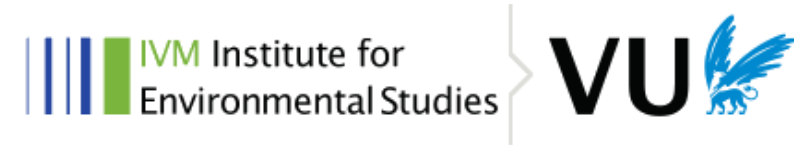


Deltares



A globally-applicable framework for compound flood risk modeling

Dirk Eilander

Email: dirk.eilander@vu.nl

Twitter: [@DirkEilander](https://twitter.com/DirkEilander)

Co-Authors:

Philip Ward (IVM, VU Amsterdam)

Anaïs Couasnon (IVM, VU Amsterdam)

Sanne Muis (IVM, Deltares)

Hessel Winsemius (Deltares, TU Delft)

Tim Leijnse (Deltares)

USGS | Monitoring Station - Brave
 dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=07374525&open=167809

USGS Mississippi River at Belle Chasse, LA
 USGS 07374525 (Surface Water, Stream)

Show Map Open Plots Site Page Data Subscribe

▼ Discharge, cubic feet per second **358,000 @ 3:30 PM (Central European Summer)**

ft³/sec

26 Aug 27 Aug 28 Aug 29 Aug 30 Aug 31 Aug 01 Sep

> Gage height, feet **9.95 @ 3:30 PM (Central European Summer)**

> Stream water level elevation above NAVD 1988, in feet **3.07 @ 3:30 PM (Central European Summer)**

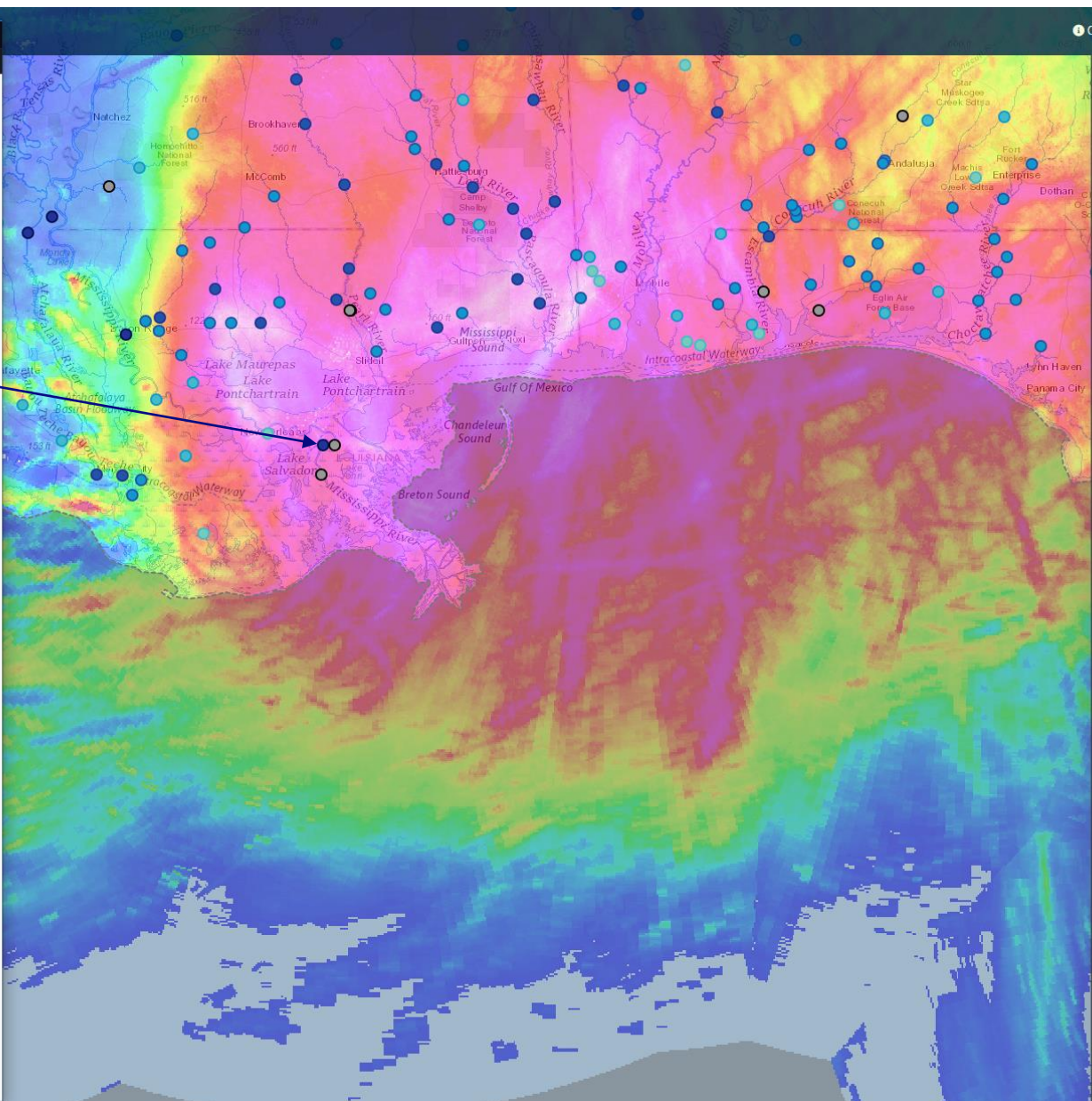
> Stream water level elevation above NAVD 1988, in feet **3.07 @ 3:30 PM (Central European Summer)**

