

Application of the LISFLOOD-FP Hydrodynamic Model for Impact-Based Forecasting over the Eastern Africa Region



Jully Ouma^{1,2}, Nishadh Kalladath¹, Khalid Hassaballah¹, Viola Otieno¹, Jason Kinyua¹, Igbal Salah¹, Mohammed Hassan¹, Ahmed Amdihun¹ & Guleid Artan¹

¹ IGAD Climate Prediction and Applications Centre- ICPAC, Nairobi, Kenya
² United Nation Office for Disaster Risk Reduction, Africa Office, Kenya

Introduction

- Impact-based forecasting (IBF) supports risk-oriented decisions in disaster risk management by emphasizing anticipatory actions that minimize damage and loss.
- Inundation forecasting is essential for IBF hazard modeling and use with impact functions, linking flood water depth to displacement risks and damage to infrastructure.
- Currently, IBF uses hydrological forecasts combined with historical maps for inundation data from stream flow forecasts, but it struggles to capture urban and riverine rainfall-induced floods. Although hydrodynamic modeling is precise, it is too computationally intensive for routine IBF.
- A parsimonious modeling framework that balances the complexity and simplicity of hydrodynamic processes might be a promising approach for generating inundation data.
- Current study evaluated the hydrodynamic model LISFLOOD-FP [1] for its potential in impact-based forecasting. We also assessed the operational IBF suitability of the parsimonious, simplified model RIM2D [2].

Methods

The Figure shows the method used to compare LISFLOOD-FP and RIM2D for operational use in cloud computing.

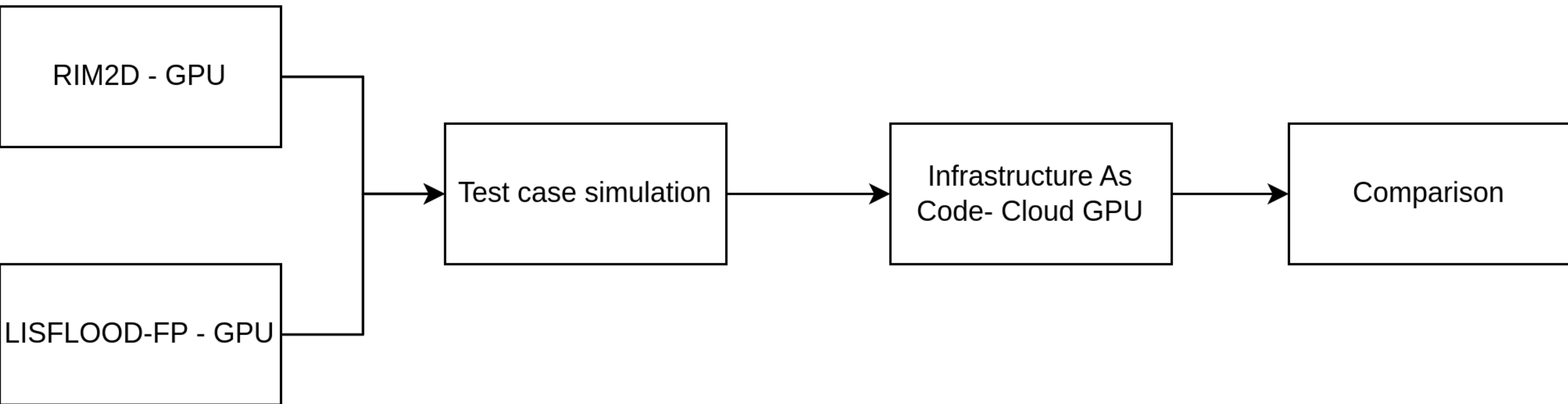


Figure 1: The GPU versions of the models are used in a similar GPU cloud computing setup.

Results

- Test case simulations indicate that RIM2D is more efficient for operational IBF due to its parsimonious hydrological modeling approach, making it suitable for IBF risk measures.
- The validation of RIM2D’s hydrodynamic modeling in East Africa is ongoing; the supporting materials detail the Python programs and cloud setup for the model.

References

[1] Mohammad Kazem Sharifian, Georges Kesserwani, Alovya Ahmed Chowdhury, Jeffrey Neal, and Paul Bates. LISFLOOD-FP 8.1: new GPU-accelerated solvers for faster fluvial/pluvial flood simulations. *Geoscientific Model Development*, 16(9):2391–2413, 2023.

[2] Heiko Apel, Sergiy Vorogushyn, and Bruno Merz. Brief communication: Impact forecasting could substantially improve the emergency management of deadly floods: case study july 2021 floods in germany. *Natural Hazards and Earth System Sciences*, 22(9):3005–3014, 2022.

RIM2D, a streamlined, parsimonious version of LISFLOOD-FP model, might be the ideal choice for impact-based forecasting. After all, why putting on a space suit to water the garden?



Scan the QR Code for supporting materials @ GitHub Repository: [icpac-igad/rim2d-ibf](https://github.com/icpac-igad/rim2d-ibf) For comments and questions [icpac-igad/rim2d-ibf/issues](https://github.com/icpac-igad/rim2d-ibf/issues)