



Dynamic flood risk assessment using globally available data: an African example

Brenden Jongman & Philip Ward

Flooding in Africa: what are the impacts?



“[...] **Globally**, we need to better understand **how and where** we are **vulnerable** to disasters, and how best to **manage the risks** we face”



Robert B. Zoellick
President
The World Bank Group
June 2012

Global flood risk research at IVM & Deltares

■ IVM VU

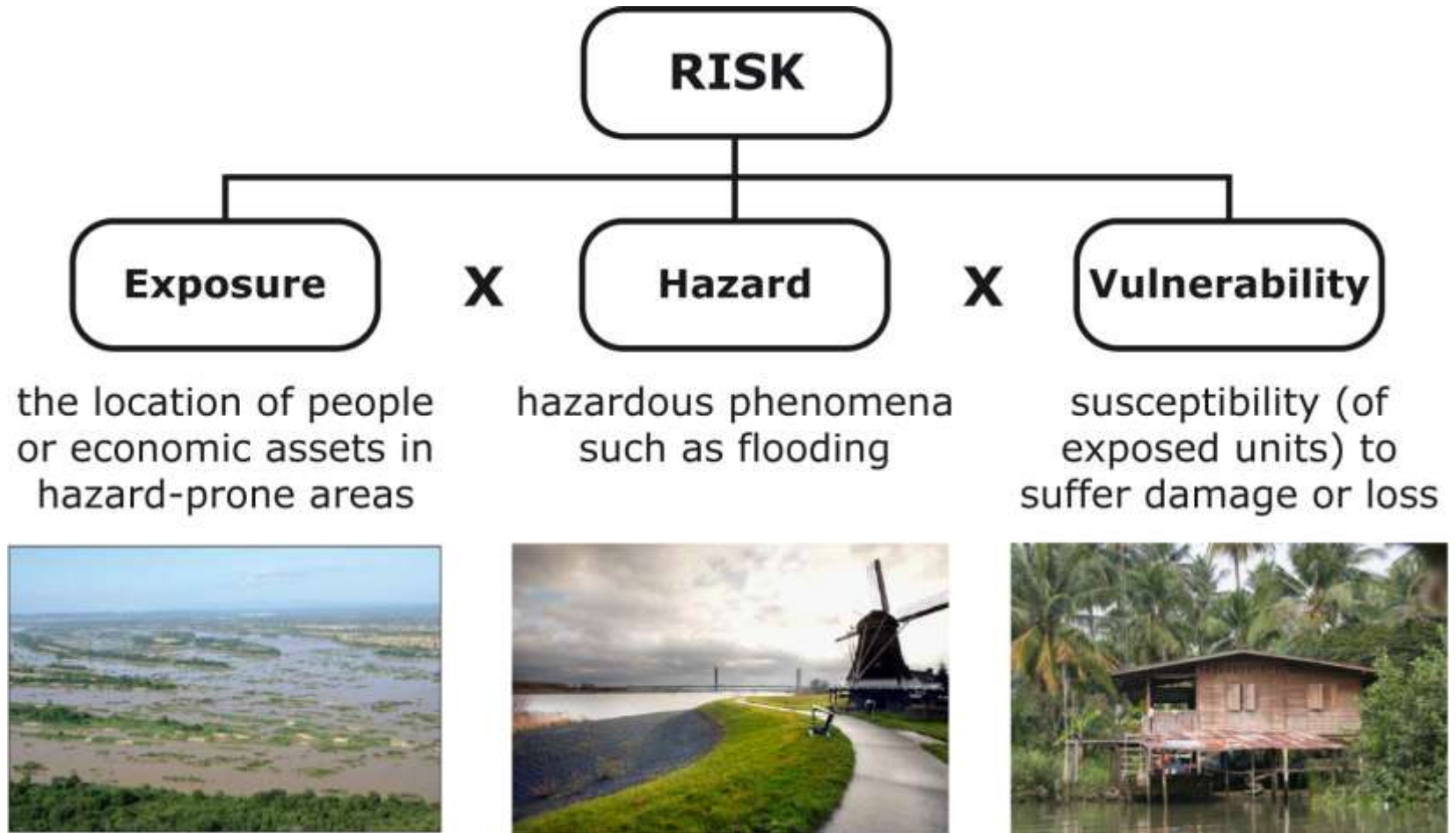
- Multidisciplinary risk studies
- ENHANCE project

■ Deltares

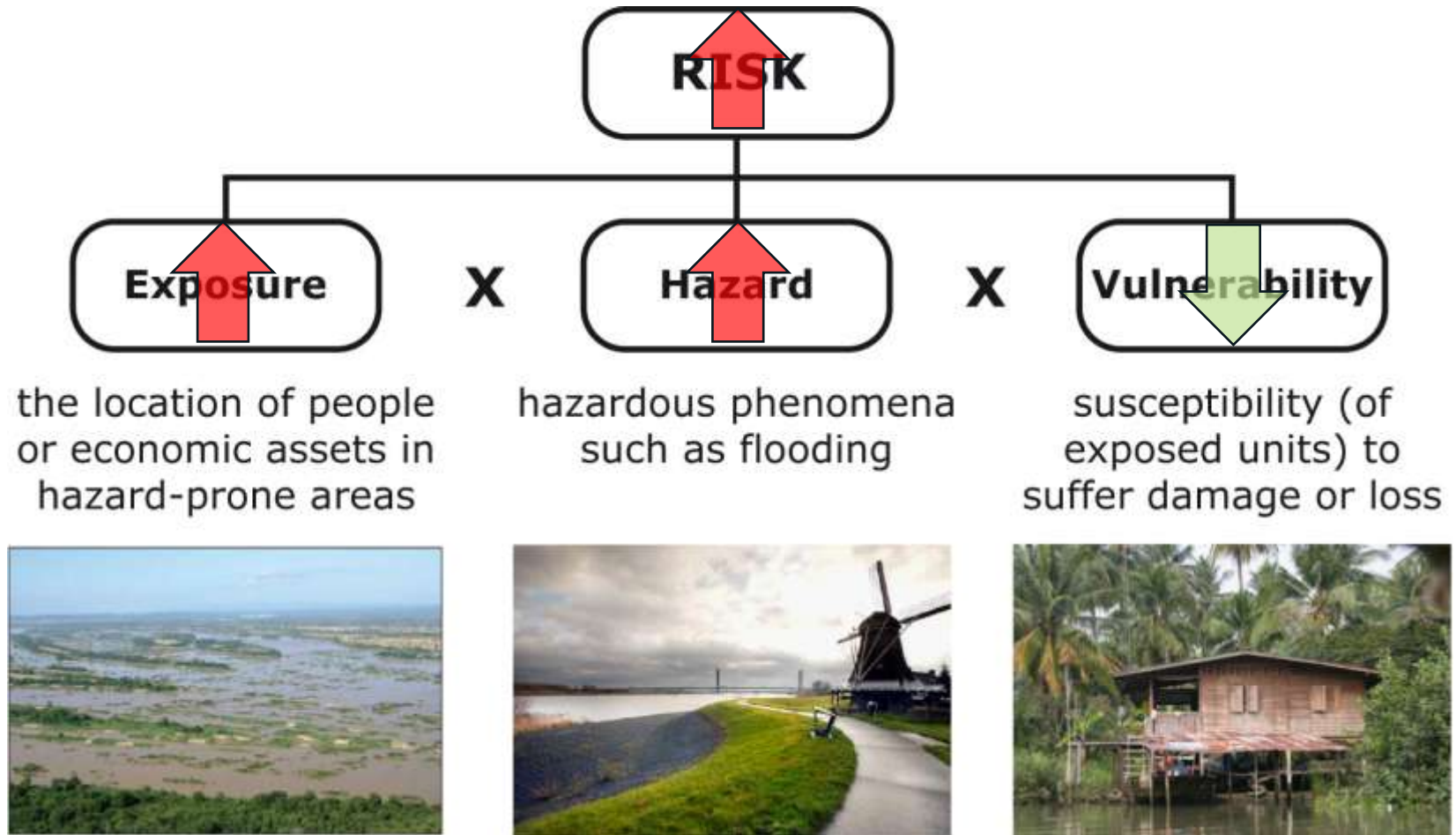
- Global hydrological modeling
- Collaborative research with The Netherlands Environmental Assessment Agency



