

# Storm Alert: Natural Disasters Can Damage Sovereign Creditworthiness

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## The Heat Is On: How Climate Change Can Impact Sovereign Ratings

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Climate Change And Our Sovereign Ratings Methodology

<https://goo.gl/NZFLRw>

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References In Our Sovereign Ratings Criteria

Few Natural Catastrophe-Related Rating Actions So Far

Quantifying The Impact Of Severe Catastrophes

Earthquakes

Tropical Cyclones

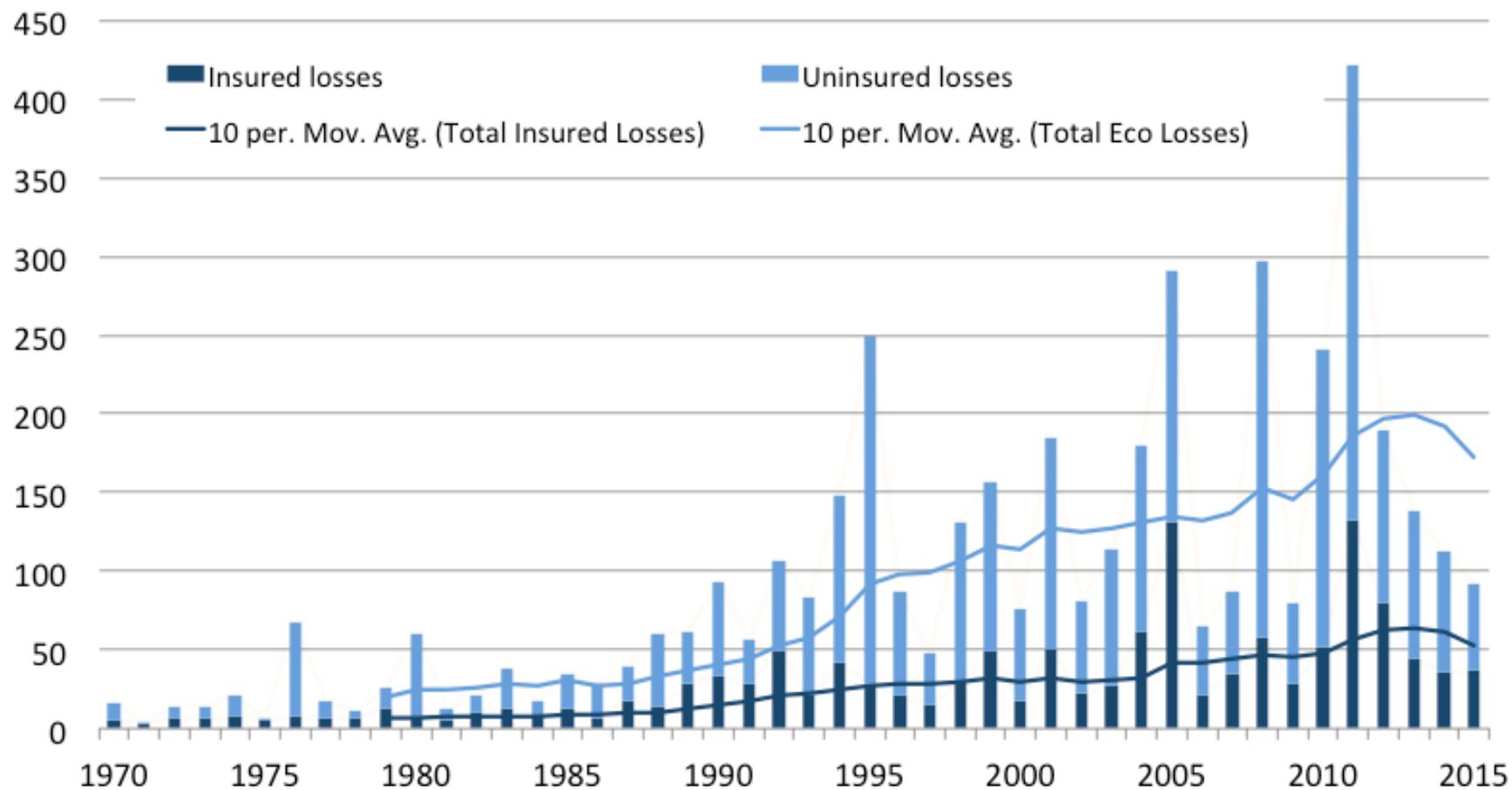
Floods

<https://goo.gl/JtZPS4>

David N. Bresch  
[dbresch@ethz.ch](mailto:dbresch@ethz.ch)

# Damage from natural catastrophes on the rise

Natural catastrophe damages 1970-2015, in USD billion (indexed to 2015)



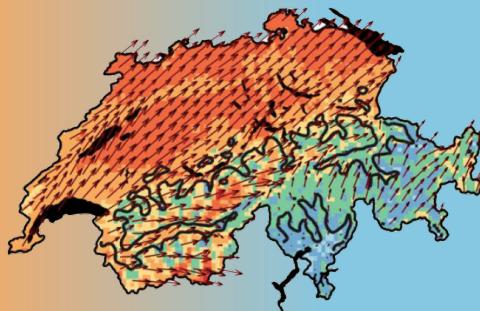
# Probabilistic event-based risk assessment

risk = hazard

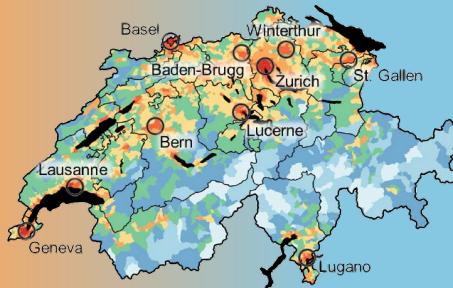
$x$  exposure  $\times$  vulnerability

= (probability  $\times$  intensity)  $\times$  exposure  $\times$  vulnerability,  
severity