> Turbidity, water, unfiltered, monochrome near infra-red LED light, 780-900 nm, detection angle 90 +2.5 **12.6 @ 3:30 PM (Central European Summer)**
 degrees, formazin nephelometric units (FNU)

▼ Mean water velocity for discharge computation, feet per second **2.15 @ 3:30 PM (Central European Summer)**

ft/sec

26 Aug 27 Aug 28 Aug 29 Aug 30 Aug 31 Aug 01 Sep



Overview Layers Legend Tools

Streamflow: Streamflow

- > 100,000 cubic feet per second
- > 10,000 - 100,000 cubic feet per second
- > 1,000 - 10,000 cubic feet per second
- > 100 - 1,000 cubic feet per second
- > 10 - 100 cubic feet per second
- > 0 - 10 cubic feet per second
- 0 cubic feet per second (not flowing)
- Measurement flag
- Recent measurement unavailable

Data Source: USGS Water Data for the Nation

TIP - Click streamflow stations to access real-time data, time-series graphs, and station information.

Recent Rainfall: Past 3 days

- 1 inch
- 2 inches
- 3 inches
- 4 inches
- 5 inches
- 6 inches
- 7 inches
- 8 inches
- 9 inches

Comments: Represents estimated accumulated precipitation over the past 3 days.

Data Source: Iowa Environmental Mesonet (IEM)

Rivers

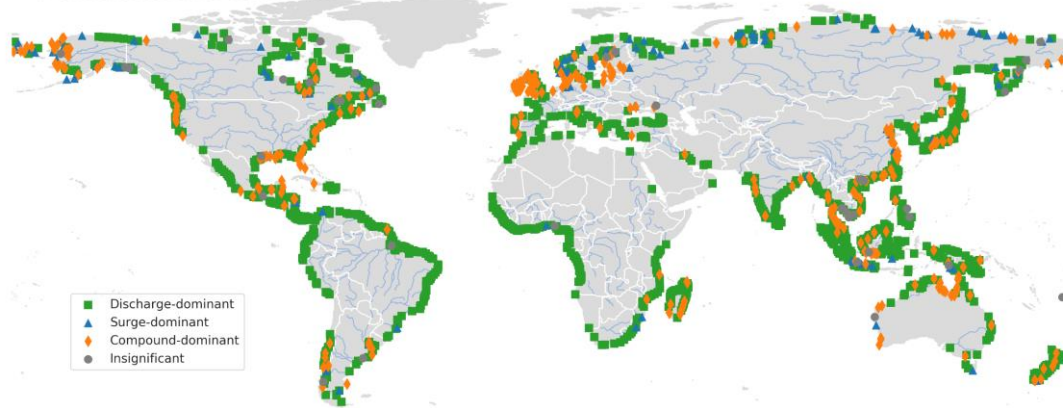
- Waterbody
- Stream
- Intermittent Stream

Comments: Depicts the National Hydrography Dataset (NHD) that encodes information about naturally occurring and constructed bodies of surface water (lakes, ponds, and reservoirs) and paths through which water flows (canals, ditches, streams, and rivers).

Data Source: USGS National Map

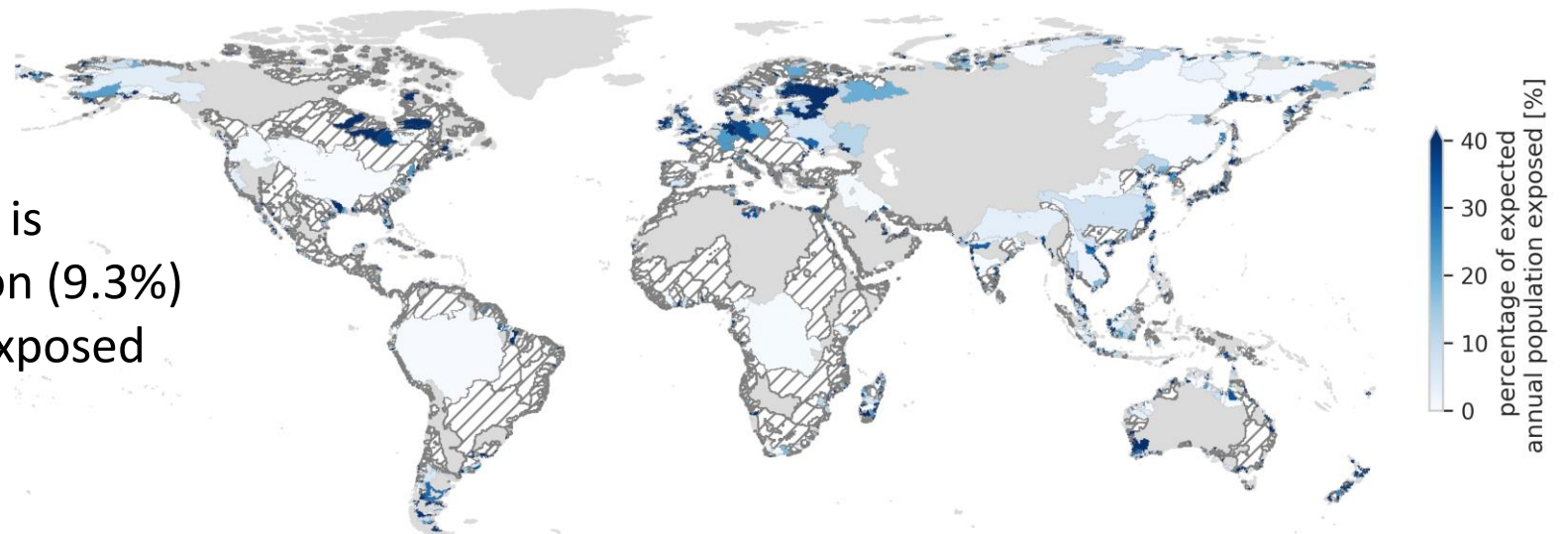
Compound events exacerbate flood levels and impacts

