Towards globally applicable and locally relevant compound flood simulations

Dirk Eilander[1,2], Anaïs Couasnon[1], Tim Leijnse[2], Hessel C. Winsemius[2,3], Philip Ward[1]

(1) Institute for Environmental Studies (IVM), VU Amsterdam, Netherlands, (2) Deltares, Delft, The Netherlands, (3) Water Management, TU Delft, Netherlands

Background & objective

Deltas are prone to fluvial, pluvial and coastal flooding, such as illustrated during cyclone Idai in Mozambique, March 2019. Current global flood risk models consider single drivers only. Local models, while accurate, typically require many person-hours to setup and might be hard to reproduce. To fill this gap we **aim to build and validate a framework to automatically setup a reproducible compound flood hazard model anywhere across the globe**.

Nested Flood Hazard Model Framework

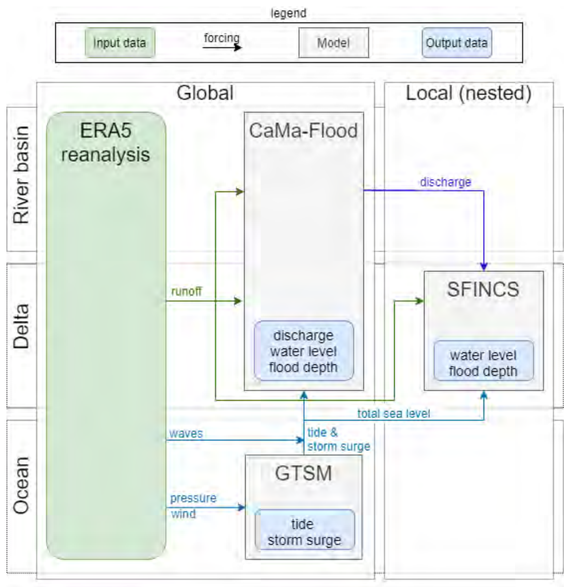

FIGURE 1: Globally applicable nested compound flood model framework

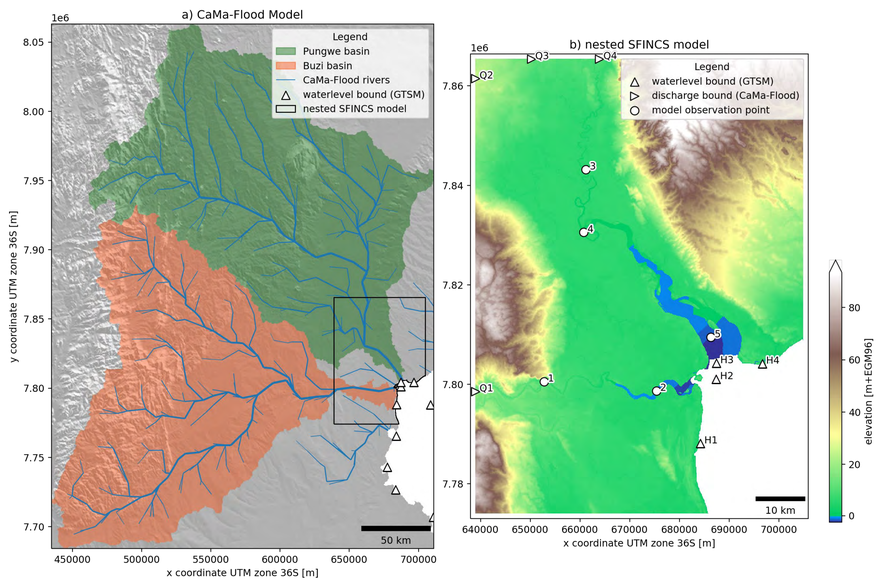

FIGURE 2: Nested flood model chain; with CaMa-Flood[1] covering the entire Buzi & Pungwe basins, SFINCS[2] the floodplain it coastal floodplains and GTSM[3] the ocean