Weather  $\rightarrow$  Hazard

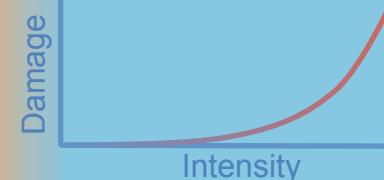


Exposure

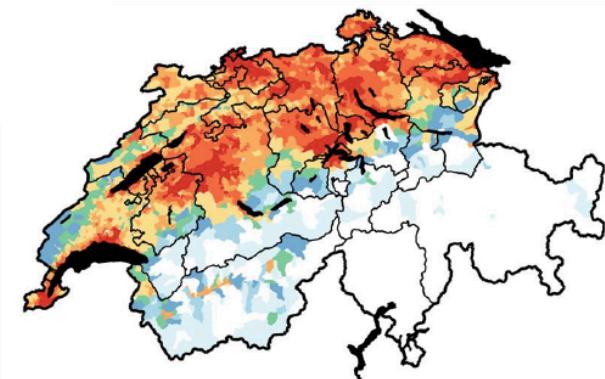


Fully probabilistic event-based simulation engine

Vulnerability



Risk assessment:  
Risk mapping &  
Early warning system



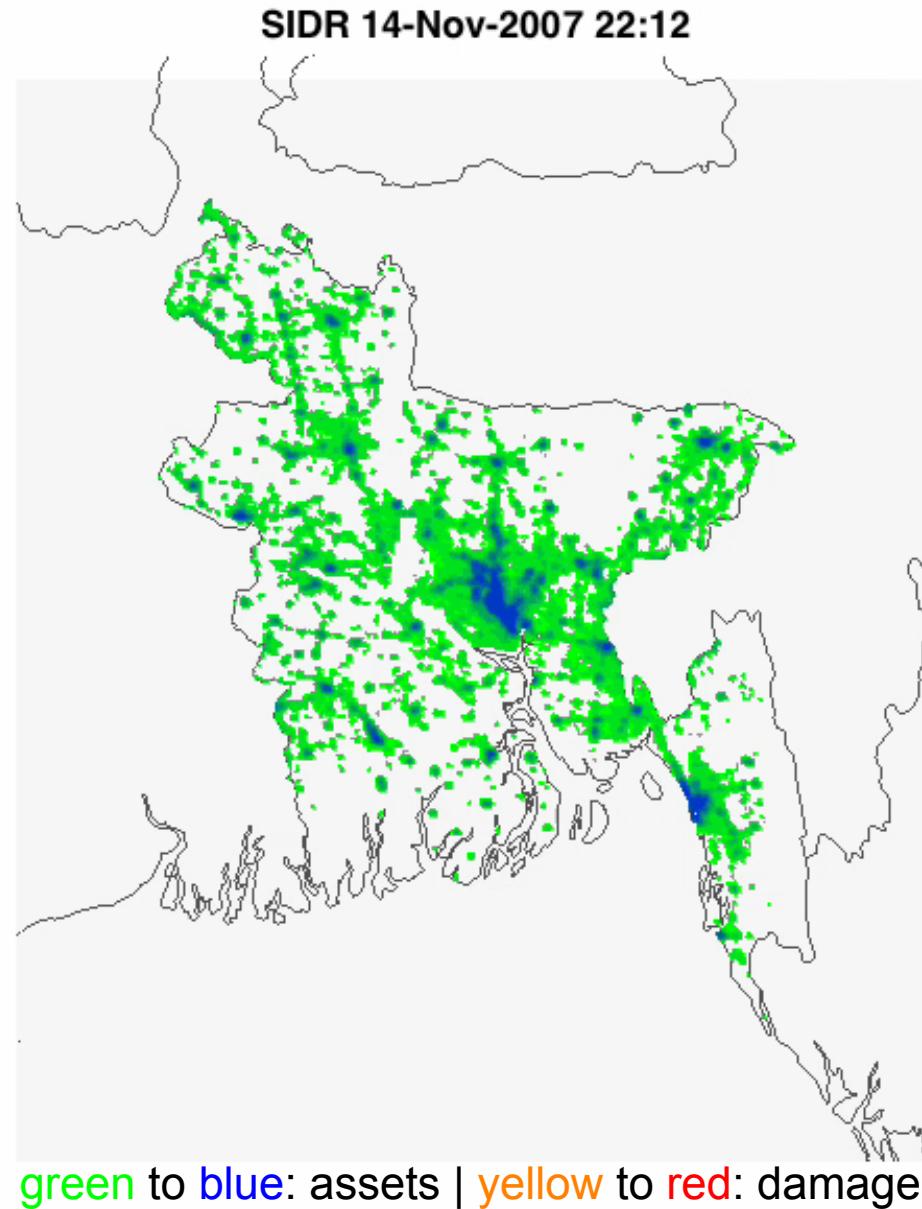
Property damage

low medium high

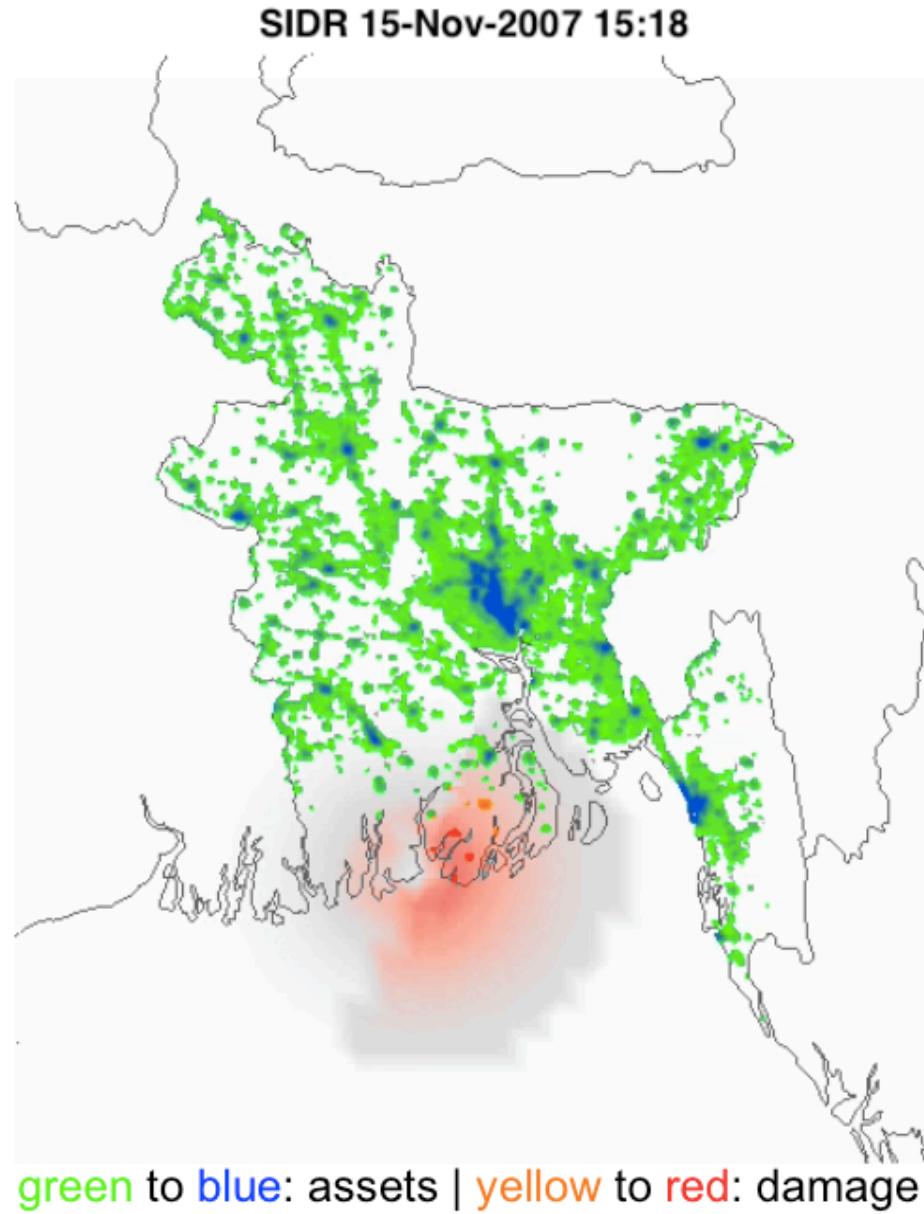
Welker, Martius, Stucki, Bresch, Dierer & Brönnimann, 2015, Tellus A, submitted

<https://github.com/davidnbresch/climada>

# climada: High-resolution (1x1km) damage model



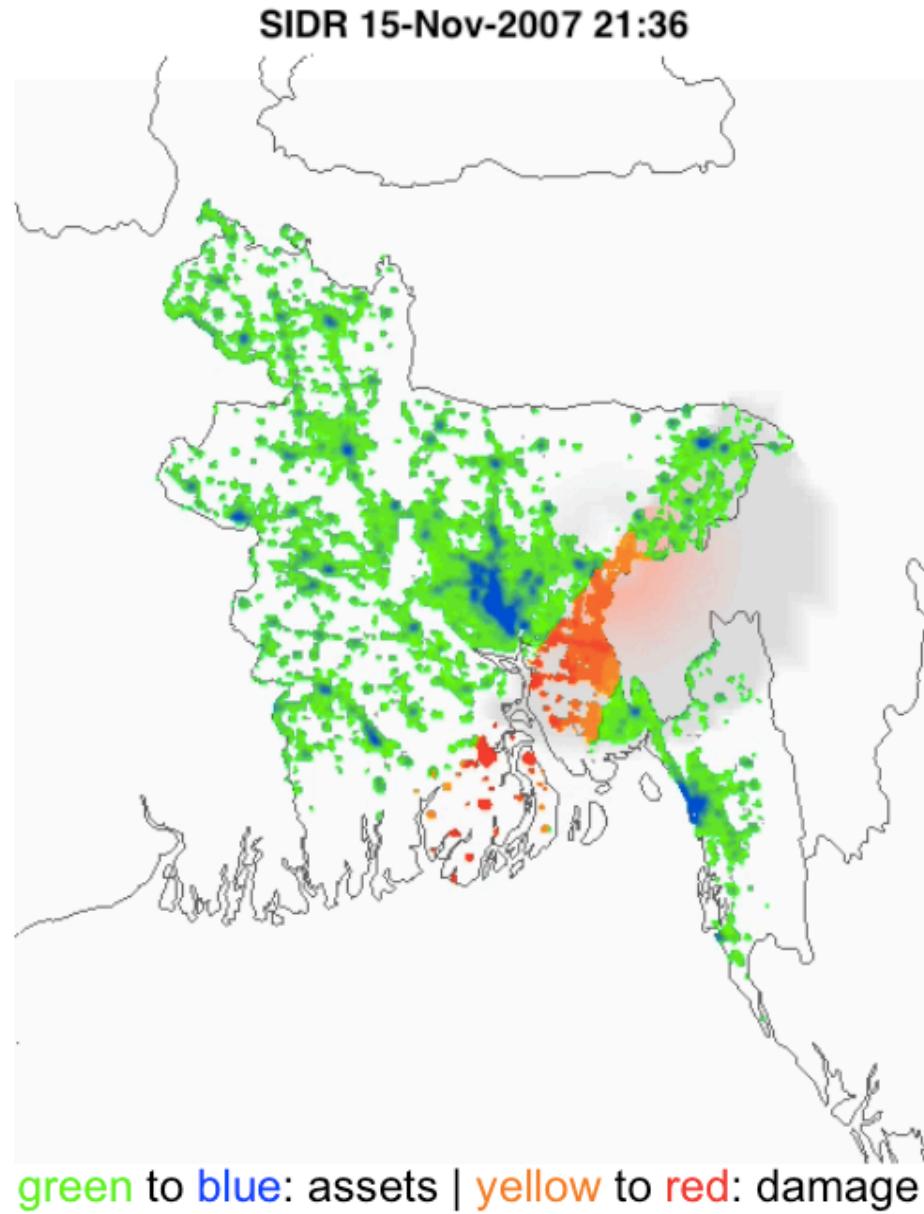
# climada: High-resolution (1x1km) damage model