A. Dominant flood driver classification

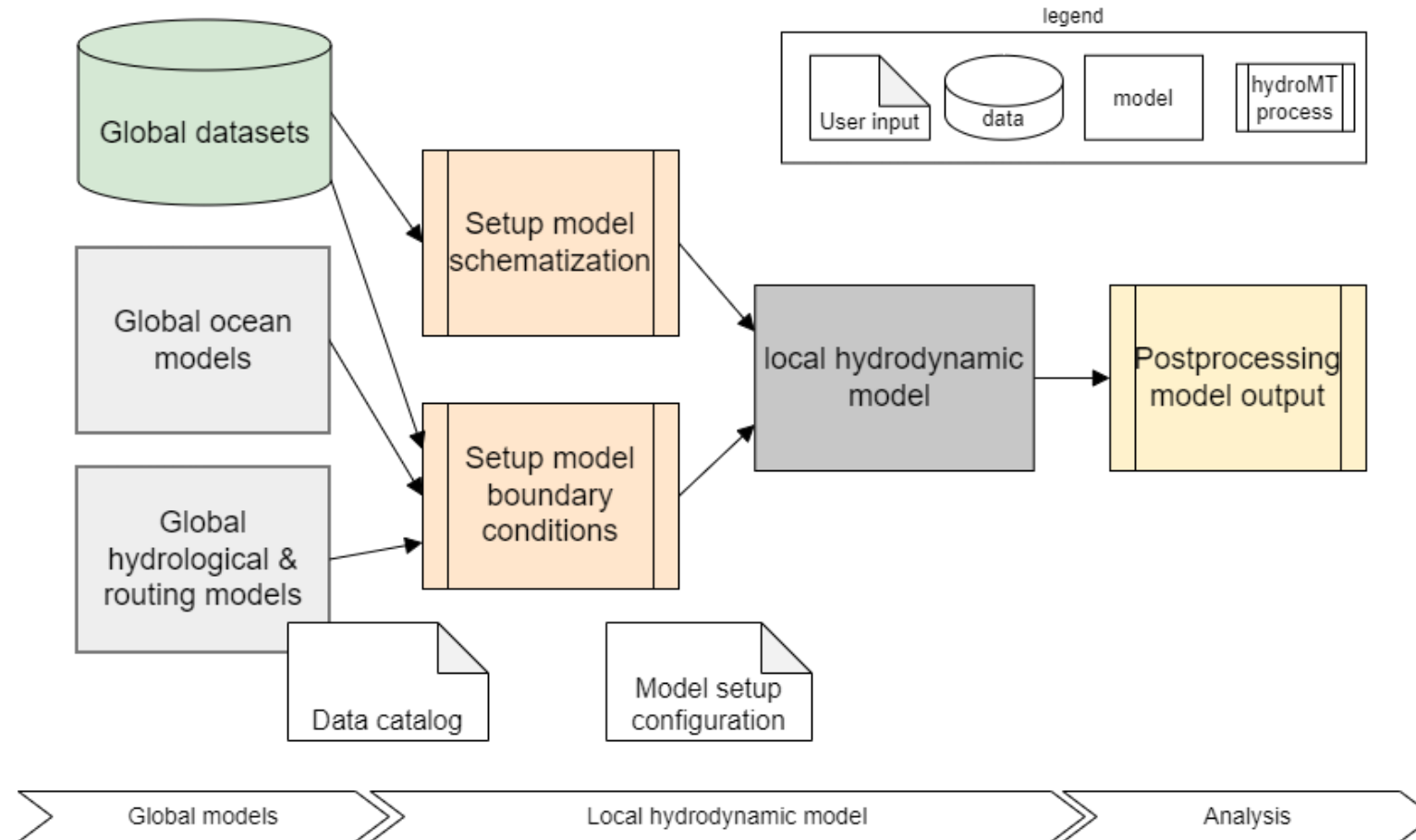


➤ At ~20% of locations combined surge and discharge drivers cause extreme water levels

