# Extreme floods in the Mekong River Delta under climate change

*Combined impacts of upstream hydrological changes and sea level rise*

Long Phi Hoang, Dung Nguyen Viet, Matti Kummu, Hannu Lauri, Jorma Koponen, Michelle T.H. van Vliet, Iwan Supit, Rik Leemans, Pavel Kabat, Fulco Ludwig

*Long Phi Hoang*
*PhD student*
*Earth System Science and Climate Change group,*
*Wageningen University*
*Long.Hoang@wur.nl*
*Long.hp2002@gmail.com*

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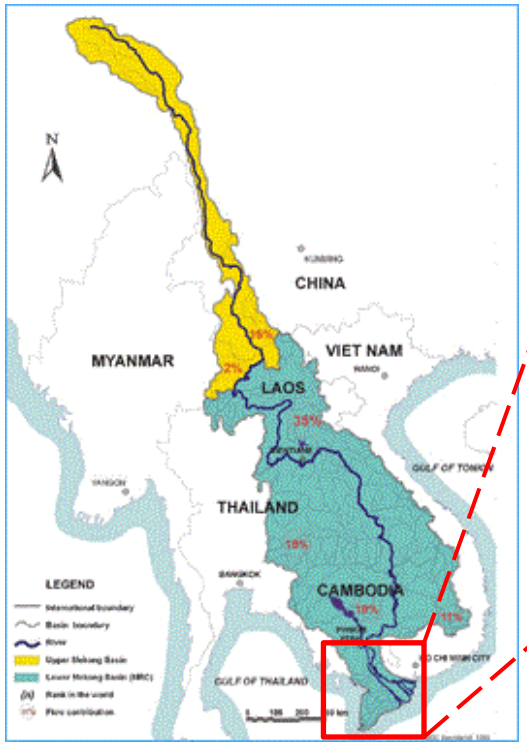
# I Background and objectives (1)




*Mekong River Basin*
*(Map from the MRC, 2009)*


The Mekong Delta

The Mekong River Delta:

- Last part of the Mekong River, largest in Southeast Asia
- Abundant water resources, fertile land and favourable climate → Most important rice production area of Vietnam(Top 5 rice export nation)
- Population: 17 mil. people

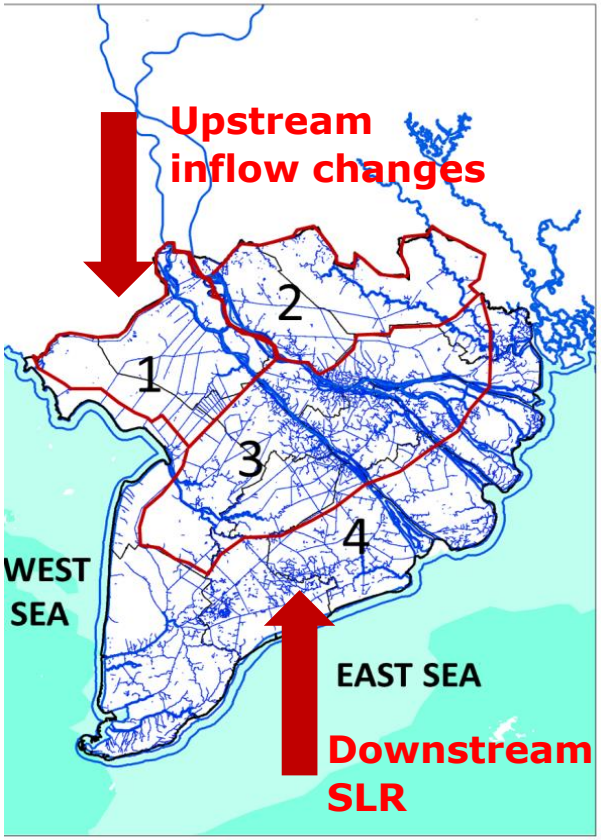
# I Background and objectives (2)

- The Mekong Delta is highly vulnerable to climate change, top 5 deltas globally *(Nicholls et al., 2007)*

