Assessment of Flood Detention Zones in the 2023 catchment-scale floods in Hai River Basin, China

Yiling Lin[1], Xie Hu[1], Fang Wang[2], Yong Zhao[3]

1. College of Urban and Environmental Sciences, Peking University, Beijing, China
2. River Basin Habitats Research Center, College of Architecture and Landscape Architecture, Peking University, Beijing, China
3. Department of Water Resources, China Institute of Water Resources and Hydropower Research, Beijing, China

NHRS lab

Abstract

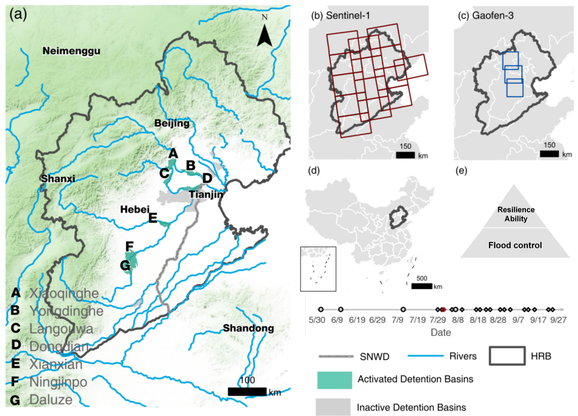
Background

- **Flood Detention Zones (FDZ):** Last defense limit in flood-control programmes.
- **Dual role played by FDZ in China:** Floodwater storage during floods (*Storage ability*) & Floodwater recession after floods (*Resilience ability*).
- **Challenge:** Lack of a quantitative assessment of the functionalibity ability of FDZ *through real flood event.*

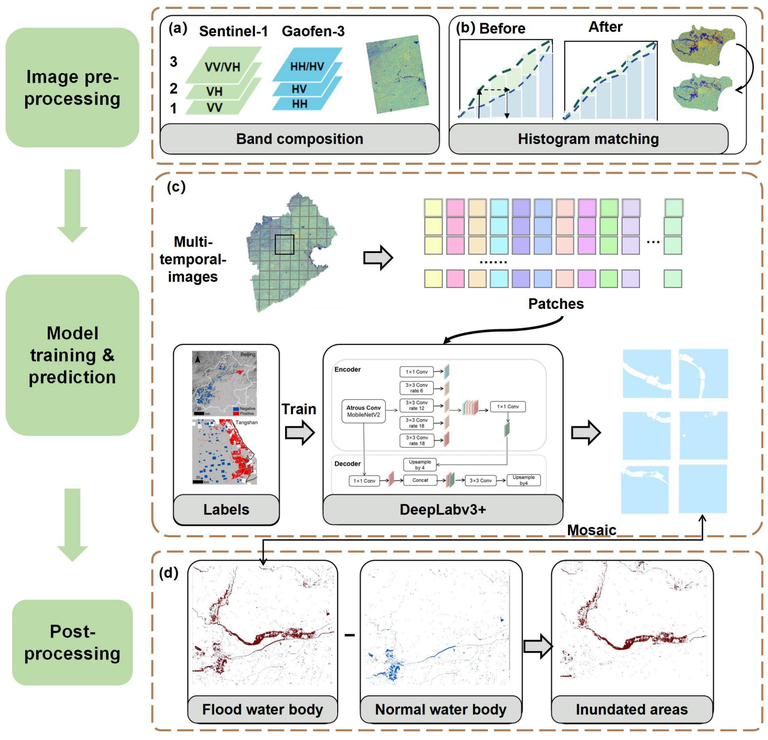
Study area and data

- **Haihe River Basin (HRB):** Flood-prone area in the Beijing-Tianjin-Hebei metropolis of China with 28 FDZ.
- **23·7 catchment-scale floods in HRB:** Triggered by Typhoon inducing severe rainfall and activated 8 FDZ.
- **Multi-source SAR data:**