Flood risk: definition

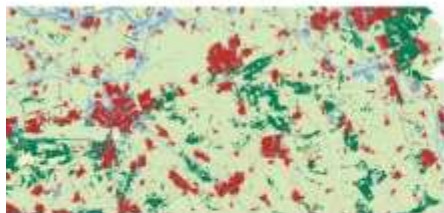


Flood risk: definition



Direct economic damages

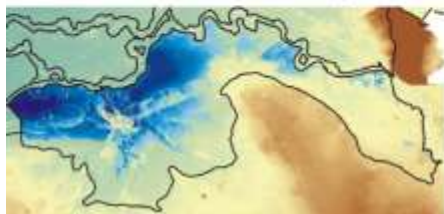
Land use / Assets



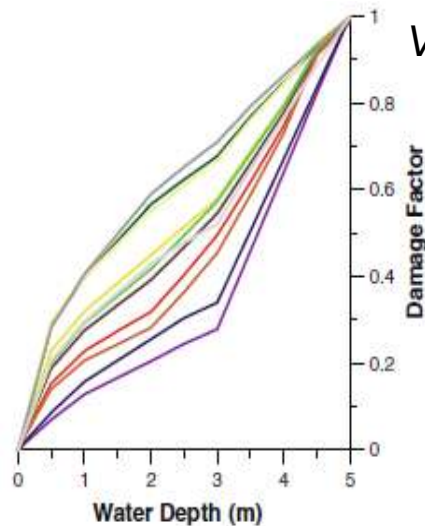
Exposure



Inundation depth



Hazard

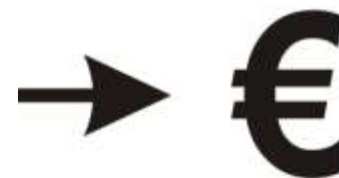


Netherlands Later curves (DM3)

- Urban
- Recreation
- Commercial
- Harbor
- Nature/Forest
- Arable land
- Grassland
- Greenhouses
- Zero grazing
- Infrastructure
- Construction