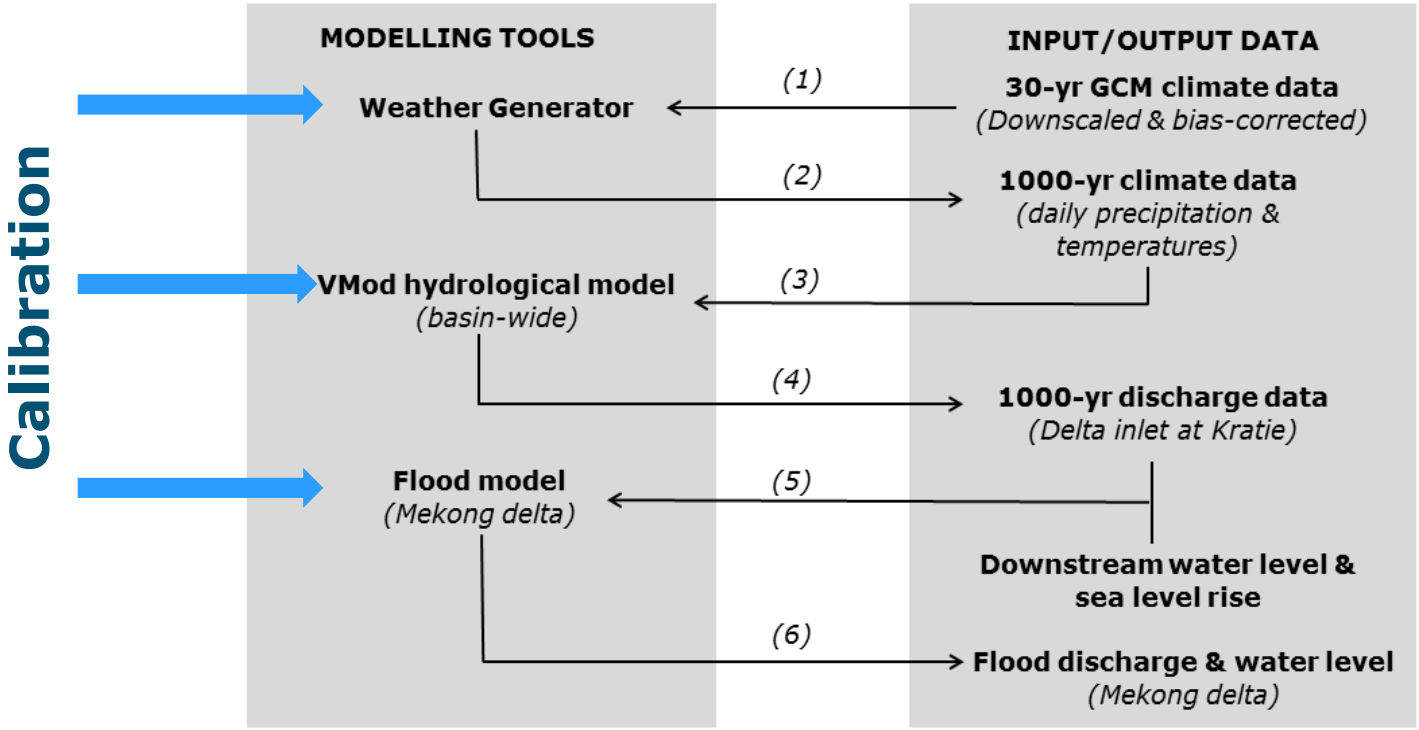
- Climate change likely to exacerbate flood hazard, because of

  - More upstream inflow *(Hoang et al., 2015)*
  - Sea level rise along the coast *(Wassmann et al., 2004)*