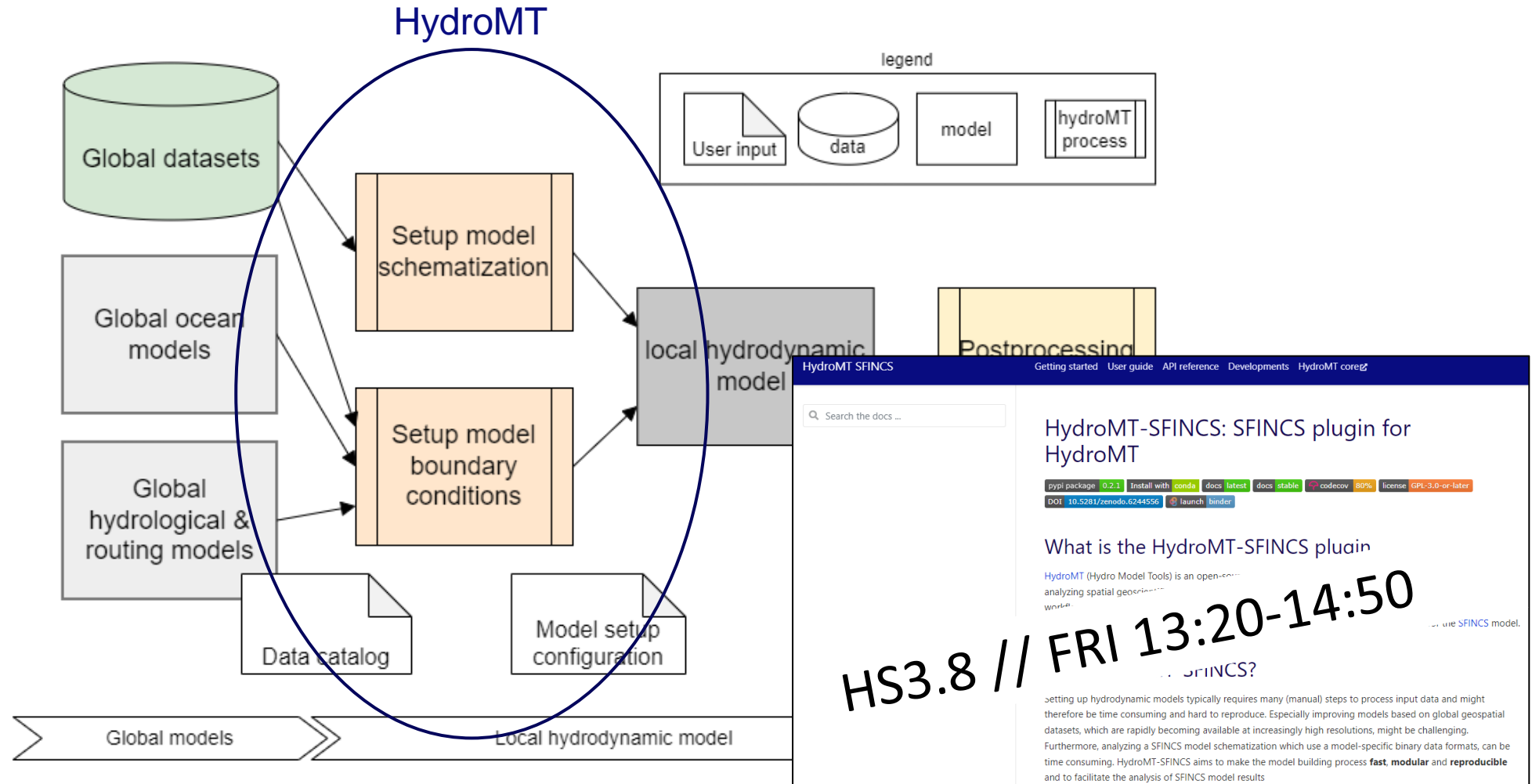
➤ If not accounted for, flood risk is underestimated for 30.7 million (9.3%) expected annual population exposed