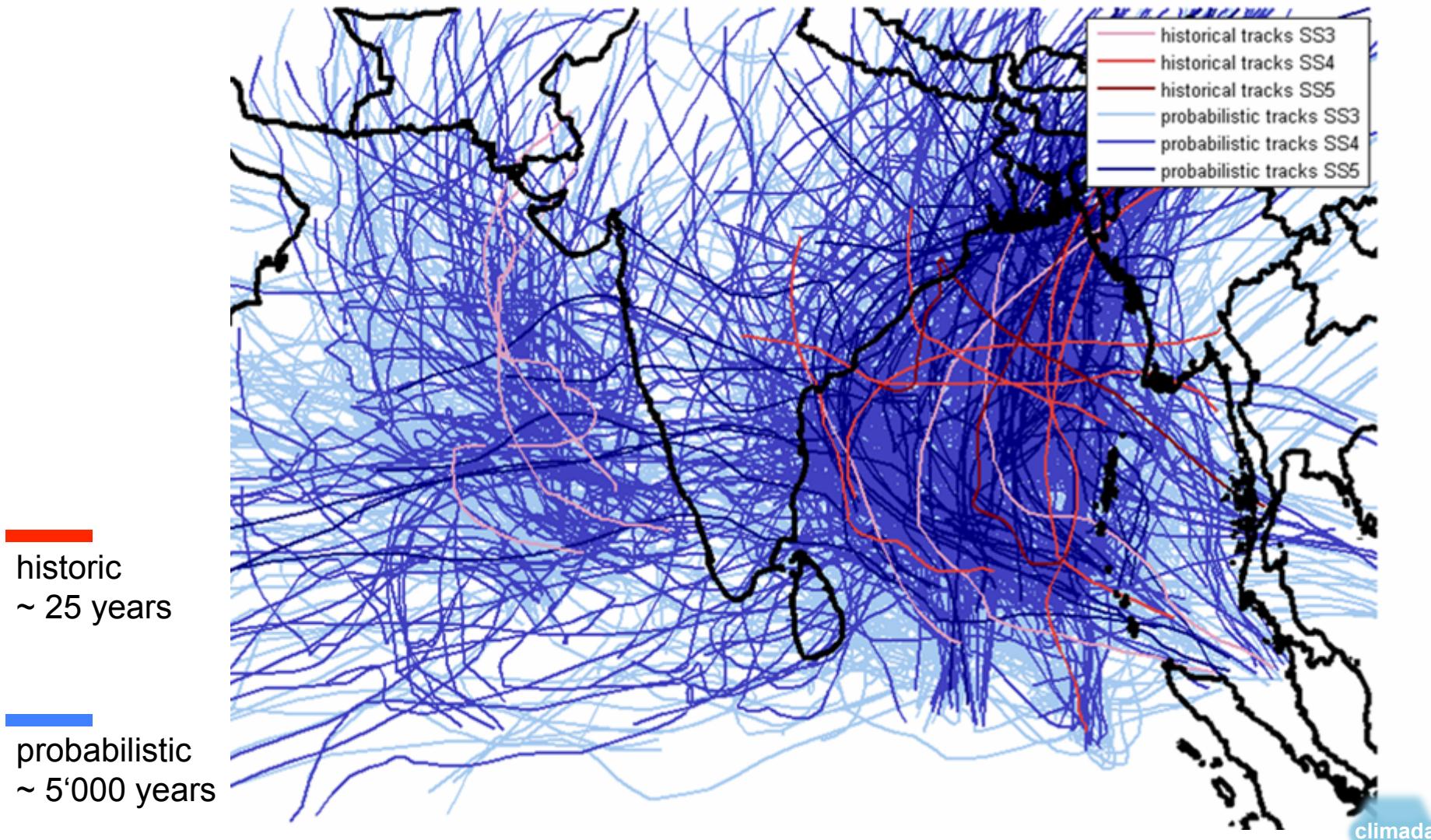
# climada: High-resolution (1x1km) damage model



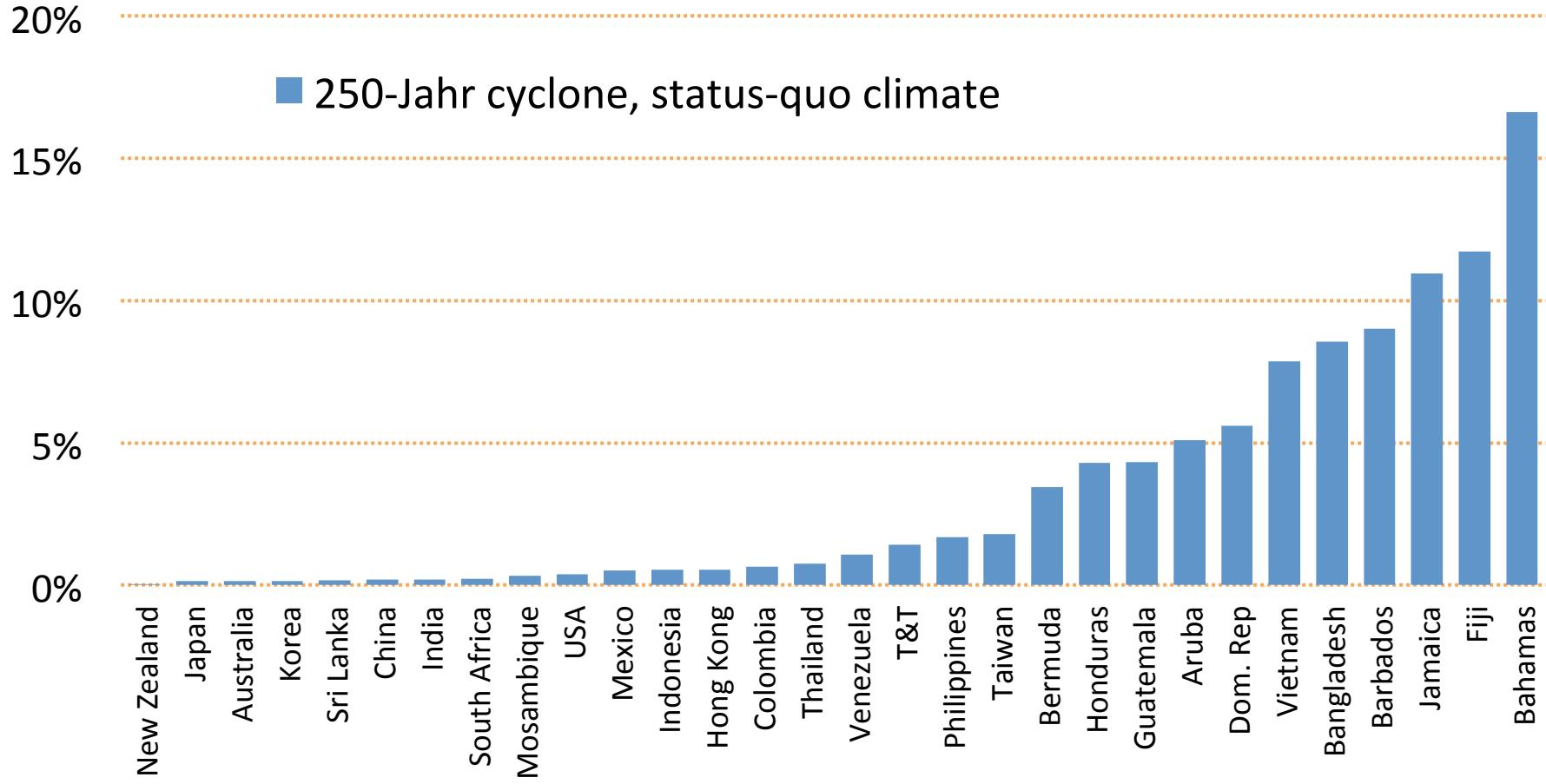
Bangladesh



# Tropical cyclones in the Indian Ocean



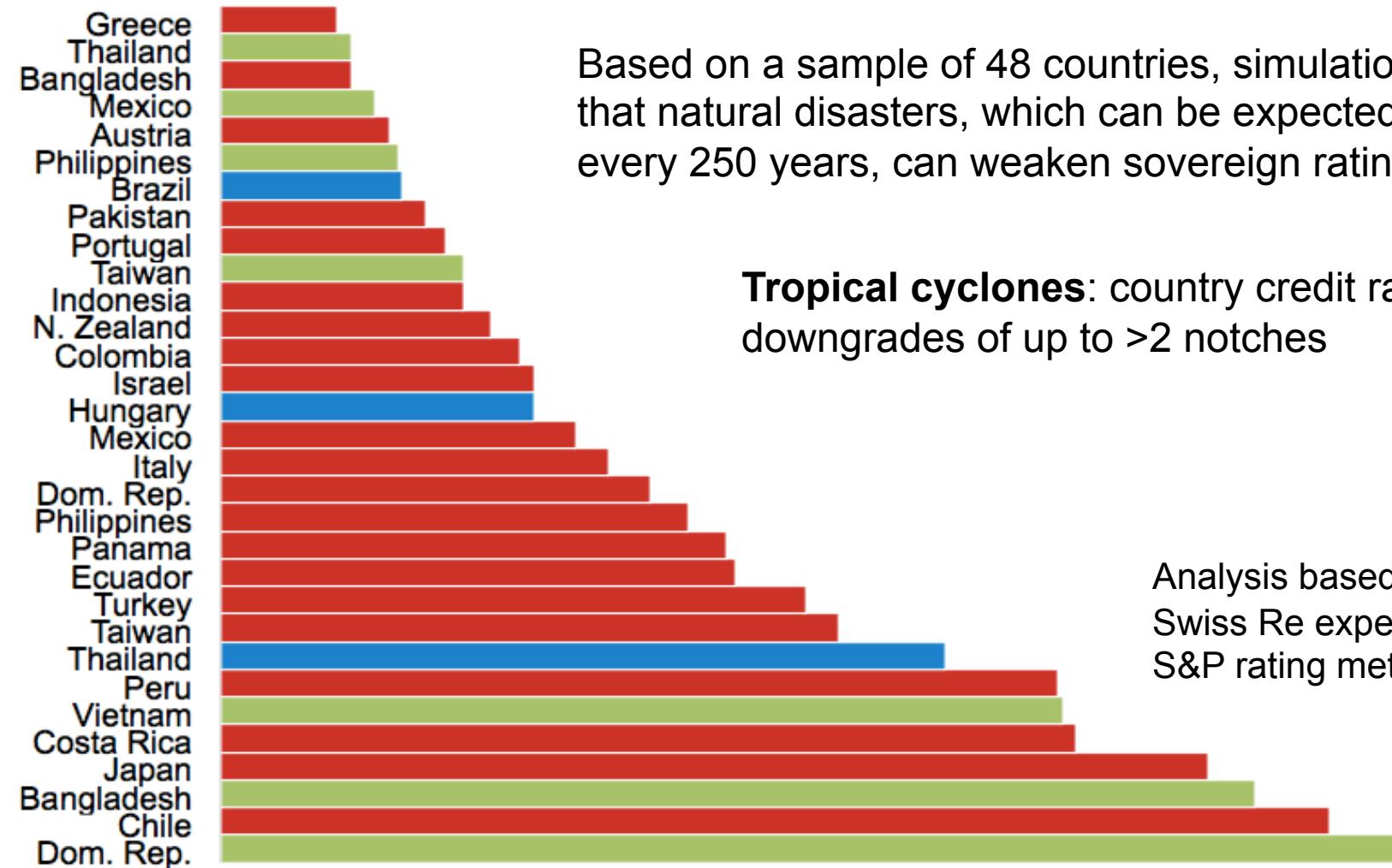
# Damage ratios tropical cyclones (% of economic property values)



Source: SwissRE

# Sovereign rating impact of Nat Cat events

■ Flood ■ Tropical Cyclone ■ Earthquake



Based on a sample of 48 countries, simulations indicate that natural disasters, which can be expected once in every 250 years, can weaken sovereign ratings.