***→ Objective: Spatial explicit, probabilistic quantification of future extreme floods under two drivers.***

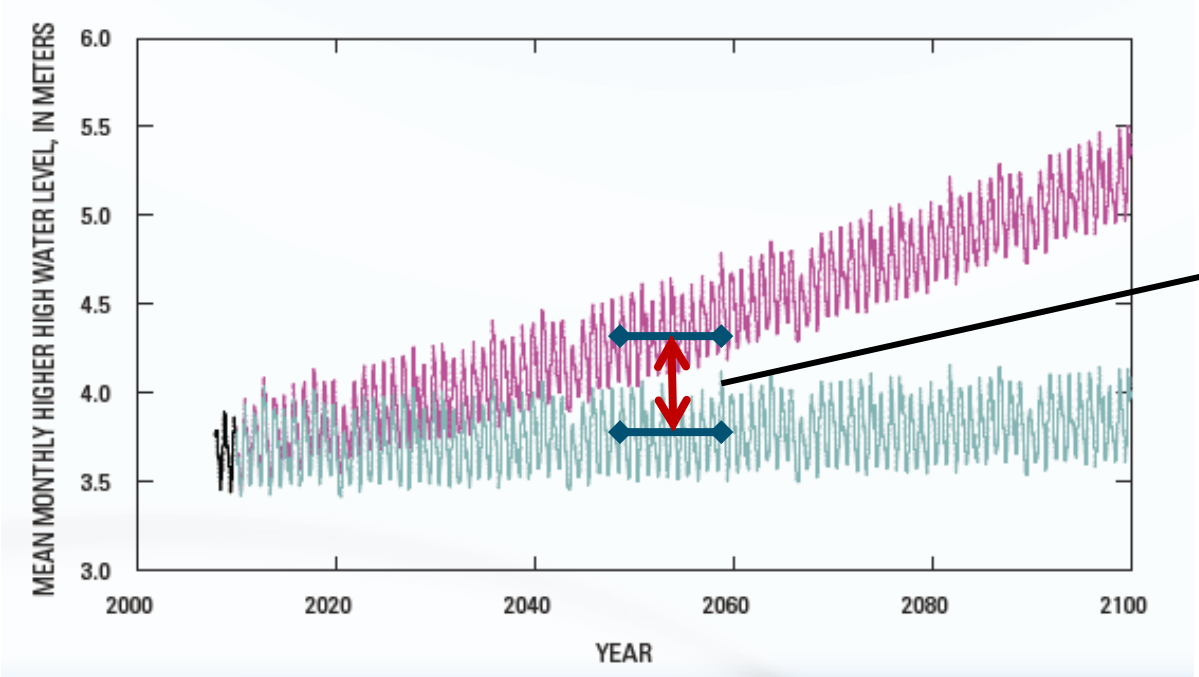


# II. Methods and data (1)




A model chain to integrate two drivers in the simulations, allowing for **spatial-explicit, probabilistic estimation of future flood hazard** (i.e. water level and probability of occurrence)

