Flood risk reduction effect of levee in a global riverine inundation model Yuki Kita^{*1*2}, Dai Yamazaki^{*1} ^{*1}Institute of Industrial Science, The University of Tokyo; ^{*2}Gaia Vision Inc.

Previous research review

- ✓ Flood extent by levee break highly depends on the situation and parameters of levee breaching. Large uncertainty should be considered for flood risk assessment (Goeury, et al., 2022).
- ✓ Top-down estimated levee standards worked well for allowing a large-scale flood model to simulate flood inundation area considering simplified levee with high agreement (Zhao, et al., 2023). Very few research on levee protection effects with Macro-scale hydrodynamics model

Research issue

Since global river models simultaneously solve for water dynamics on the river and floodplain, it is inherently difficult to represent smaller structures such as embankments on land in an explicit way.

Solution

By defining the water capacity inside and outside the embankment with sub-grid parameters, the flood protection effect of the embankment was successfully represented without fine resolution.

Objective

To develop a fine-tuning methodology to make CaMa-Flood for operational flood forecasting, focusing on levee protection.





Introduction



Levee protects even for high flow in 2019 October (Typhoon Hagibis)

Methods

Results



(above channel)



- Time lapse of levee break should be calibrated and sophisticated.
- Features of levee should be considered
- Estimation method of levee parameter (height) • Needs to be calibrated
- \checkmark For operational flood prediction,
 - Probabilistic prediction should provide better insight.
 - Other flood protection facilities are necessary (dam, drainage, etc...)
- \checkmark Issues to be solved

 - Calibration is hard for too much parameterization.

Future work

 \checkmark Improve methodology for validation and calibration for operational prediction. Classification method of inundation factors can be developed ✓ Large ensemble simulation to assess uncertainty

References

Goeury, et al., 2022: Uncertainty Assessment of Flood Hazard Due to Levee Breaching Flood Hazard Modeling



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Summary & Discussion

• Due to the lack of inundation observation, simulation results are hard to be validated.