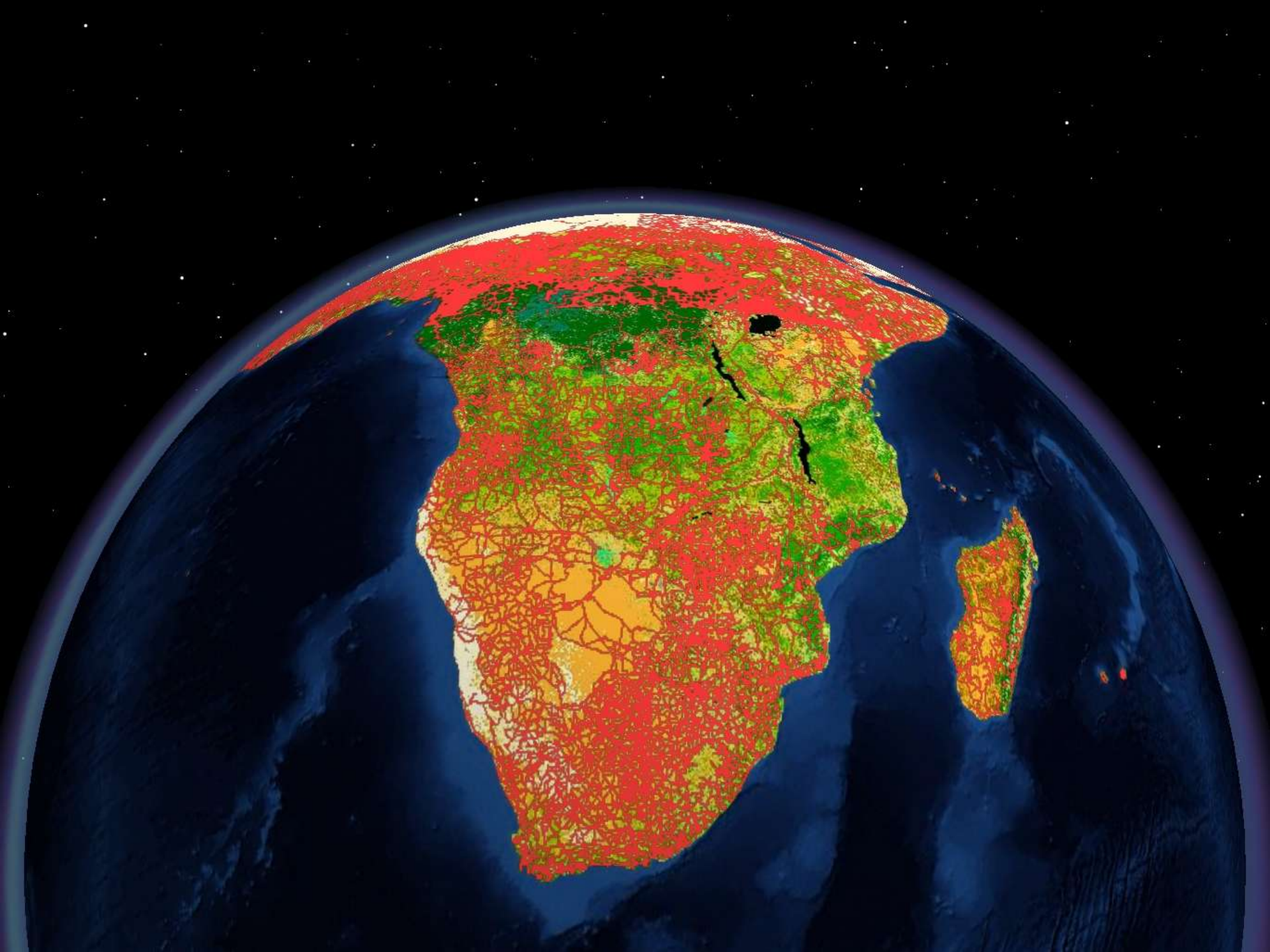
Vulnerability

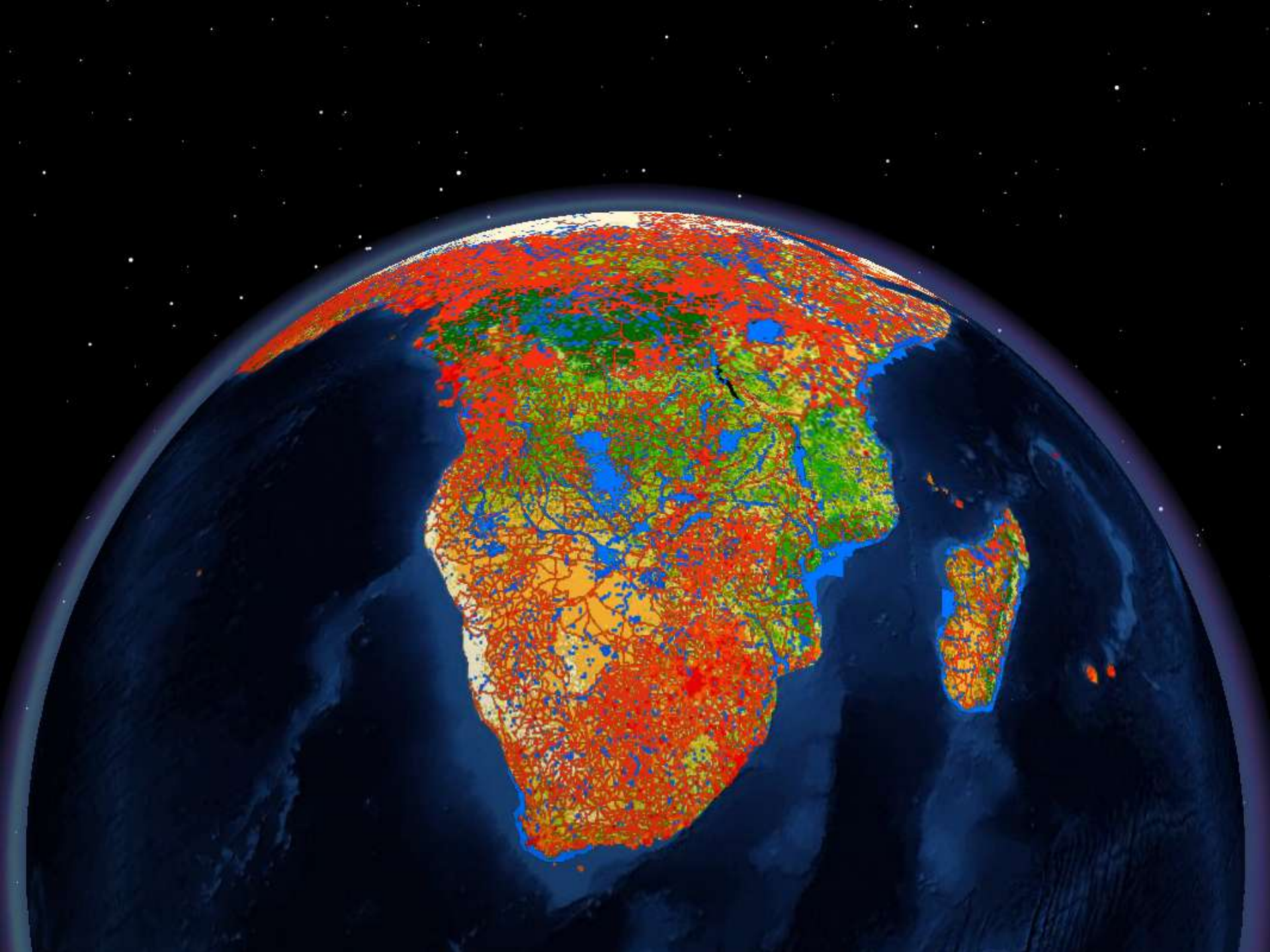
Flood Damage

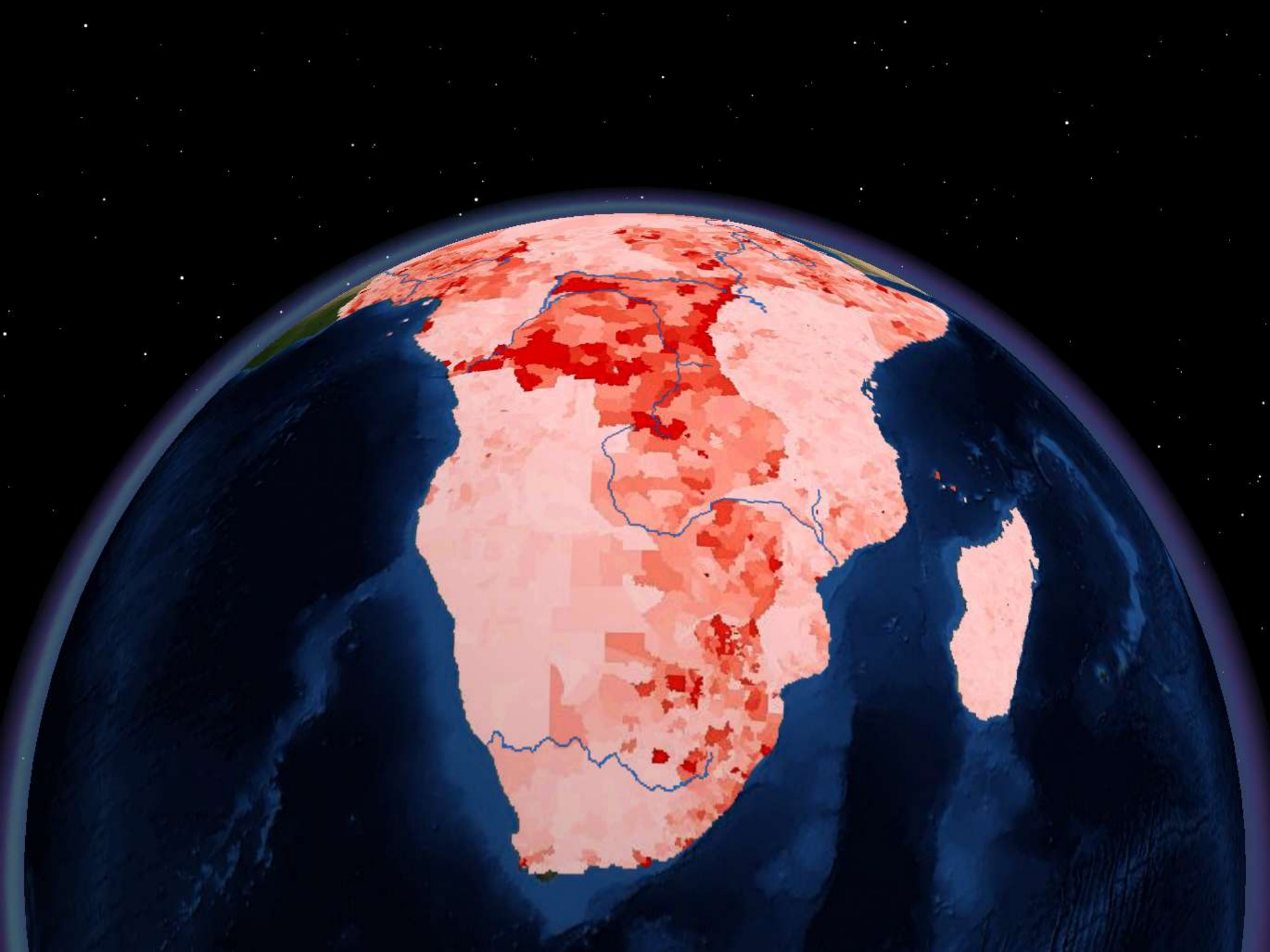












Global flood hazard model

- **Global hydrological inundation model**
- **Currently:** up to **1 in 30 year** floods
- **Possible:** up to **1 in 100 year** floods
- **Output:**
 - Inundation extent (1km x 1km)
 - Inundation depth (10cm intervals)