A globally-applicable framework for compound flood hazard modelling

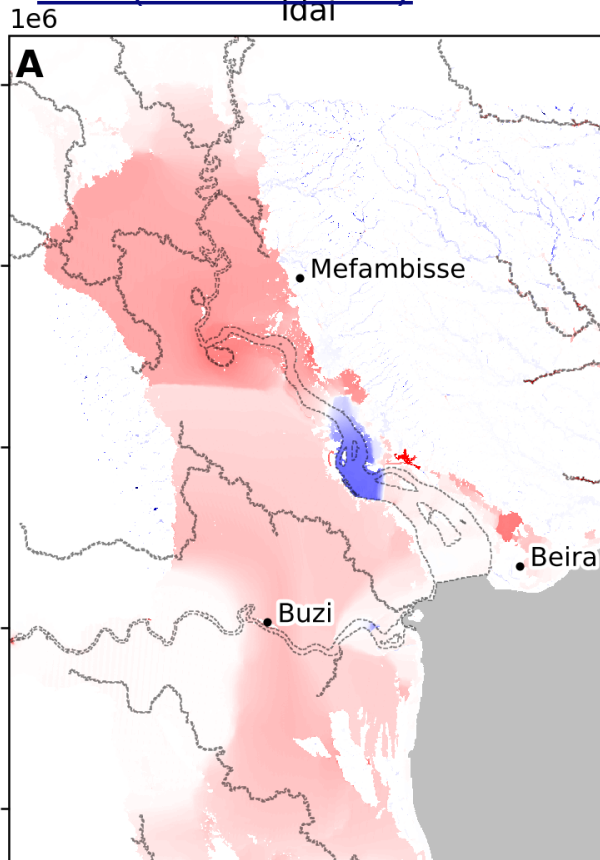


A globally-applicable framework for compound flood hazard modelling

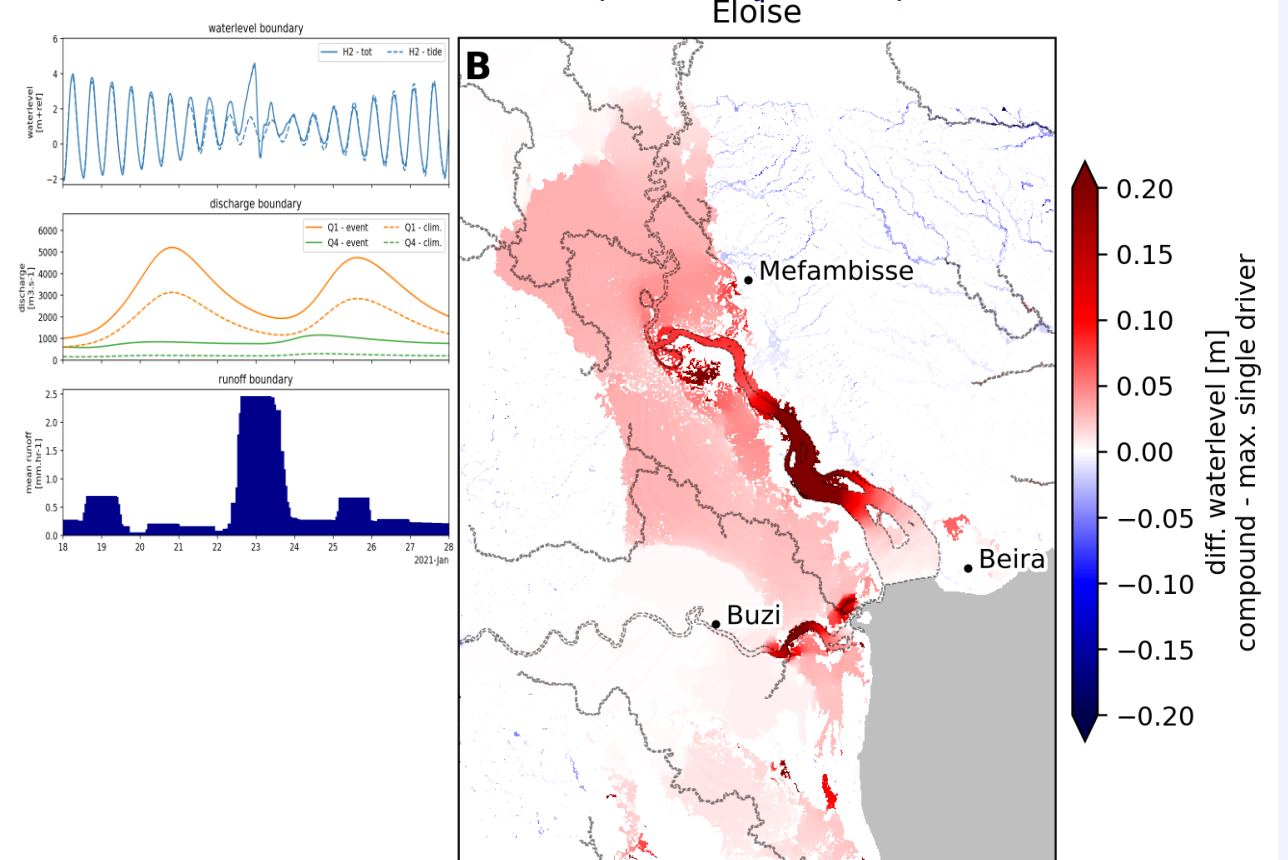


Application: compound flood driver analysis

Idai (March 2019)