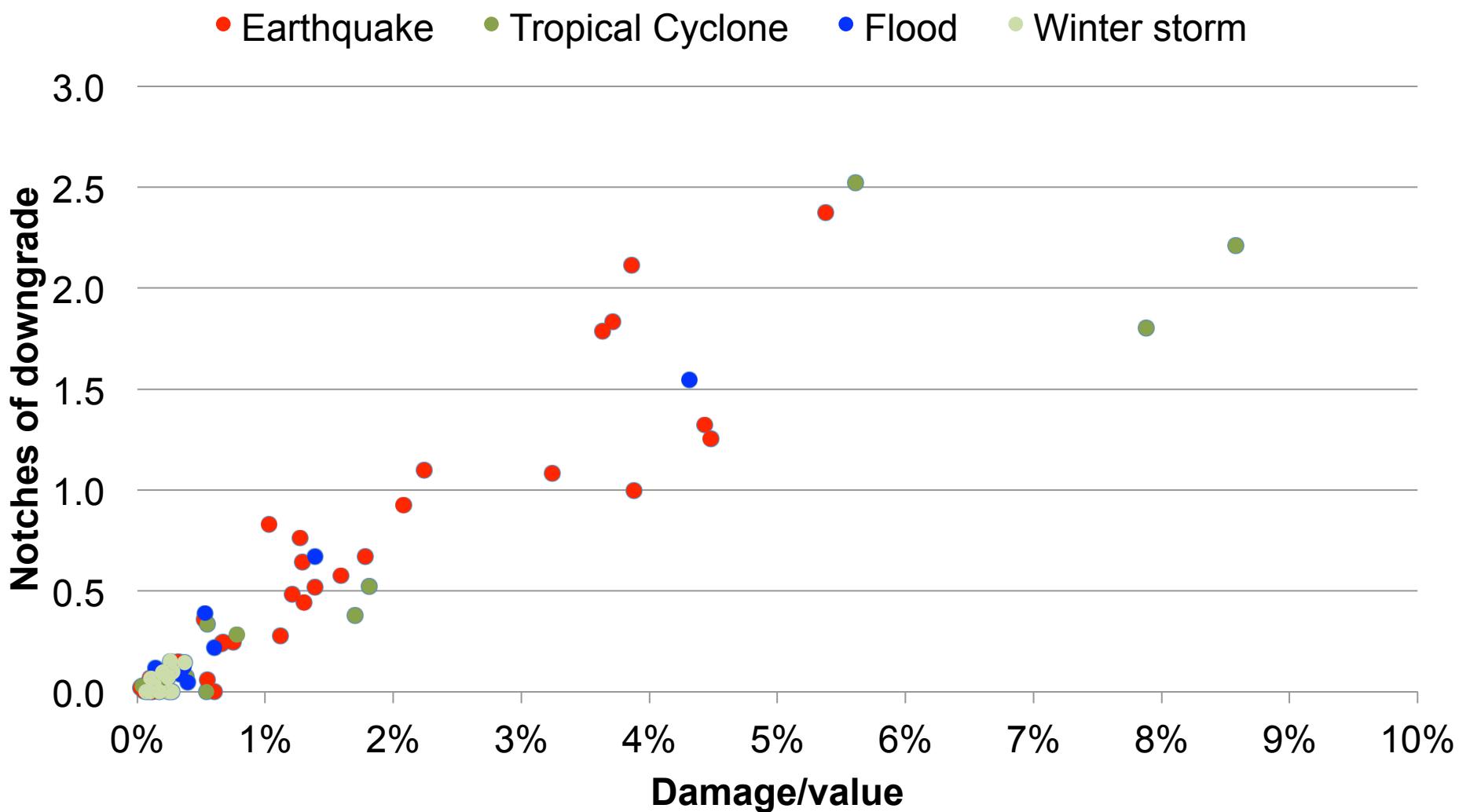
**Tropical cyclones:** country credit rating downgrades of up to >2 notches

Analysis based on climada,  
Swiss Re expertise and  
S&P rating methodology

0 0.5 1 1.5 2 2.5

Hypothetical country rating downgrade in notches (AAA, AA+, AA-, ...)

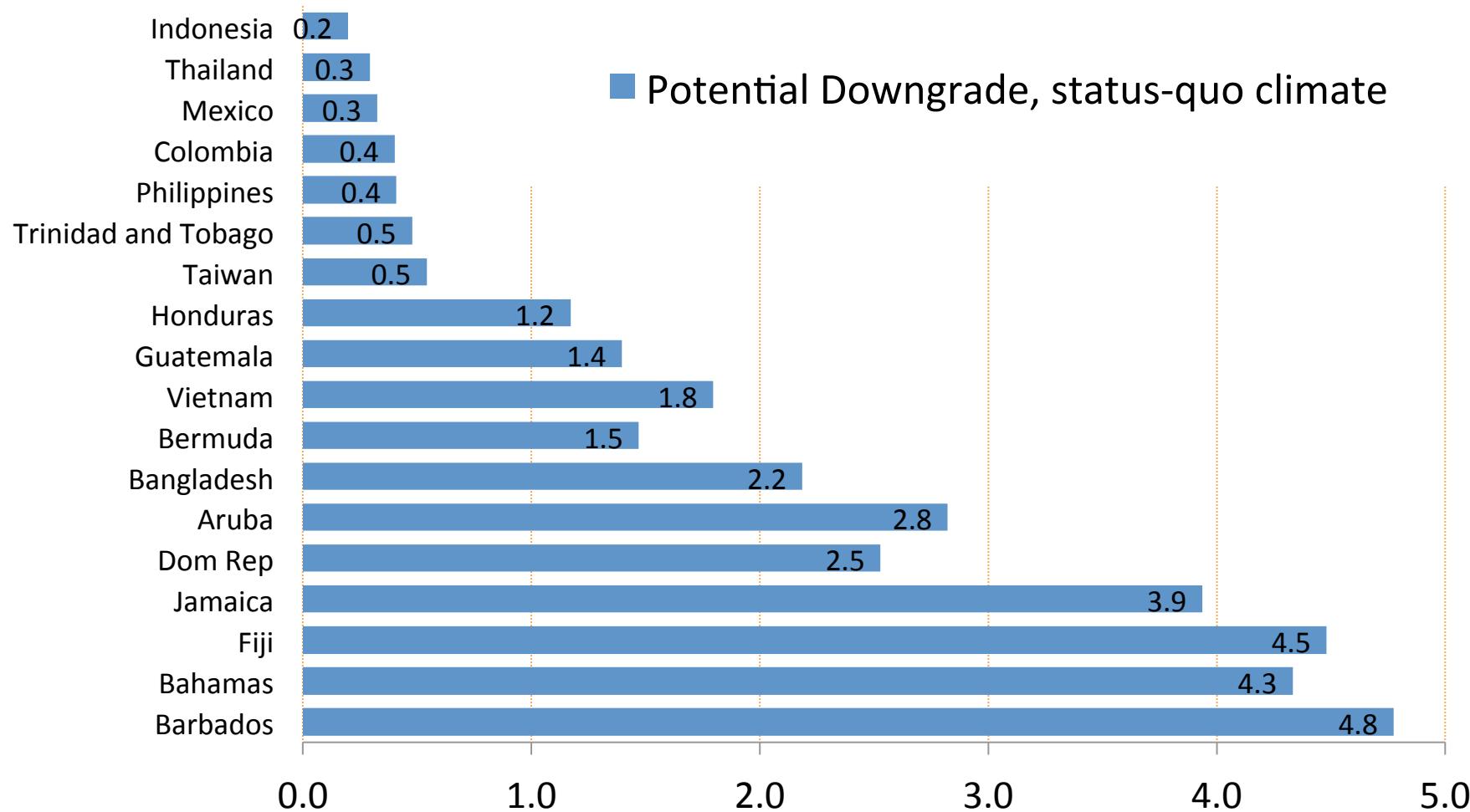
# Sovereign rating impact of Nat Cat events