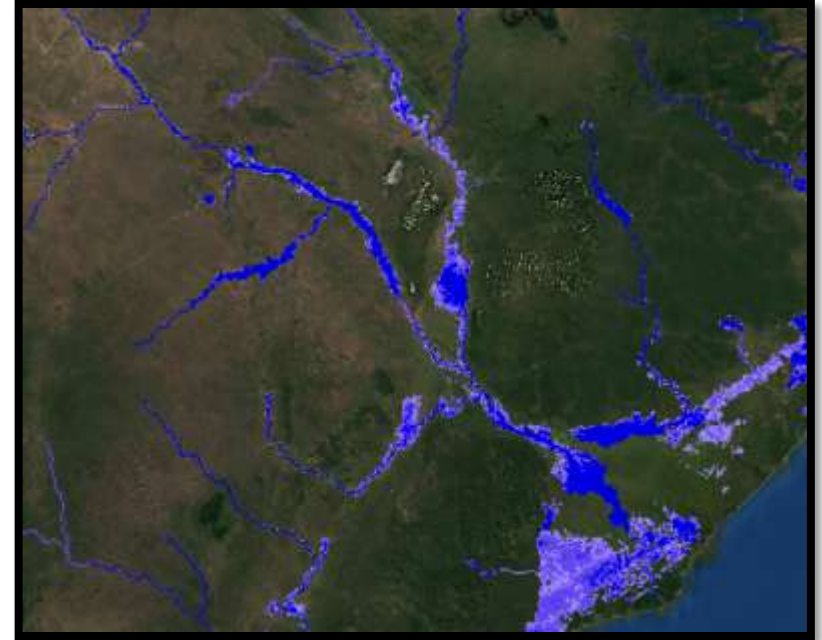


Hazard validation: case-study Mozambique

Satellite observations

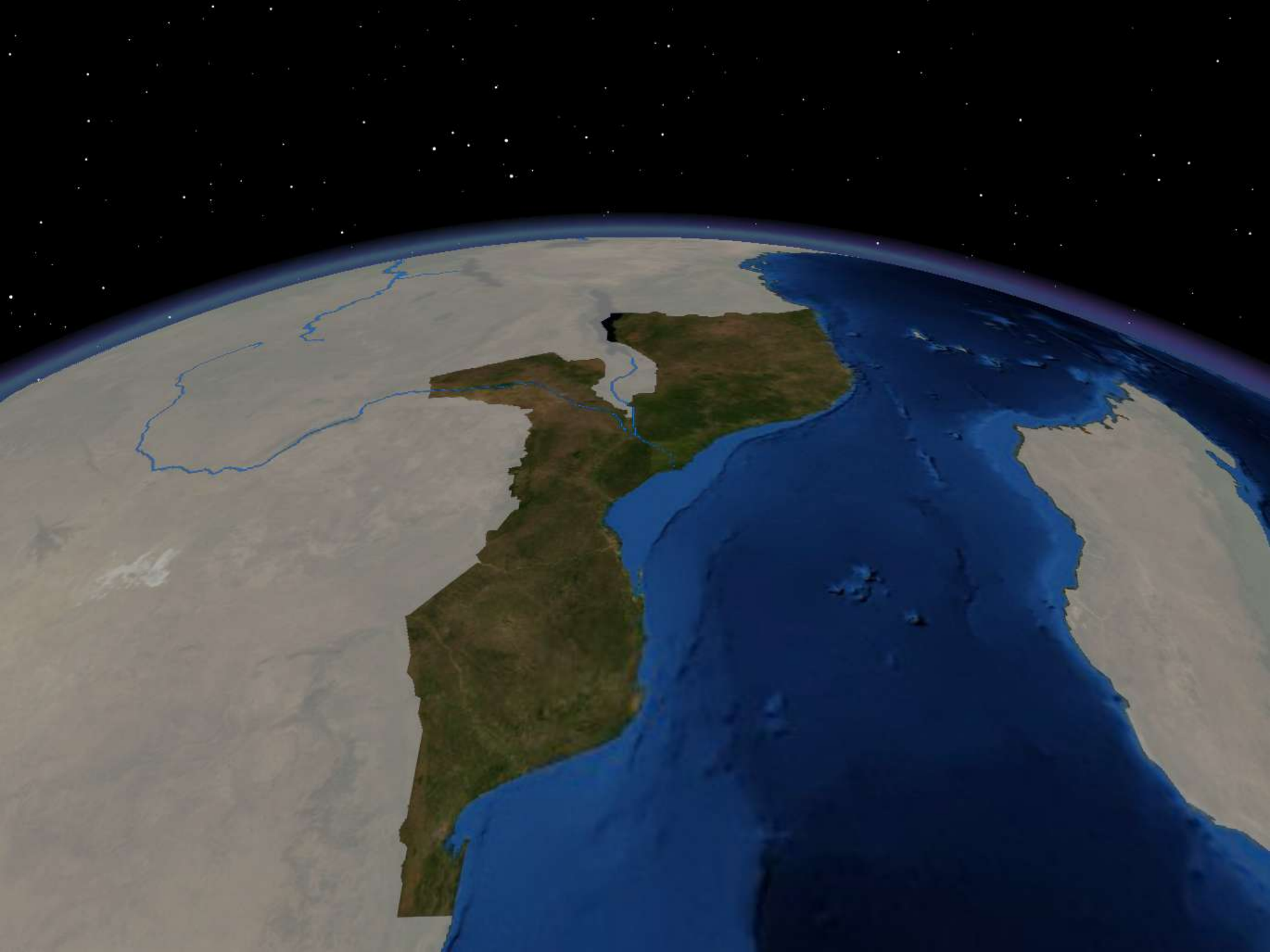


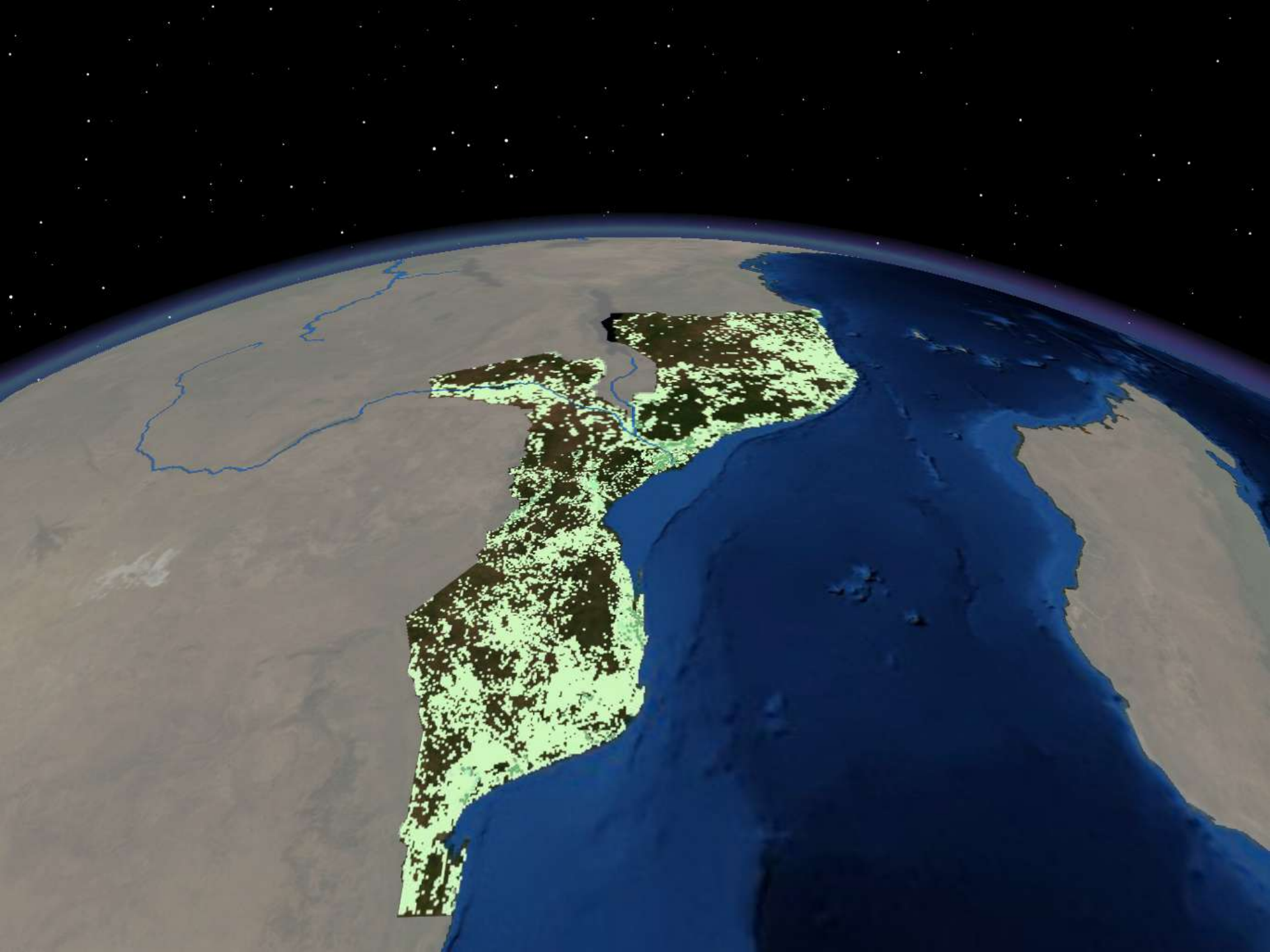
Global flood model



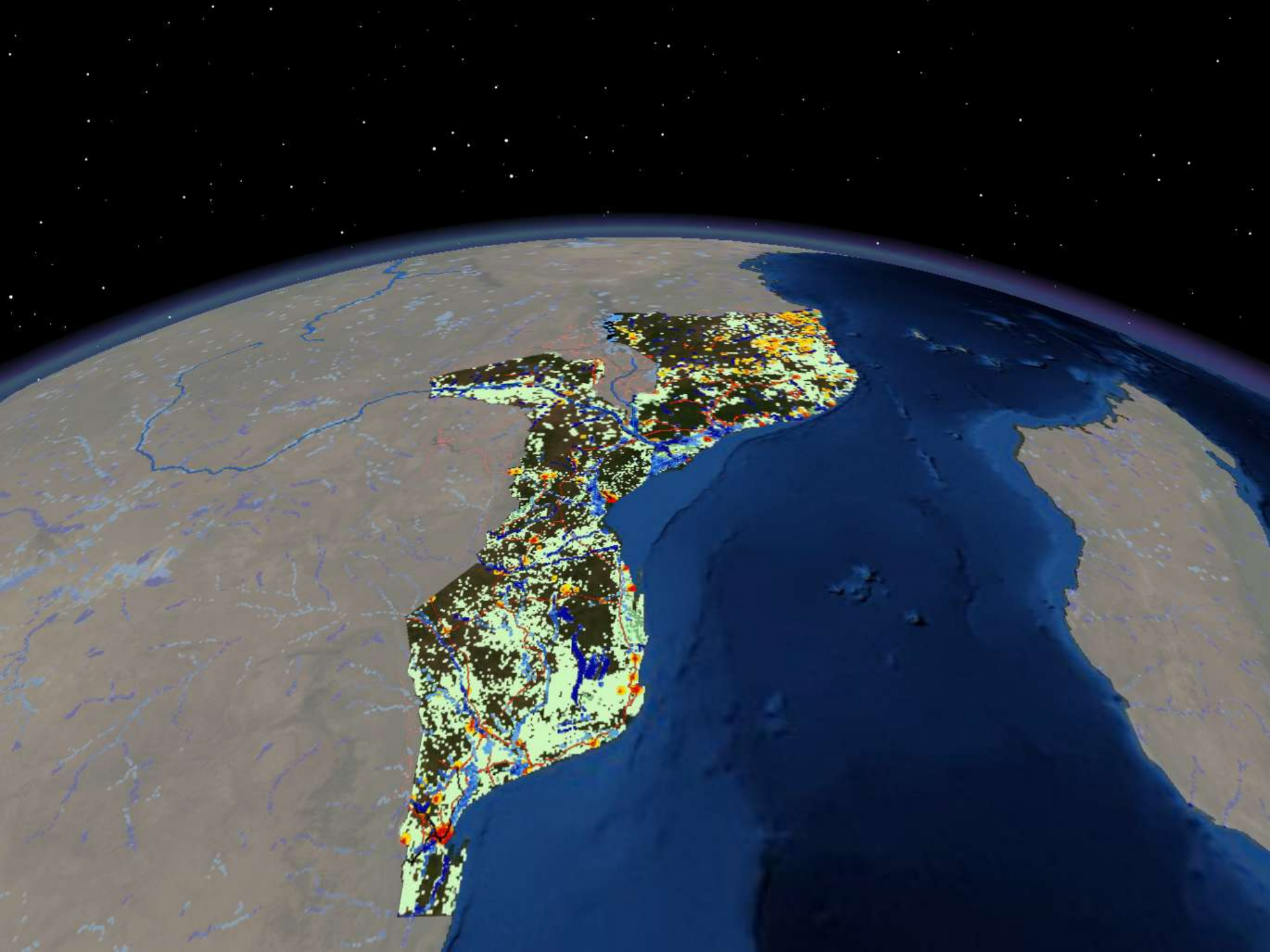
Flood risk assessment: case-study Mozambique

- Flood risk assessment using **global data**
- **Exposure:** three land-use types
 - Urban (density 0 – 100%)
 - Crops (density 0 – 100%)
 - Infrastructure (roads and railways)
- **Hazard:** global inundation model
- **Vulnerability:** vulnerability functions with depth











Flood risk assessment: Mozambique case-study