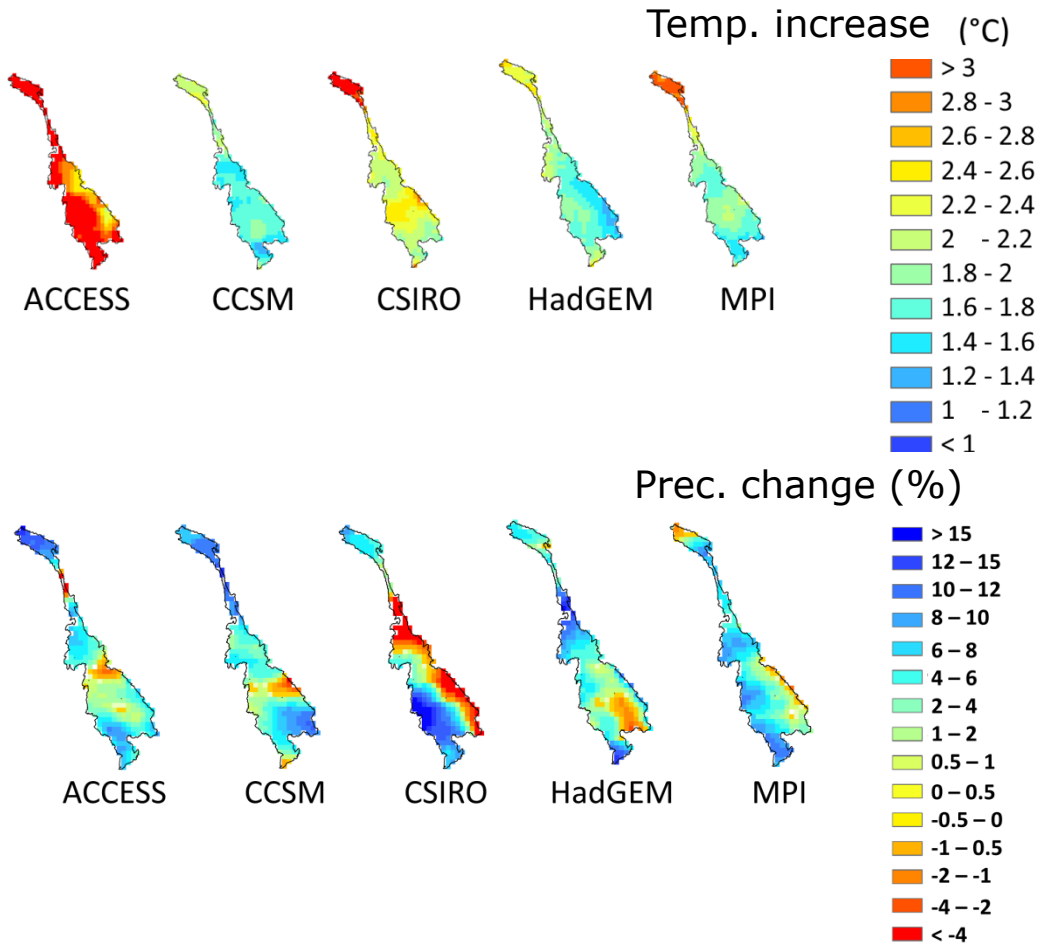
# Sea level rise scenario




+ 0.6 m relative sea level rise by 2035-2065 period

Sea level rise projection for the Mekong delta under A1FI scenario, combined with 9mm yr-1 land subsidence
*(From Doyle et al., 2010)*

# Climate change scenario

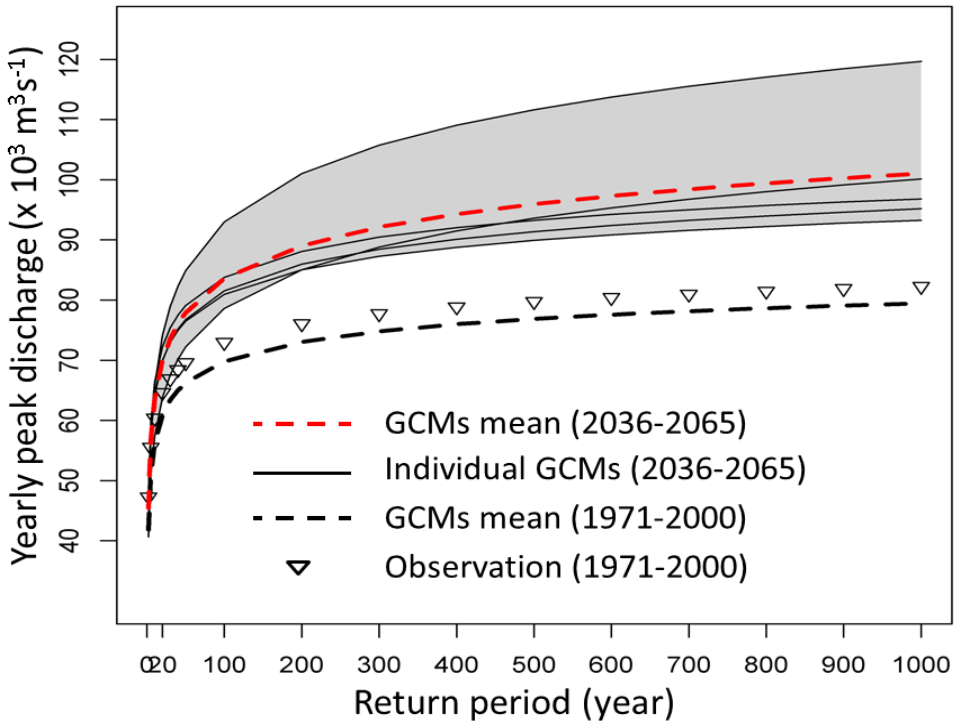



Basin-average temperature increases between +1.8°C (HadGEM) and +3.4°C (ACCESS) in (2036-2065) compared to (1971-2000).

Basin-average annual precipitation increases between +4% (CSIRO) and +7% (CCSM).

Some regions also show slight prec. reductions, less than 5% annually.