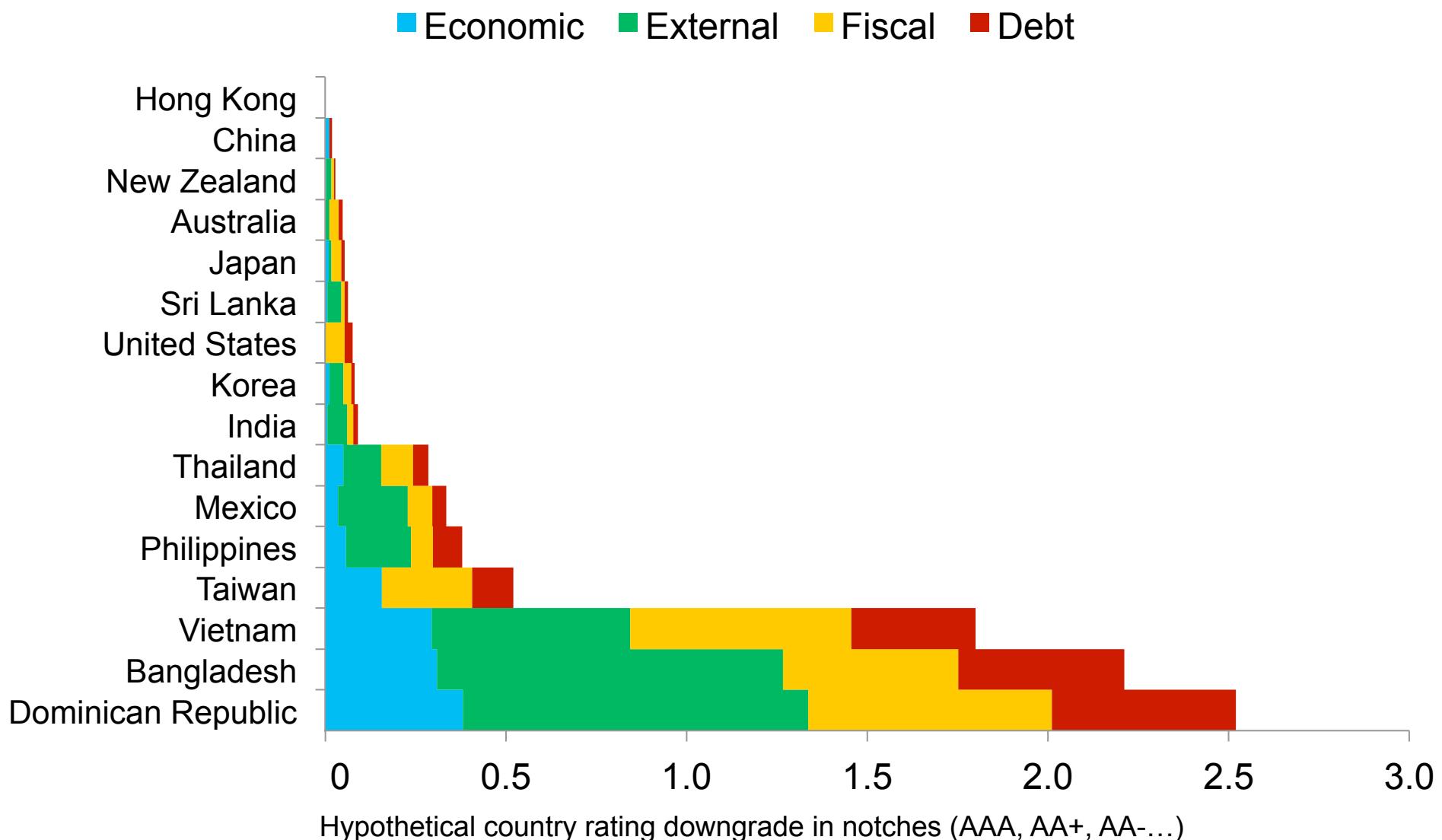
Damage: as simulated by climada | Value: total asset value

climada

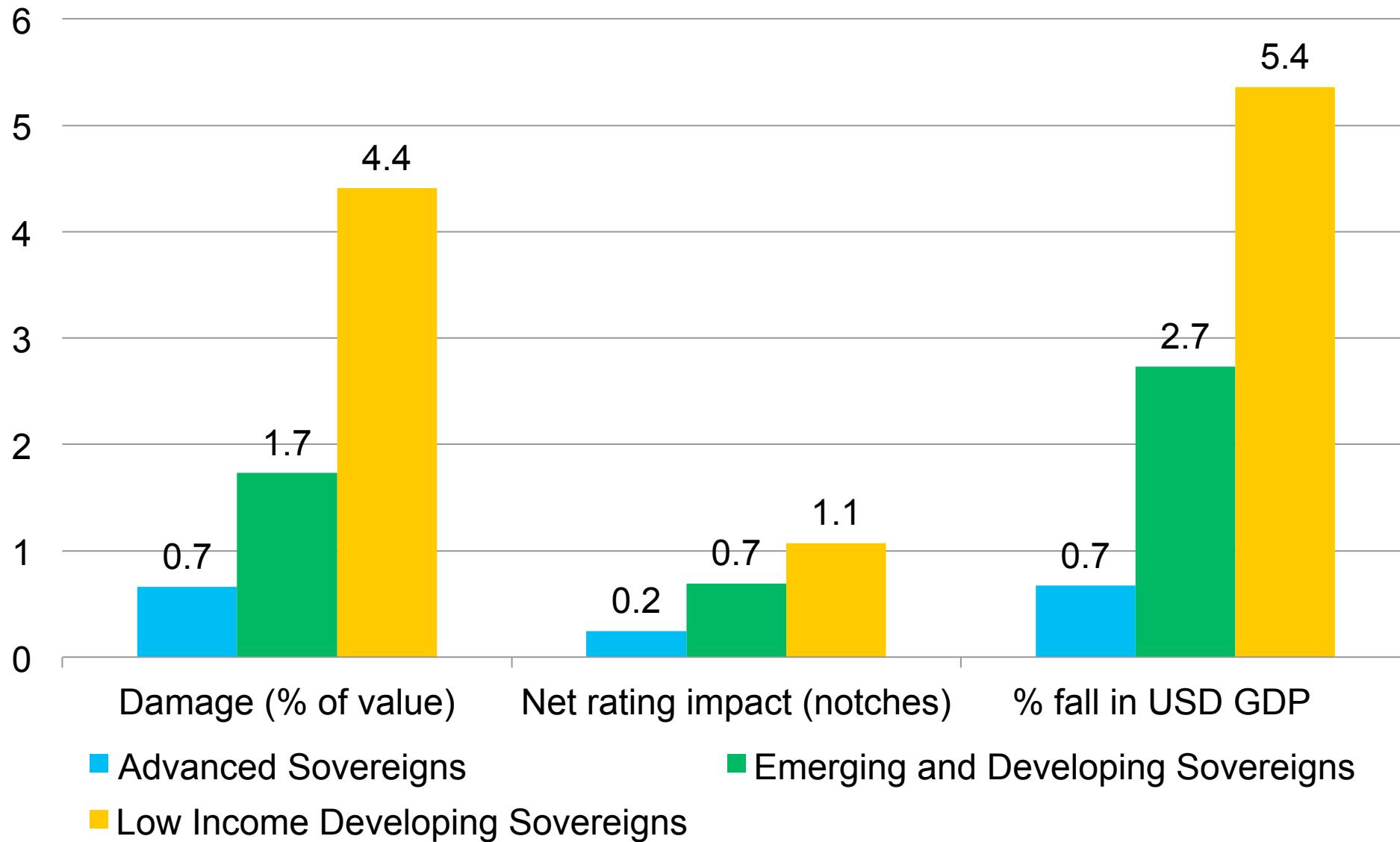
# Potential Sovereign Rating Downgrades (in notches)