Damages to...	Model estimates, total Mozambique (millions)	Observed, year 2000 flood (millions)
Urban areas	\$ 3,162	\$ 1,105
Crops	\$ 17	\$ 85
Infrastructure	\$ 131	\$ 100
Total	\$ 3,310	\$ 1,290



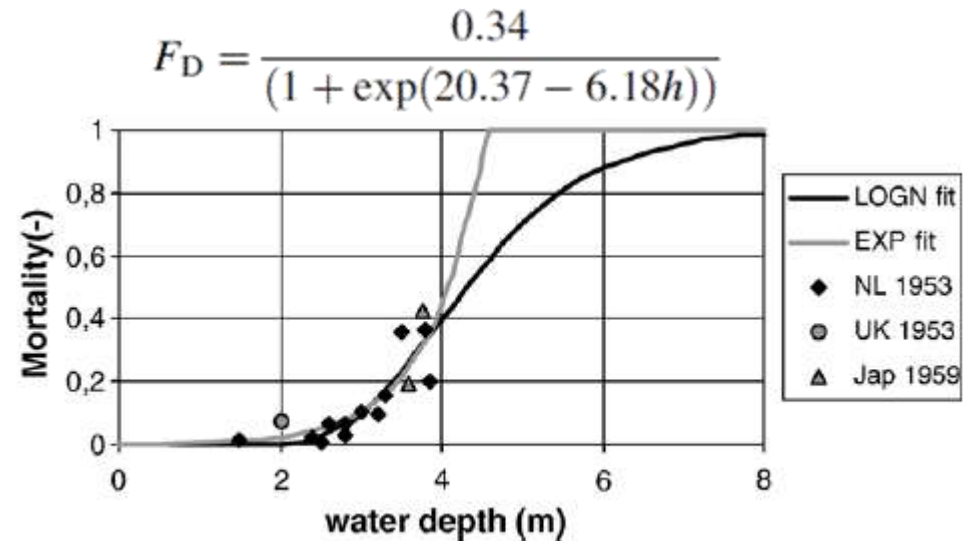
Population impact

■ Affected population

- Number of people affected
- Average poverty, age break-down and health of affected people

■ Mortality

- Expected deaths
 - > Flood depth
 - > Poverty and health
 - > Governance indicators



Source: Jonkman et al., 2008

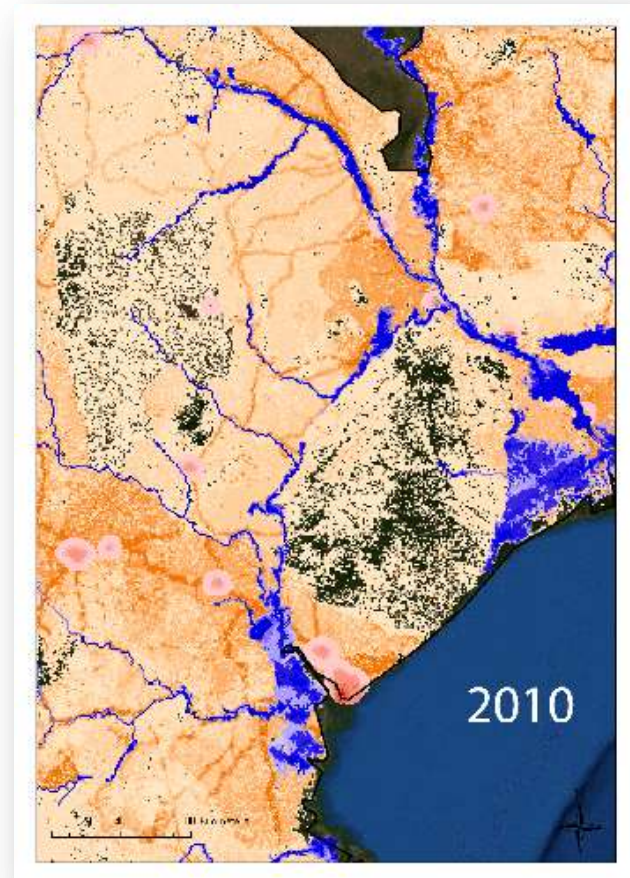
Dynamic scenarios

■ Flood risk under scenarios of..