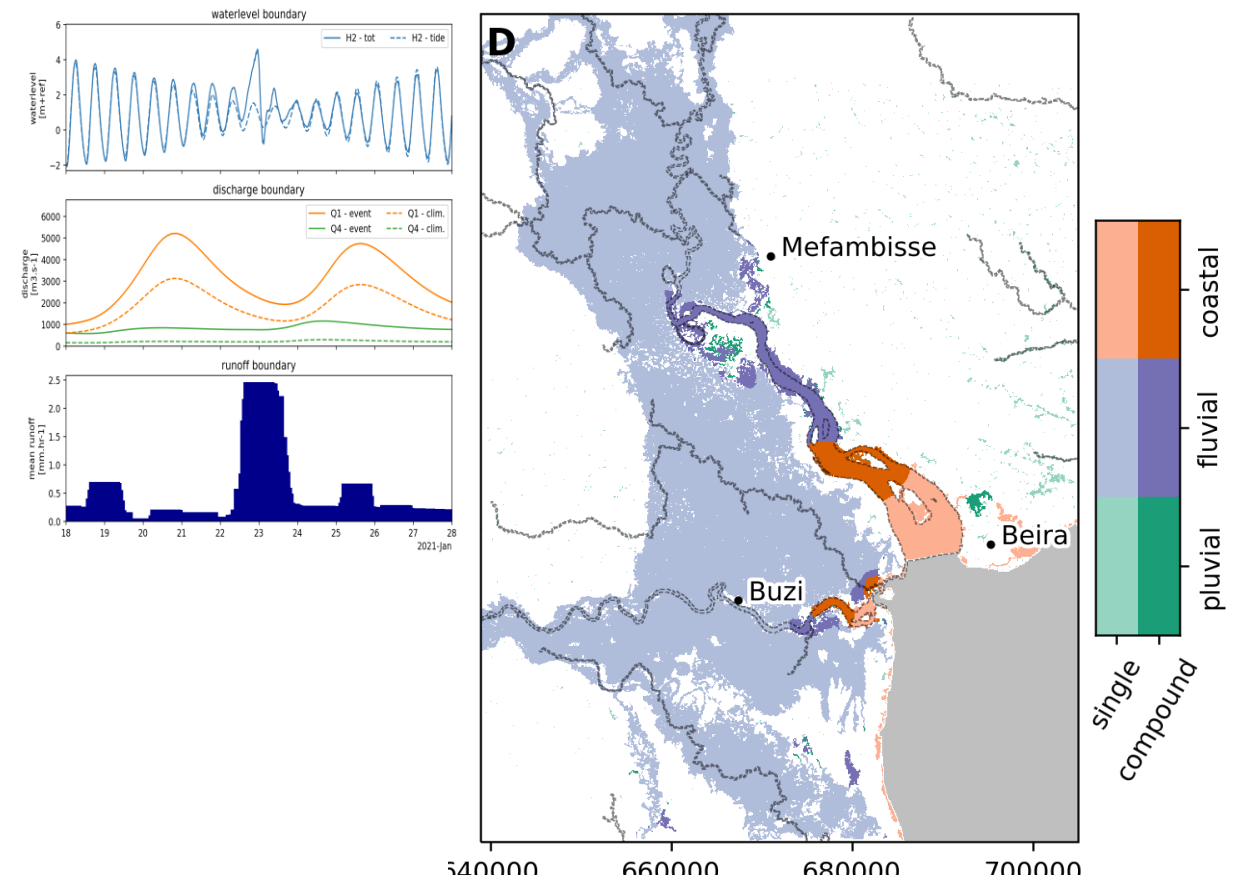
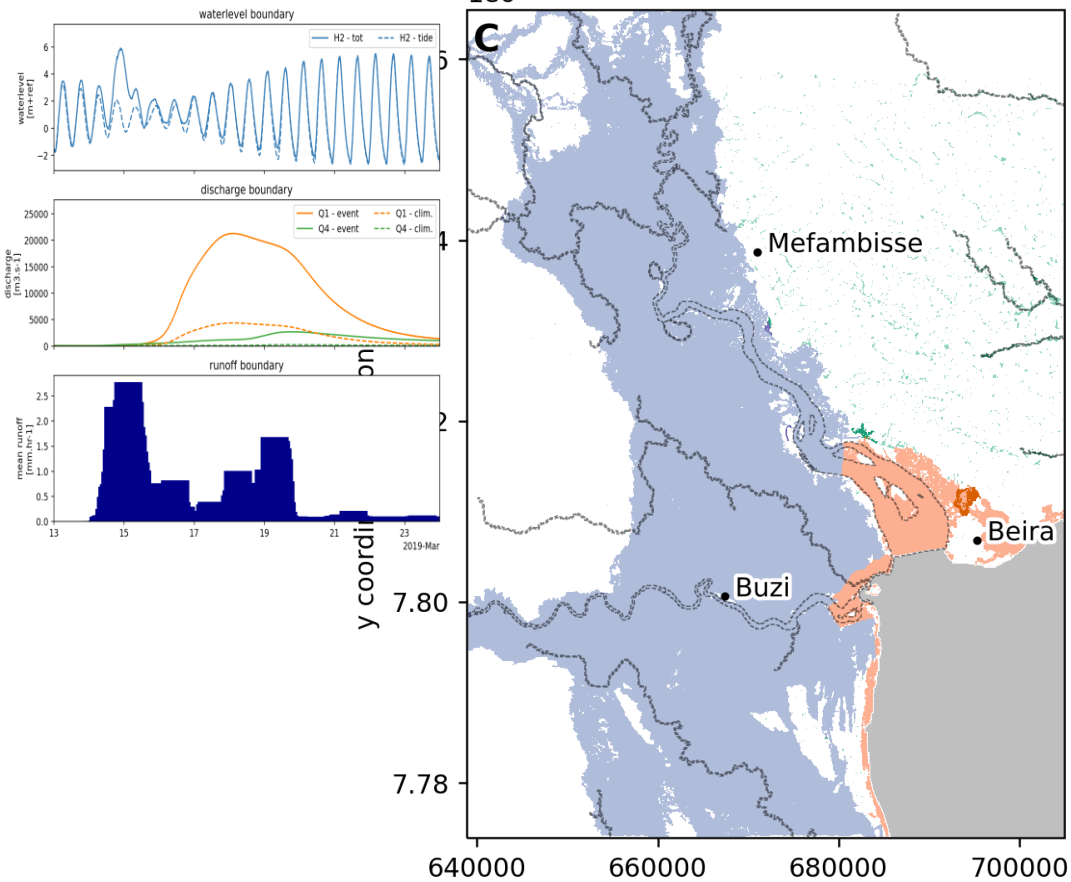
Eloise (January 2021)