	Resolution	Polarization	Time
Sentinel-1	10 m	VV/VH	7/28-9/25
Gaofen-3	10 m	HH/HV	8/1

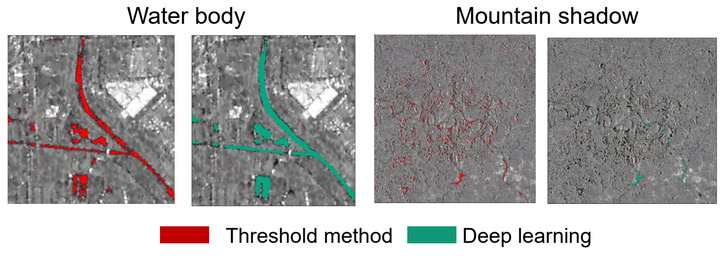


Method



Deep learning based flood mapping Fram-ework

- **High Generalizability:** Higher accuracy (~80%) in multi-source | temporal | spaitial image.
- **Less false positives and more continuous water body.**



Functionalibity ability assessment

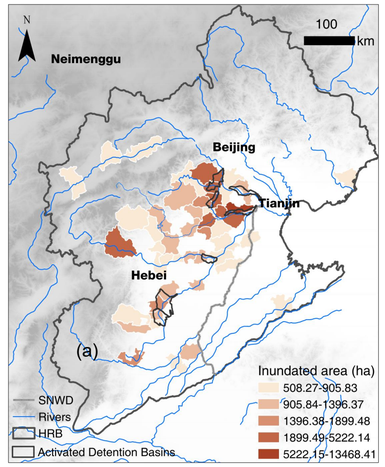
Storage ability

- Maximum inundation area calculation.

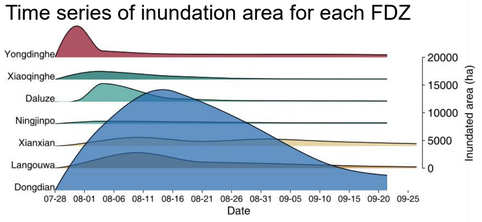
Resilience ability

- Fit Cumulative Distribution Function (CDF) of inundated pixels' water recession time with Logistic function.

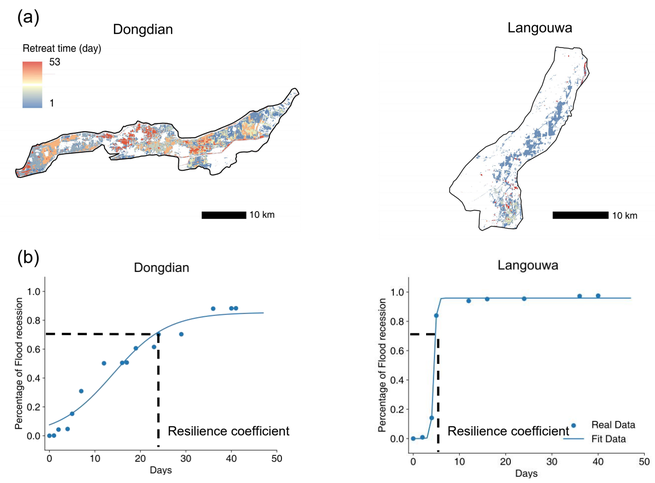
Results



Time series of inundation area for each FDZ



- **Storage ability:**
  The Dongdian, Yongding River, and Daluzi FDZ stored most floodwater.
- **Resilience ability:**
  Most FDZ have high resilience ability while Dongdian FDZ needs furthre improvement.



(a) Flood water recessioin time map for Dongdian and Langouwa FDZ. (b) CDF of inundated pixels' water recession time and fitting curve for Dongdian and Langouwa FDZ.

Conclusions

- Build a catchment-level multi-temporal flood mapping framework leveraging multi-source SAR data and deep learning model.
- Extract inundation paths which evolved for two months encompassing HBR.
- Prove the high flood storage and resilience ability of the activated FDZ in the HRB.