- Climate change
- Population growth
- Urban expansion
- Wealth growth

■ Dynamic assessment

- How does flood risk change?
- Which developments matter?
- Which can we influence?



Adaptation measures

▪ Model can be used to assess adaptation measures

1. Hazard reduction

- Standard of flood protection

2. Exposure reduction

- Value of assets in flood zone

3. Vulnerability reduction

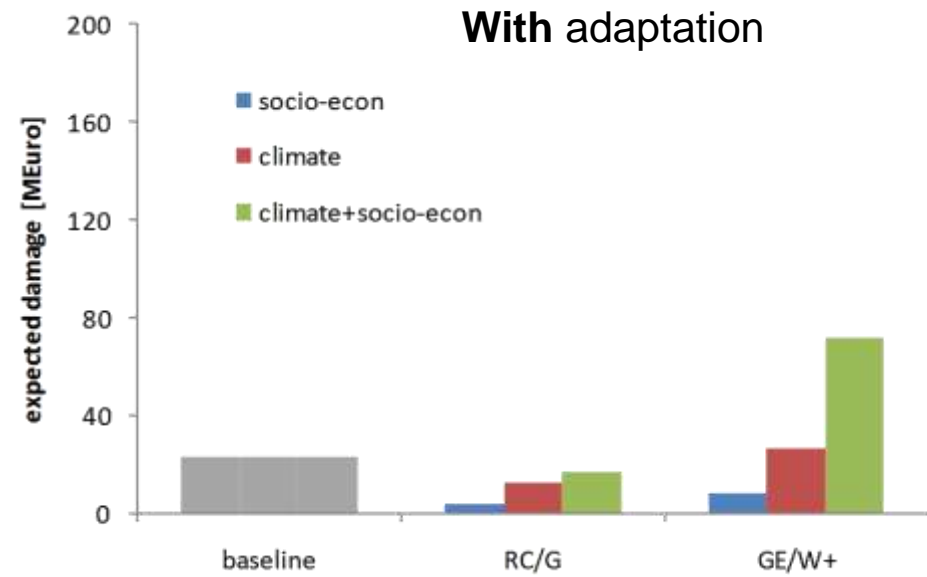
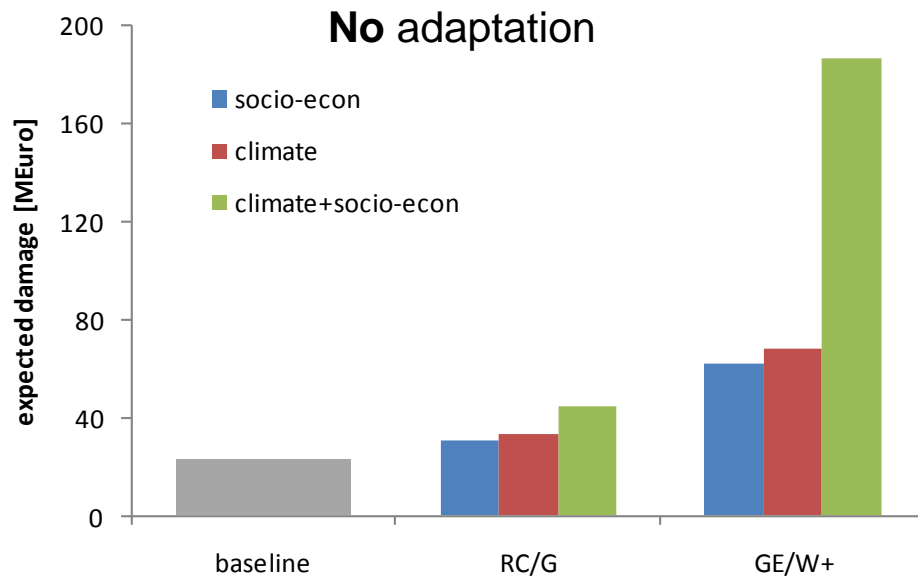
- Asset vulnerability
- Societal resilience



(Source: Rijkswaterstaat)

Adaptation measures

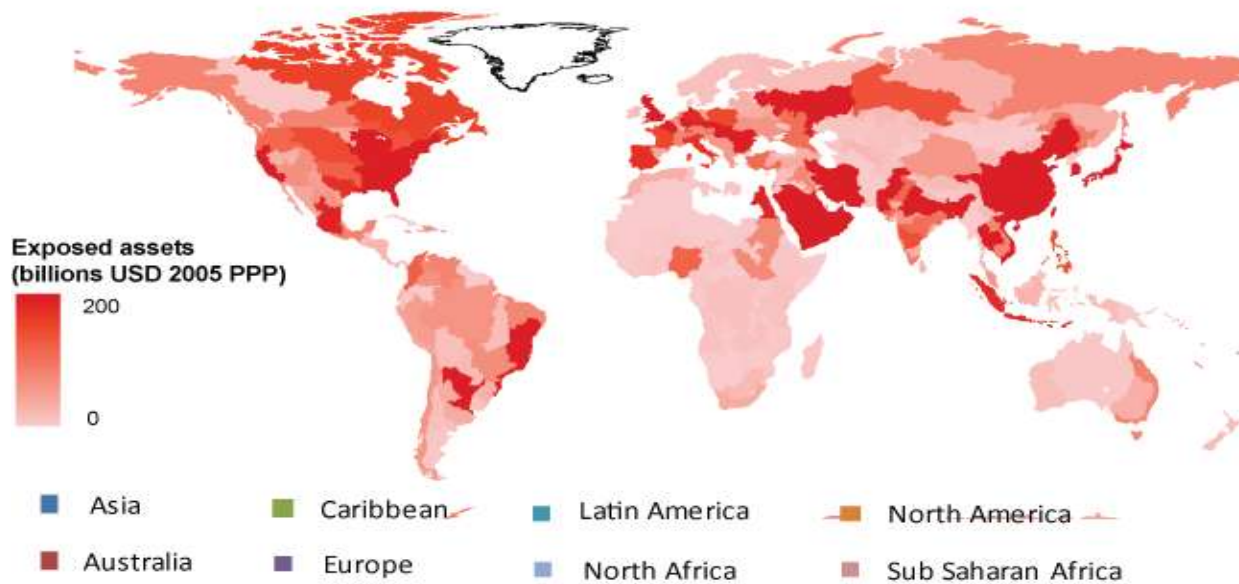
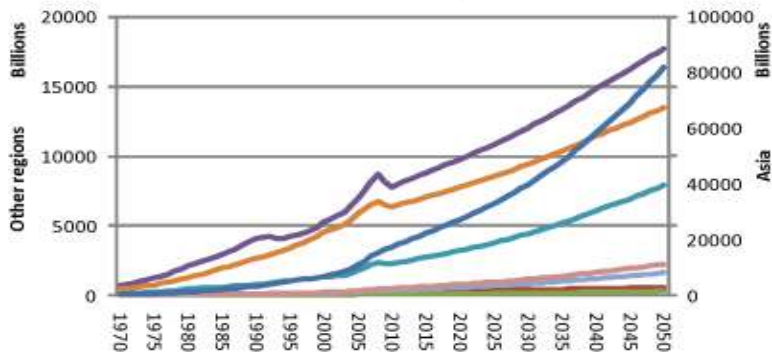
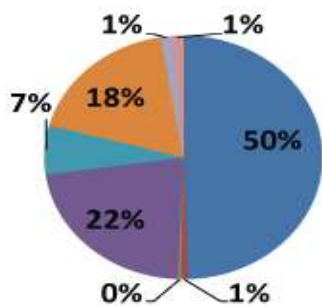
- Model can be used to assess adaptation measures