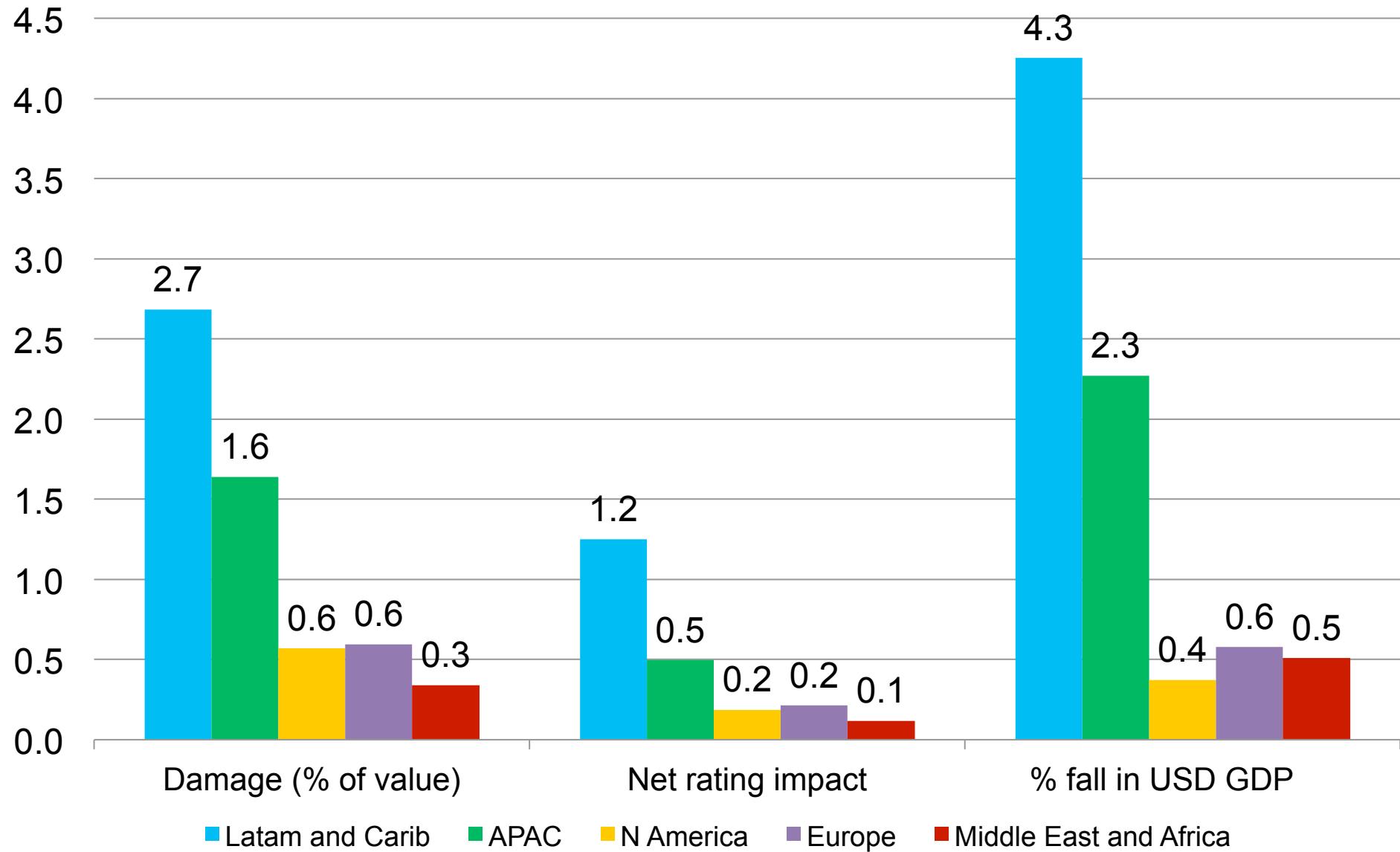
# Tropical cyclones: factors



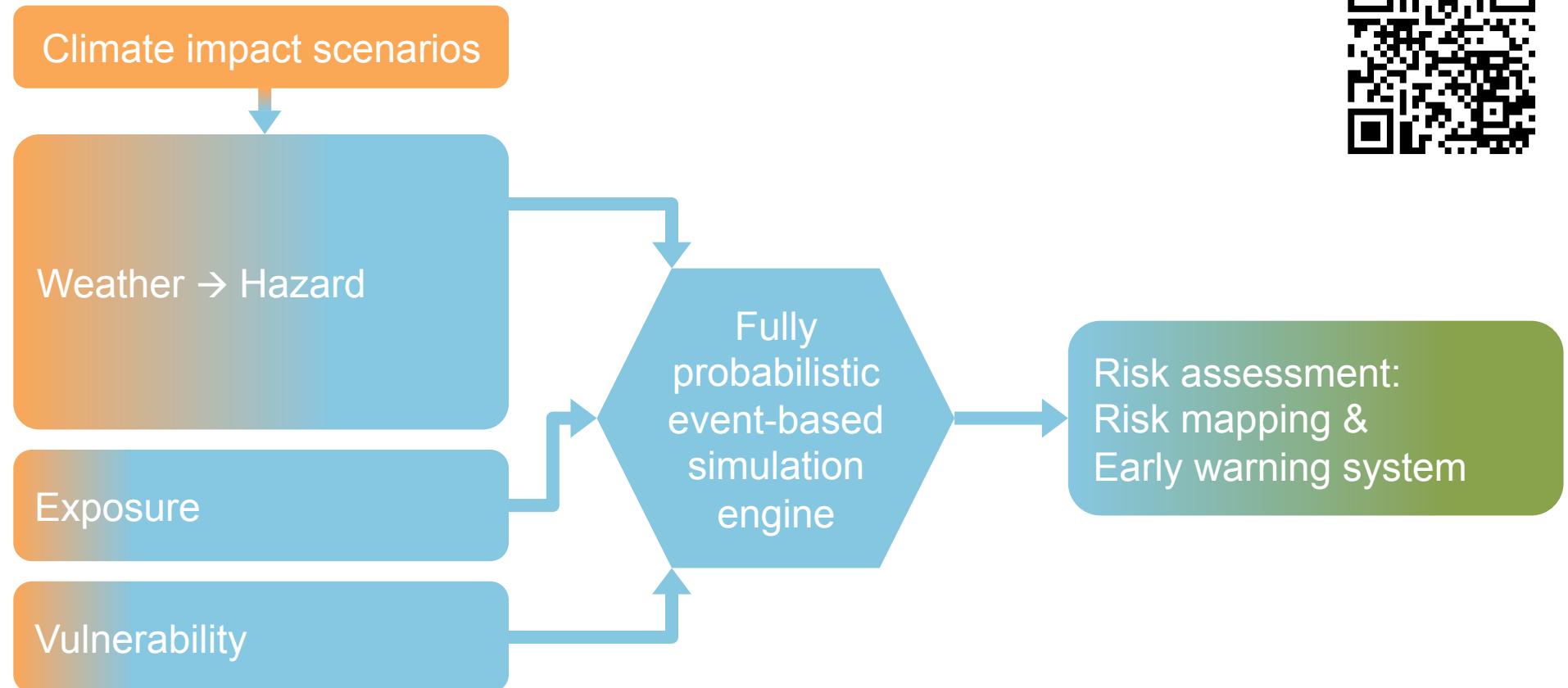
# Impact by income group



# Impact by region



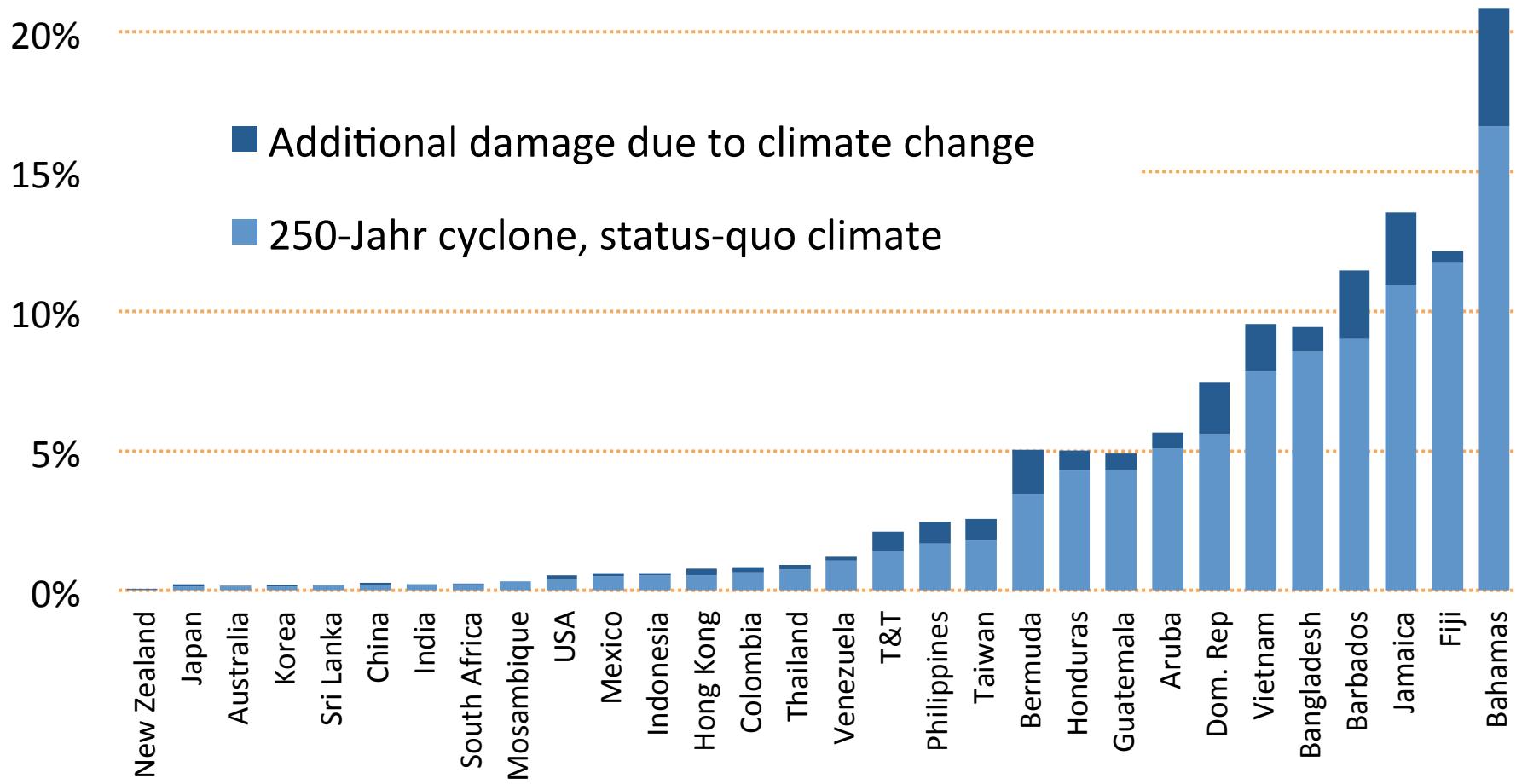
# Probabilistic event-based risk assessment