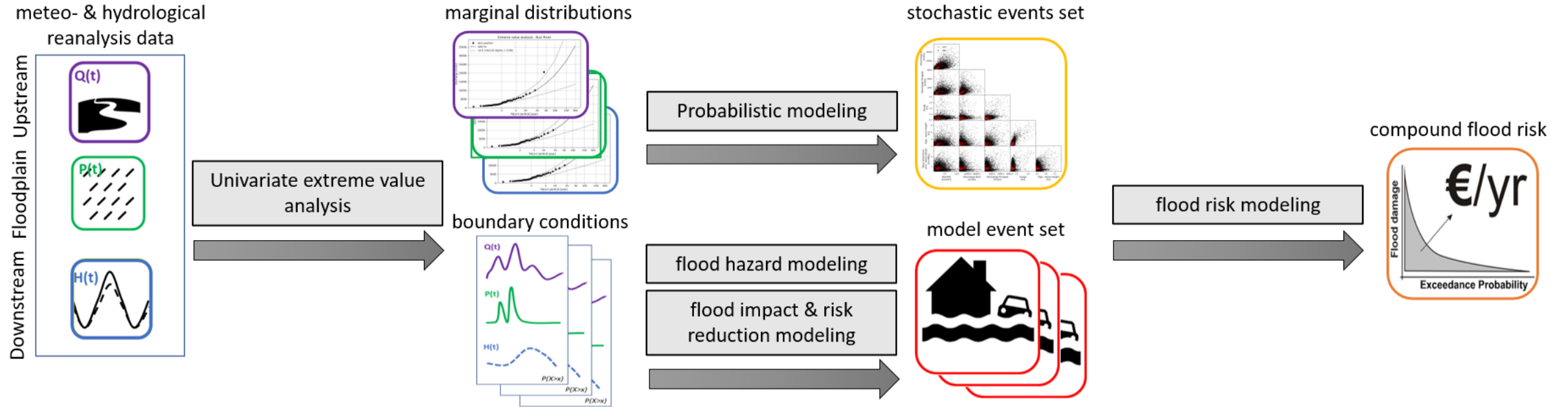
Application: compound flood driver analysis

Idai (March 2019)

Eloise (January 2021)