Source: De Moel et al., 2011

Global scale analyses

Total assets exposed to river flooding, 2010



Links to stakeholders operations

1. Quantifying and mapping **current and future flood risk**
2. Linking to **adaptation planning and financing**
3. Assessing the effects of **development** on flood risk
4. Applications in **short- to medium-term disaster planning**
5. Added value to the **Global Assessment Report?**

Thank you for your attention

Contact:

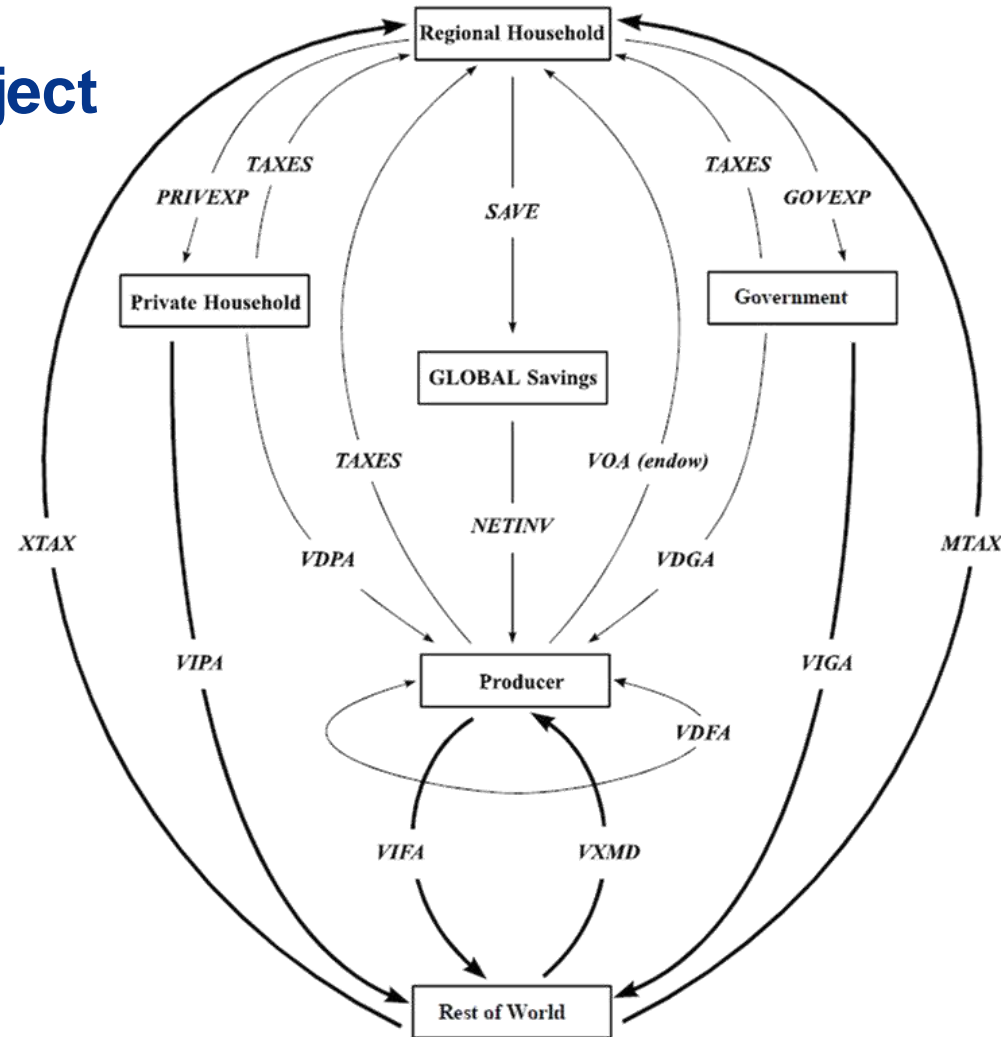
Brenden Jongman

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Indirect effects and macroeconomic impact

- Global Trade Analysis Project
- Direct damages cause changes in flows
- Effect on other countries



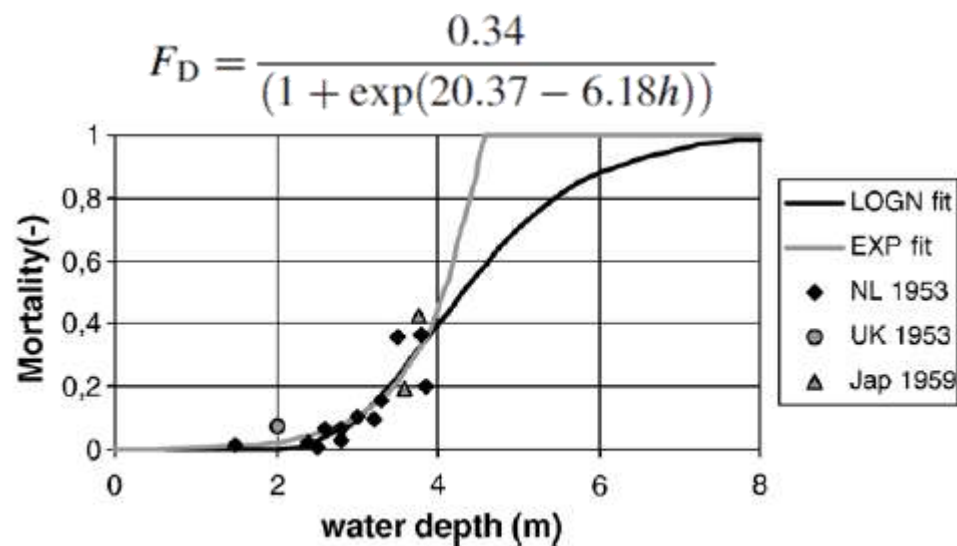
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