**Open-source** (GitHub, on MATLAB and Octave), open-access databases and open architecture (incl. interfaces)

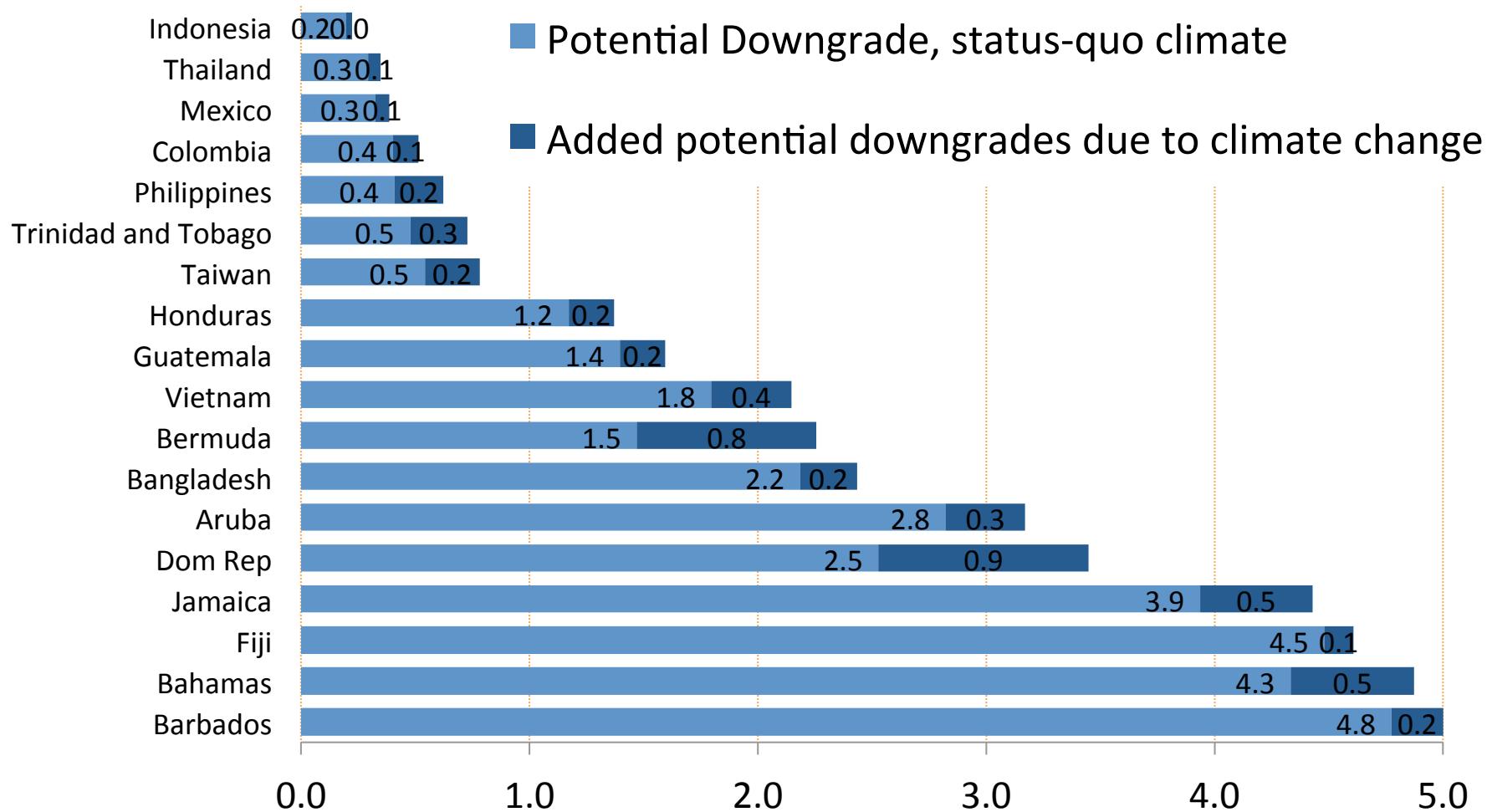
**Widely used**, basis for several peer-reviewed publications, past and on-going collaborations with ETH Zürich, MeteoSwiss, Uni Bern, NCAR, TNC, consultants... <https://github.com/davidnbresch/climada>