Model Validation

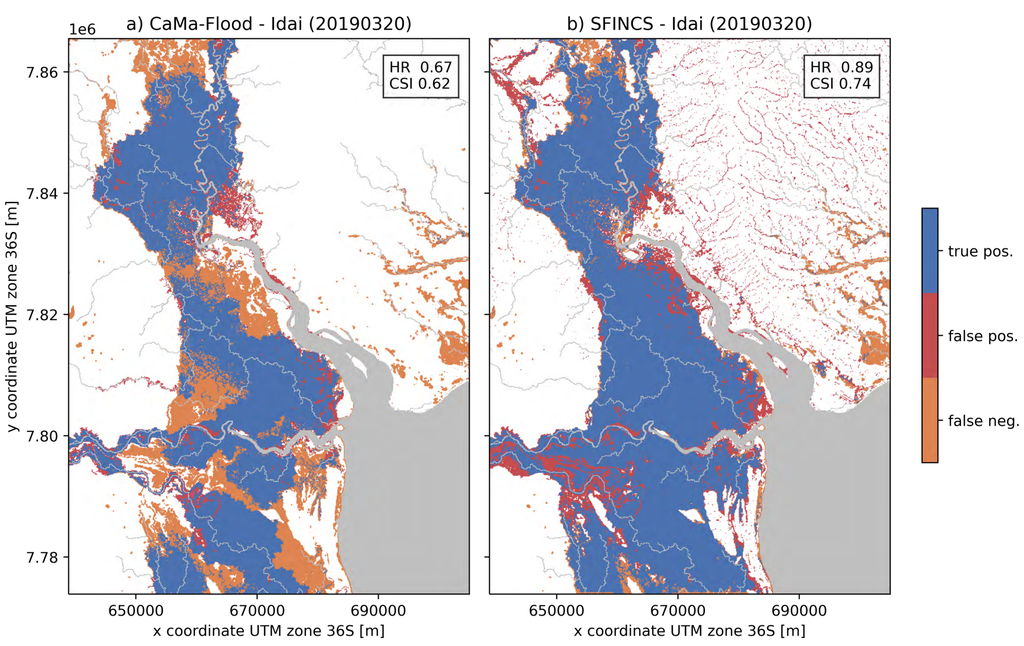

FIGURE 4: Validation of simulated flood extent against Sentinel-1 SAR EO data processed by RAPID[4] based on hit rate (HR) and critical success index (CSI).

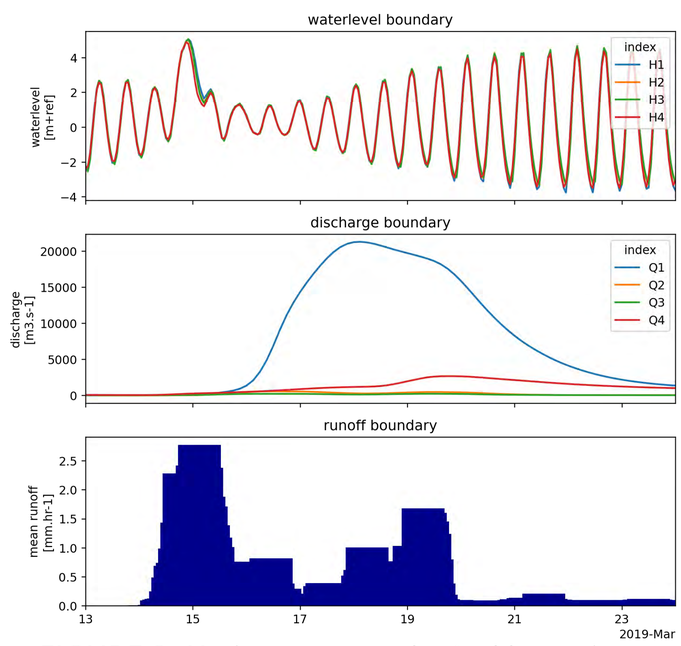

FIGURE 3: Hydro- meteorological boundary conditions during cyclone Idai, March 2019.

Methods and results

- ➢ Local high-res (100m) floodplain models are automatically build from global data and nested in global models with **hydroMT**[5], a python package for automatic & reproducible model setup.
- ➢ This setup is validated with flood extent EO data for **cyclone Idai, March 2019.**
- ✓ The nested floodplain model increases the simulation accuracy compared to a global model.
- ✓ Upstream discharge in the Buzi basin is the main driver of the Idai floods.
- ✓ Compound fluvial–pluvial and fluvial–coastal interactions increase flood levels and change flood timing.