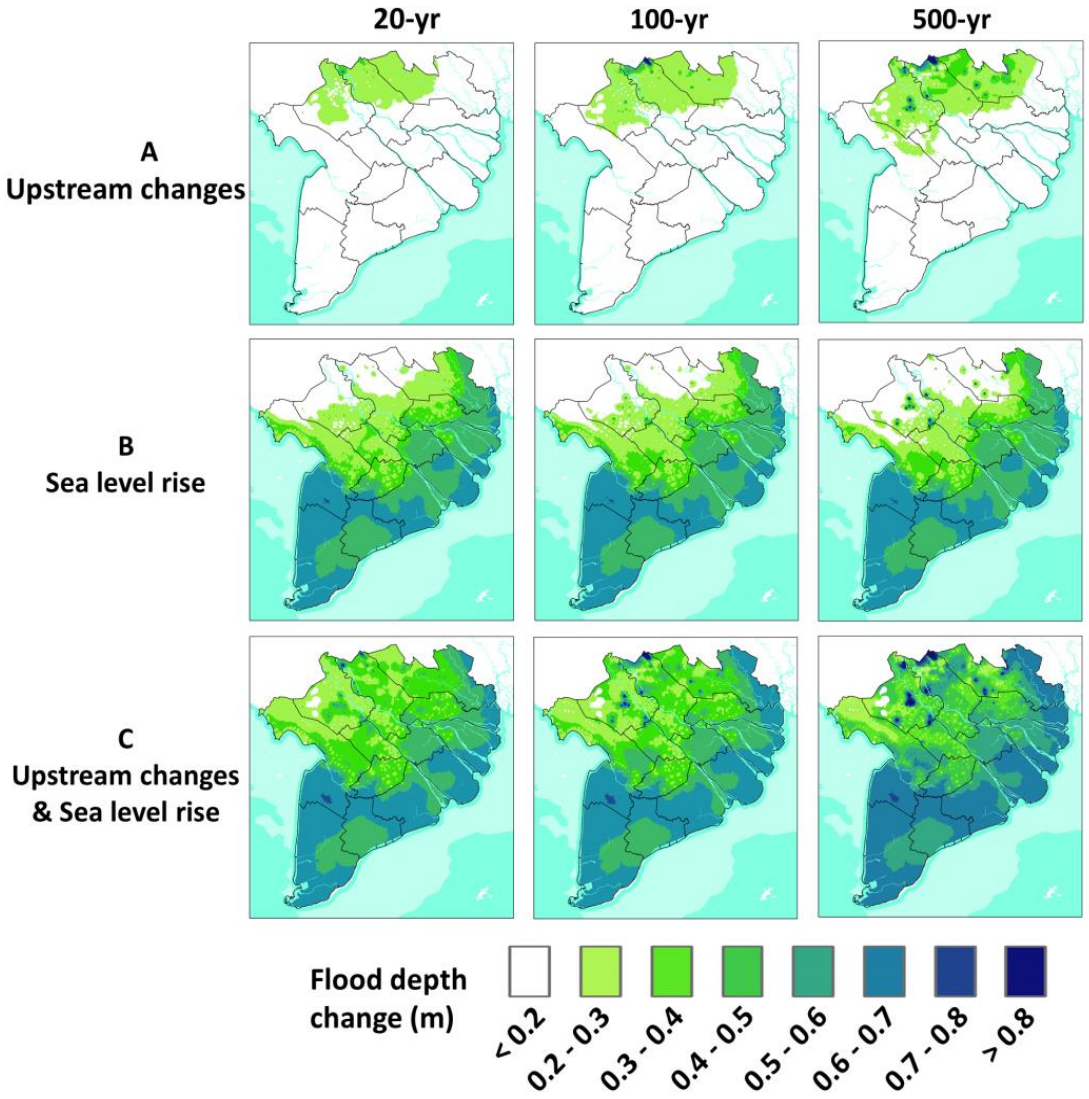
# Changes in upstream inflow




Estimated return values of yearly peak river discharge at the Mekong Delta inlet (Kratie, Cambodia) under climate change

