Cambodian floodplain of the MRB under the effect of future climate change dam construction. Therefore, appropriate activities and countermeasures should be prepared for response and adaptation to these severe flood events.

References

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