Compound flood dynamics and drivers

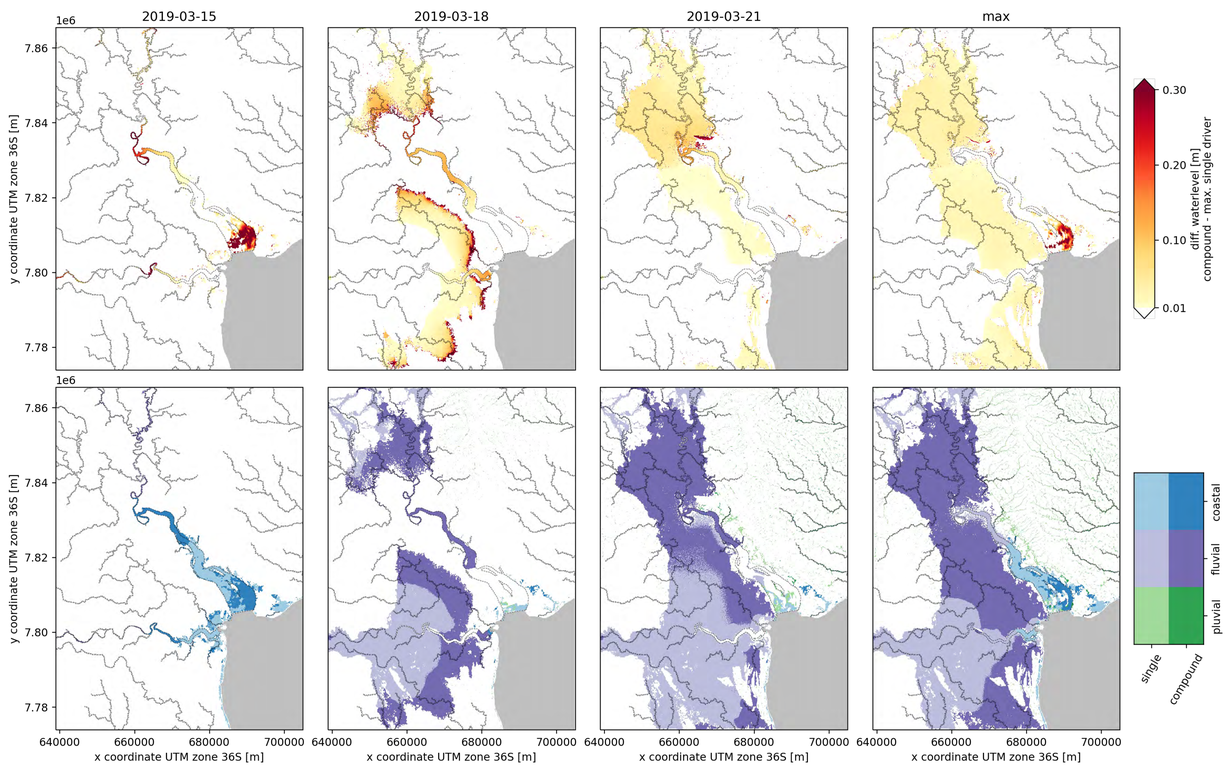

FIGURE 5: Compound flood dynamics and drivers based on a scenarios with and without each driver, where the tidal signal is used in case of no coastal driver and the climatological mean discharge in case of no fluvial driver.

Next steps

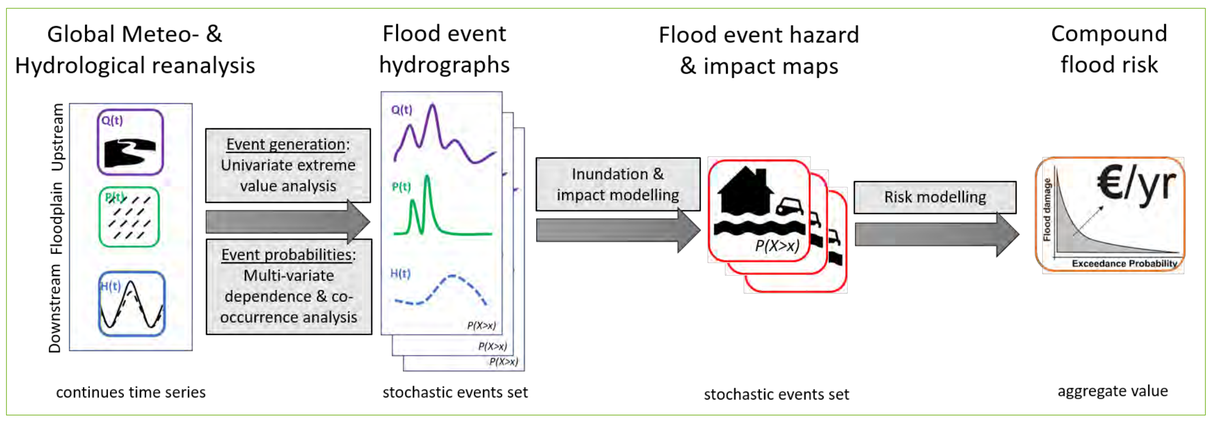

FIGURE 6: Proposed approach to extend the framework to compound flood *risk* modelling.

References

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5. Eilander et al. "HydroMT: Build and analyze models like a data-wizard!" https://github.com/Deltares/hydromt

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https://github.com/Deltares/hydromt_sfincs

@DirkEilander
@Compound_Event

E: dirk.eilander@vu.nl
W: www.compoundevents.org

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