# Damage ratios tropical cyclones (% of economic property values, climate 2050)

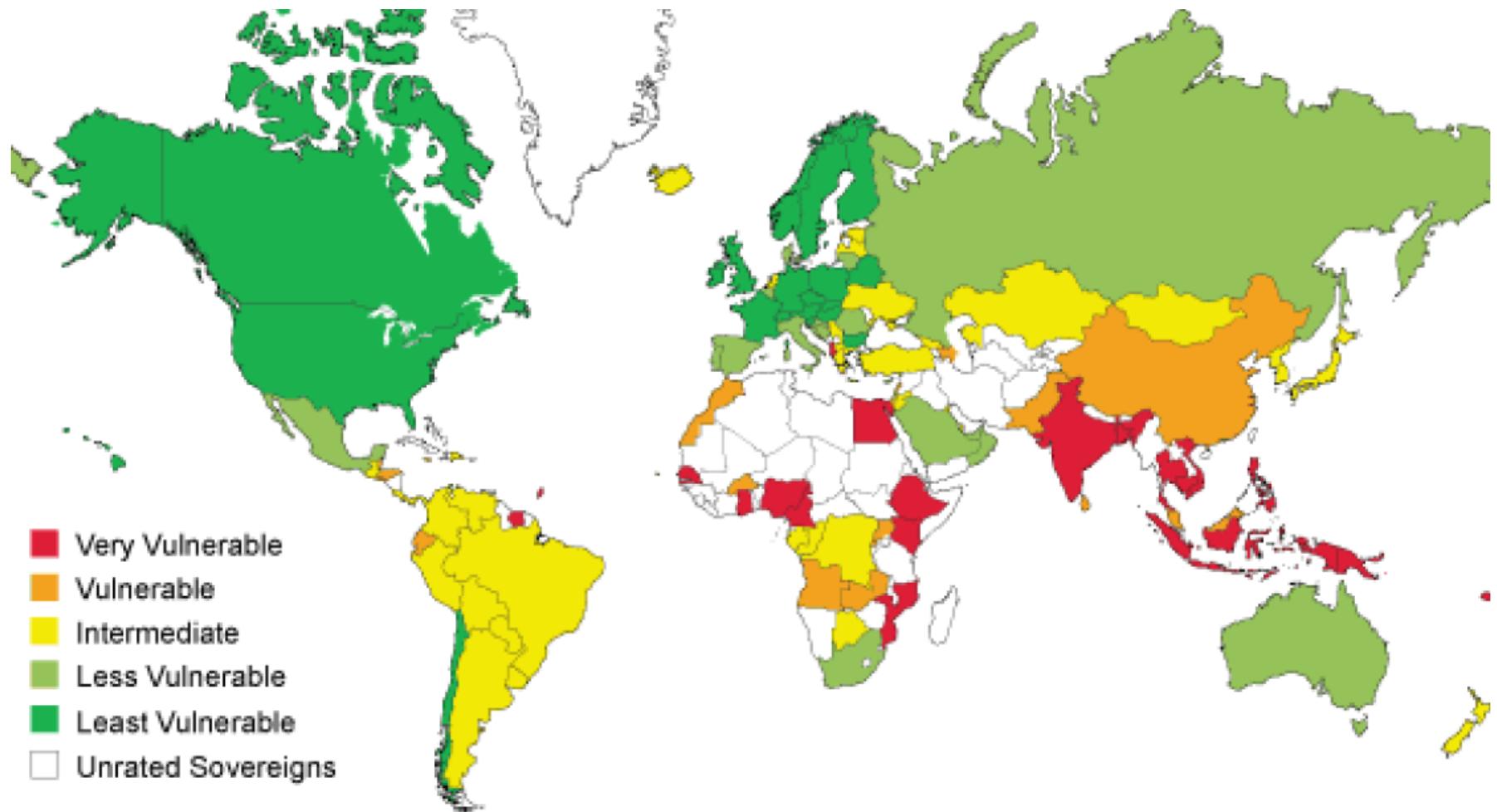


Source: SwissRE

# Potential Sovereign Rating Downgrades (in notches, climate impact scenario 2050)

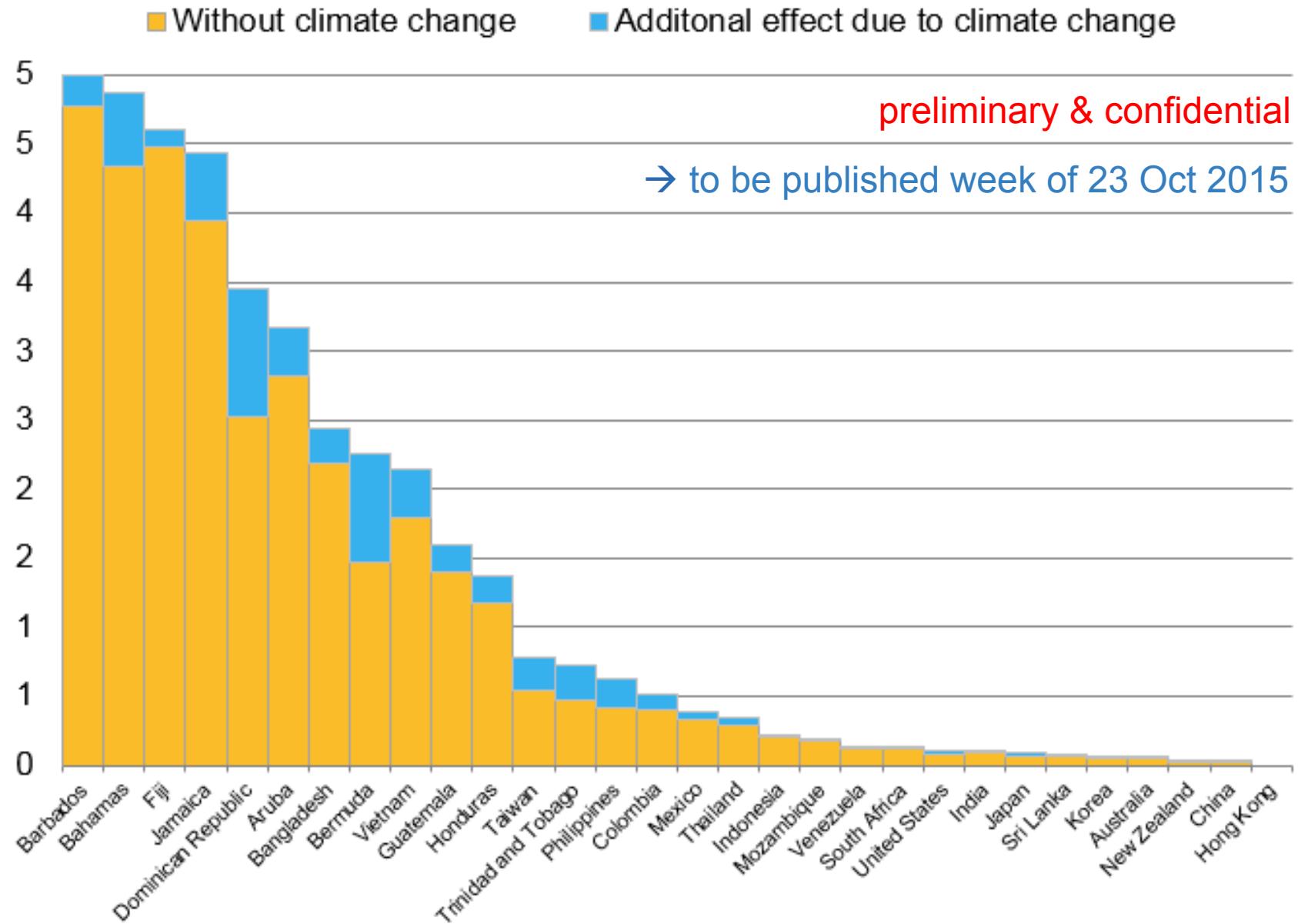


# Potential Vulnerability to Climate Change

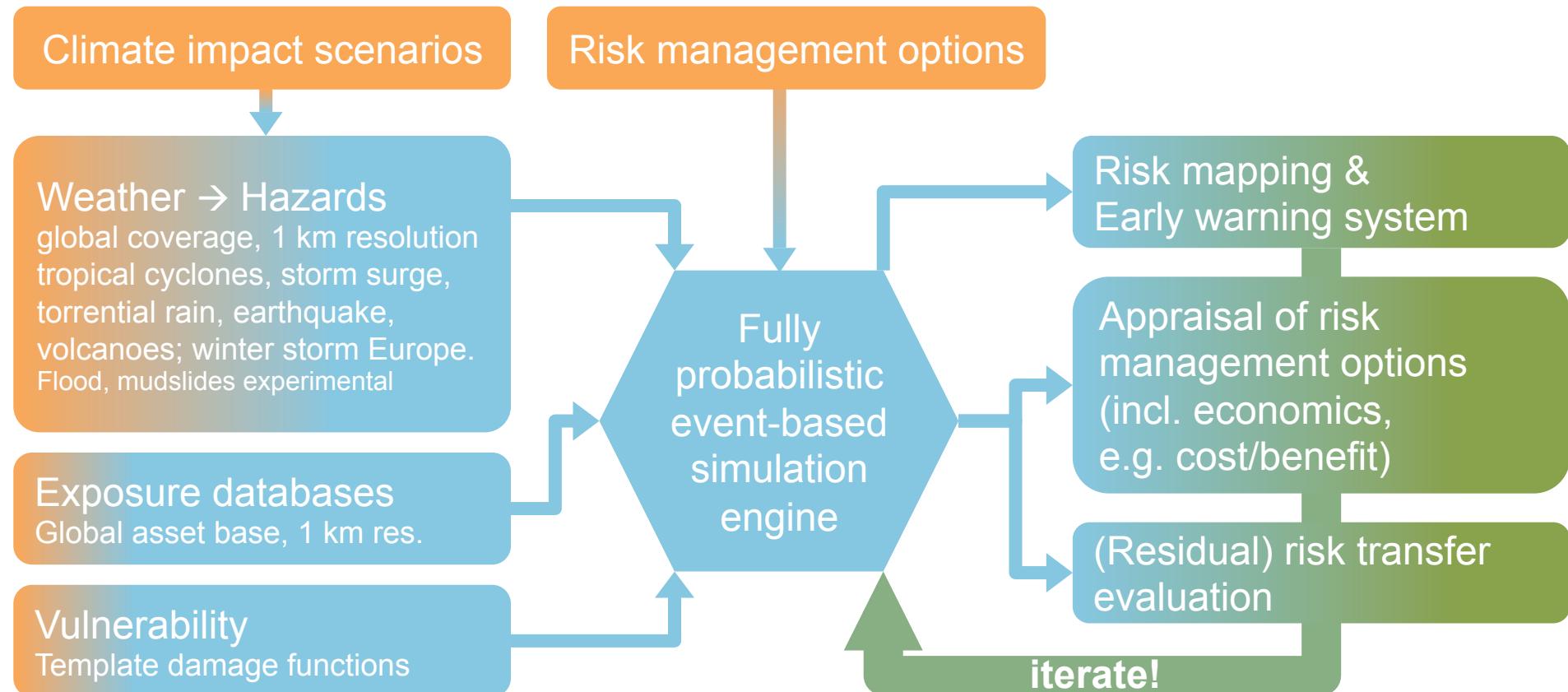


Source: Standard & Poor's

# Effect of climate change by 2050



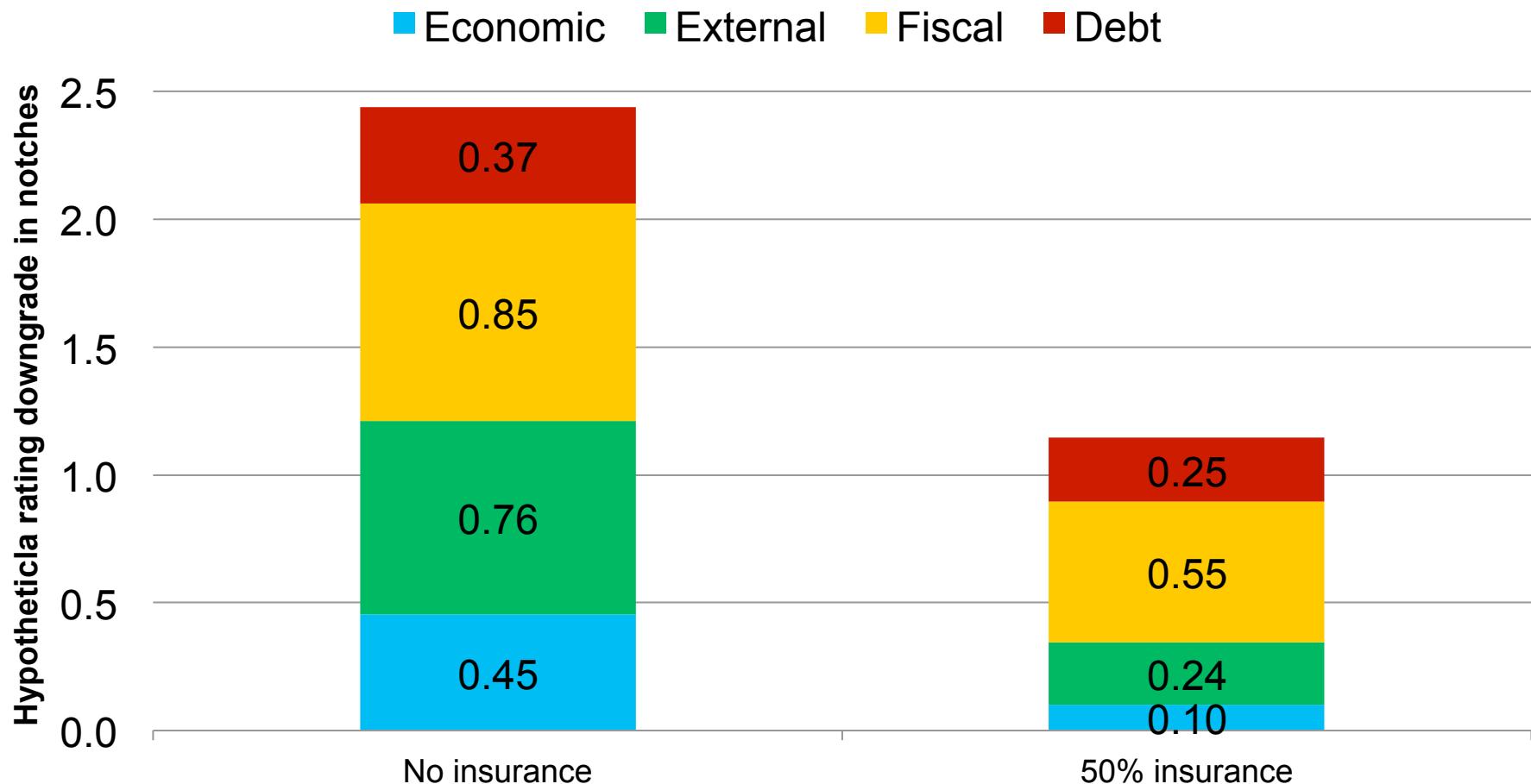
# Probabilistic event-based risk assessment and comprehensive options appraisal:



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# Effect of insurance (5% damage to value case)



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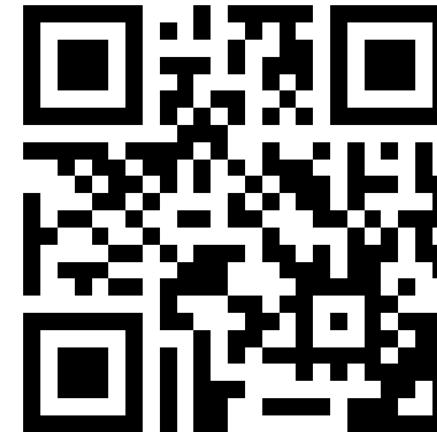
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