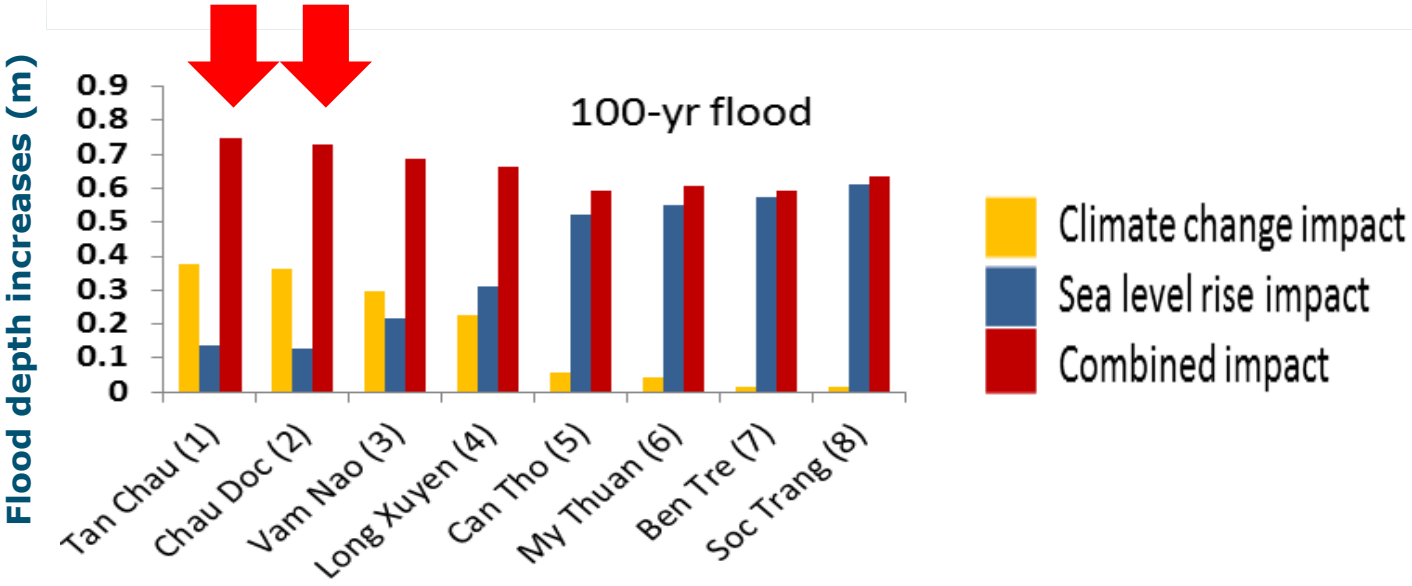
- Both the frequency and magnitude of peak flows increase substantially under climate change

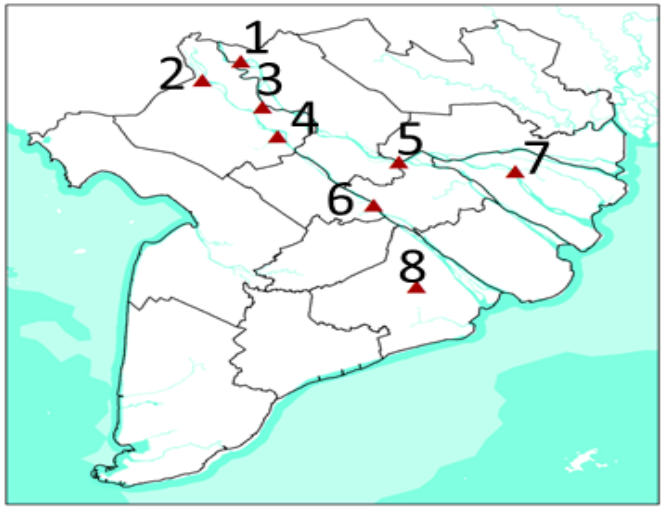
# Flood depth increases under considered scenarios




- Upstream changes mainly affect the current floodplain in the upper delta
- Sea level rise impact is highest at the coastal zones and reduces gradually towards upper delta
- Two drivers together increase flood hazard throughout the whole Mekong delta

# Flood depth increases at representative locations




Impact intensification effect: The combined impact is higher than summed impact of each driver

# IV. Conclusions

Upstream hydrological changes and SLR will increase flood's magnitude and frequency → **More flood protection and flood resilience development.**

Each driver's impact will be distributed differently across different zones → **Special attention to new flood zones caused by SLR.**

Flood dynamics is complex and driven by multiple drivers → **Including multiple drivers in flood hazard/risk assessment is highly relevant in complex deltaic systems like the Mekong Delta.**

# *Thank you for your attention!*

Long.hoang@wur.nl

Long.hp2002@gmail.com

*Relating papers*

*Hoang et al. Extreme floods in the Mekong River Delta under climate change: Combined impacts of upstream hydrological changes and sea level rise. Submitted to Journal of Hydrology*

*Hoang et al. Mekong River flow and hydrological extremes under climate change. Under review for Journal of Hydrology and Earth System Science*

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