Application: Compound flood risk



Water Resources Research

RESEARCH ARTICLE
10.1029/2021WR030002

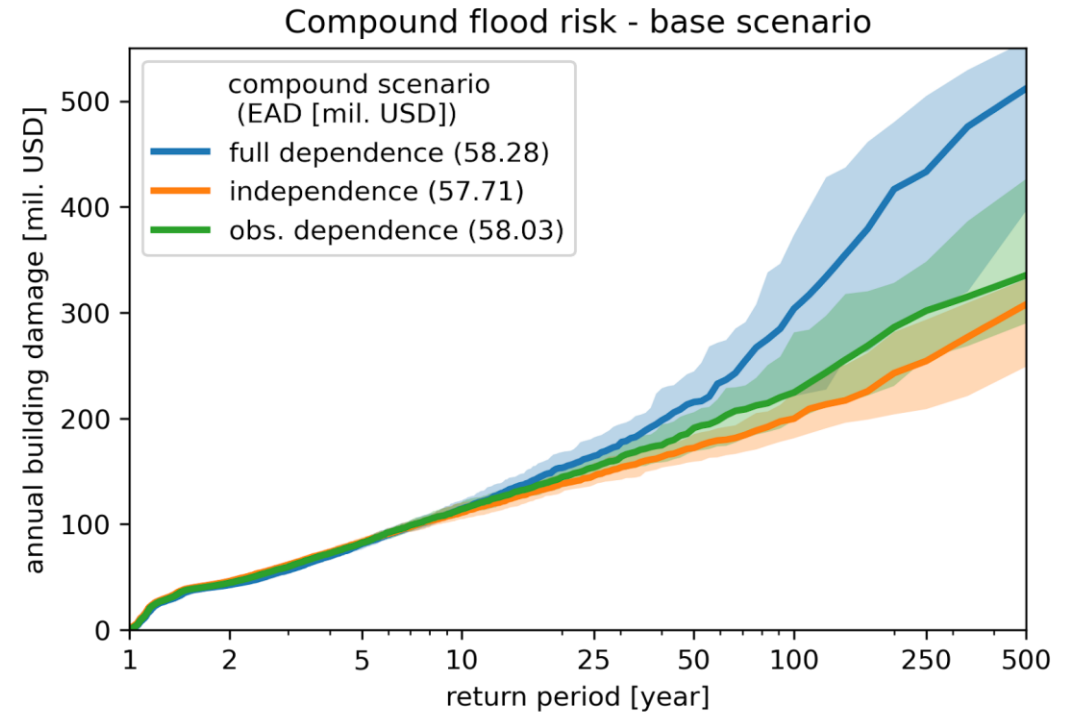
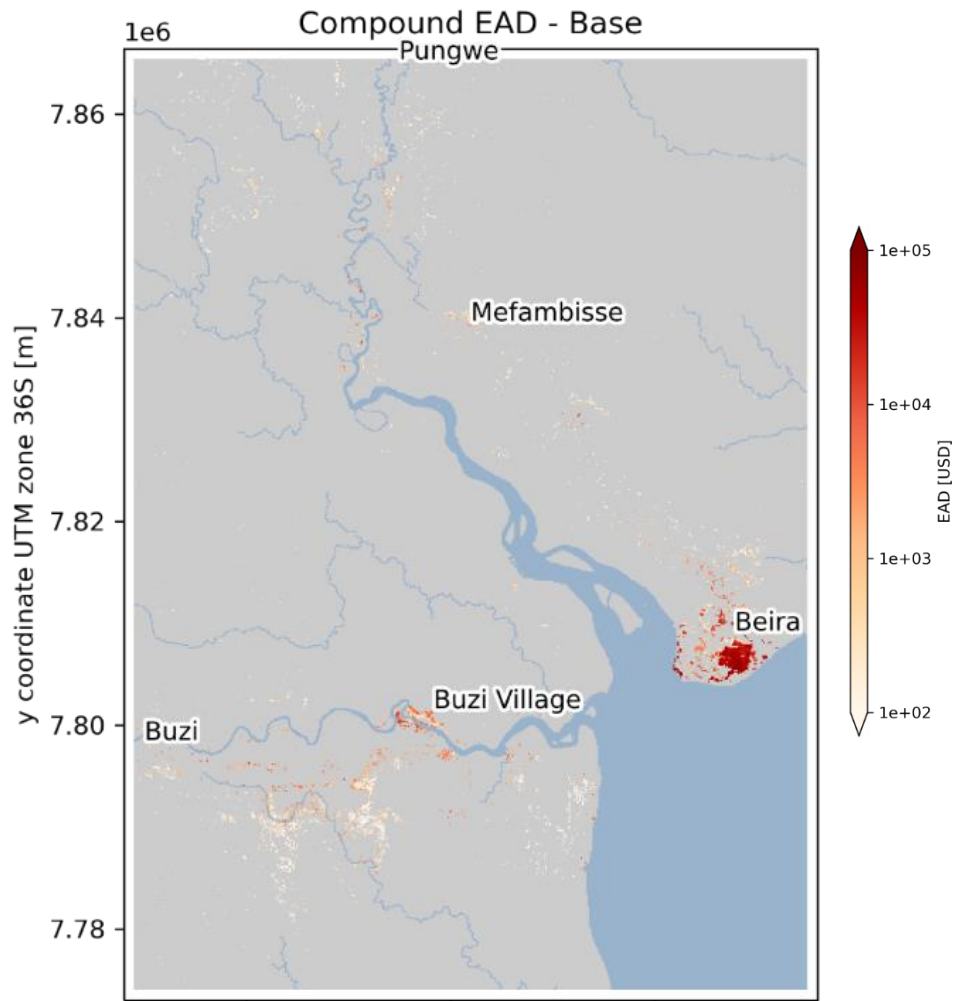
Special Section:
Coastal hydrology and
oceanography

Key Points

A Flood Risk Framework Capturing the Seasonality of and Dependence Between Rainfall and Sea Levels—An Application to Ho Chi Minh City, Vietnam

A. Couasnon¹, P. Scussolini¹, T. V. T. Tran², D. Eilander^{1,3}, S. Muis^{1,3}, H. Wang⁴, J. Keesom¹, J. Dullaart¹, Y. Xuan⁴, H. Q. Nguyen^{2,5}, H. C. Winsemius^{3,6}, and P. J. Ward¹

Application: Compound flood risk



Take away messages

General conclusions:

- Need to move towards *integrated flood risk* in coastal areas
- Large event sets are required for a robust analysis of transition zones

Conclusion flood risk Sofala (Mozambique):

- Physical compound interactions limited, but important for rare events (> T100 year)

Next steps:

- Fixed timing is a crucial assumption in current compound risk approach

Questions?

Dirk Eilander

Email: dirk.eilander@vu.nl

Twitter: [@DirkEilander](https://twitter.com/DirkEilander)

Co-Authors:

Philip Ward (IVM, VU Amsterdam)

Anaïs Couasnon (IVM, VU Amsterdam)

Sanne Muis (IVM, Deltares)

Hessel Winsemius (Deltares, TU Delft)

Tim Leijnse (Deltares)



<https://github.com/Deltares/hydromt>

HS3.8 // FRI 13:20-14:50

