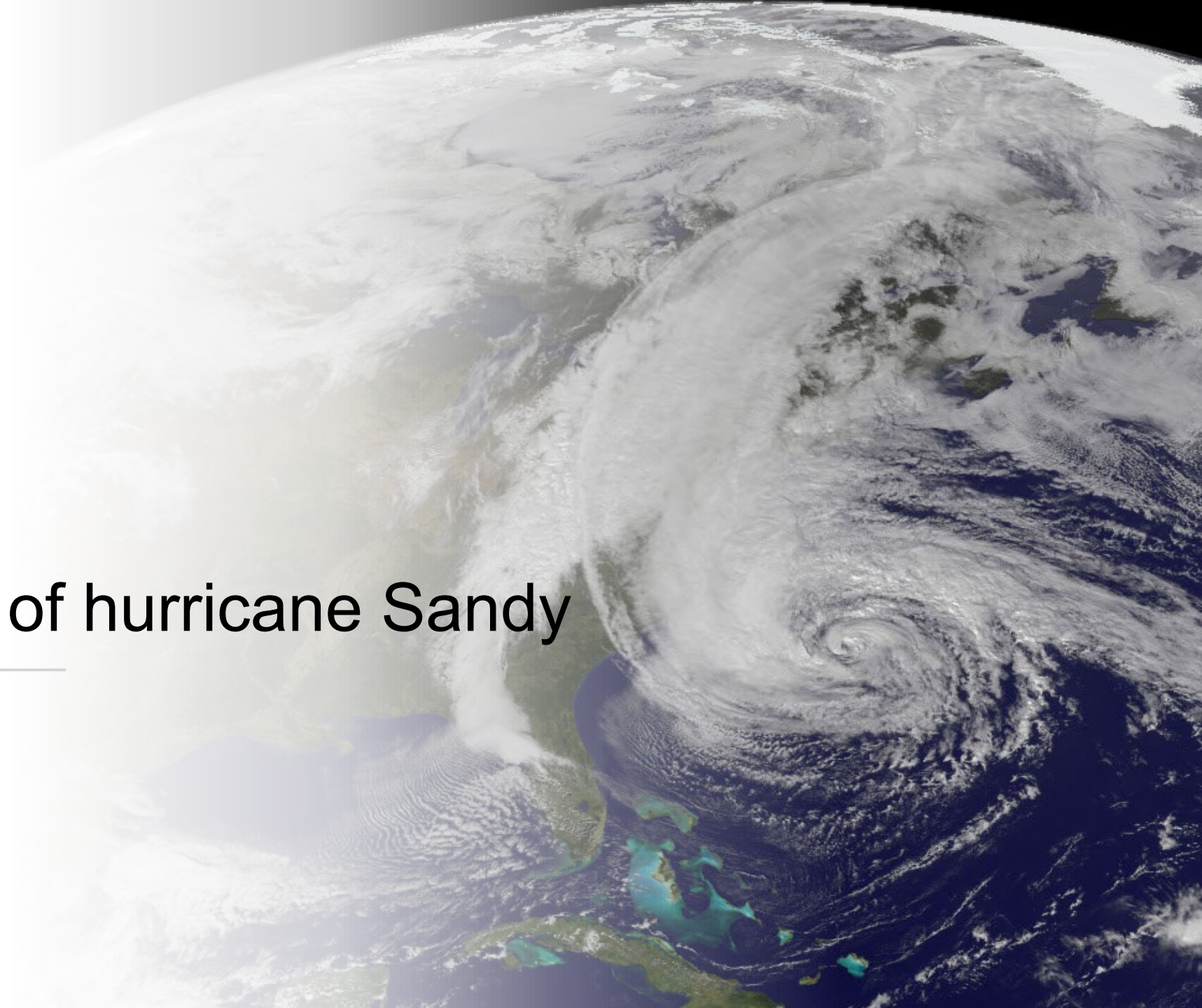# Creating storylines of hurricane Sandy

Henrique M. D. Goulart

Hurricane Sandy

- Second-costliest hurricane in U.S.

- Worst natural hazard to occur in NYC;
    - Not a lot of precipitation;
    - Extremely high storm surge.

- Conditioned adaptation plans for NYC.

- *How would Sandy affect NYC under different conditions (such as climate change)?*
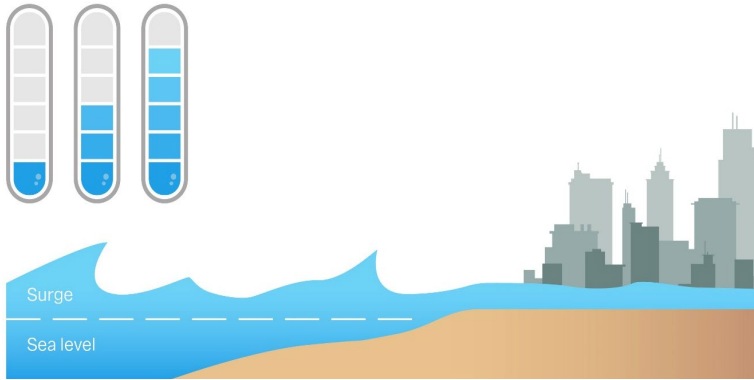
Creating storylines of Sandy

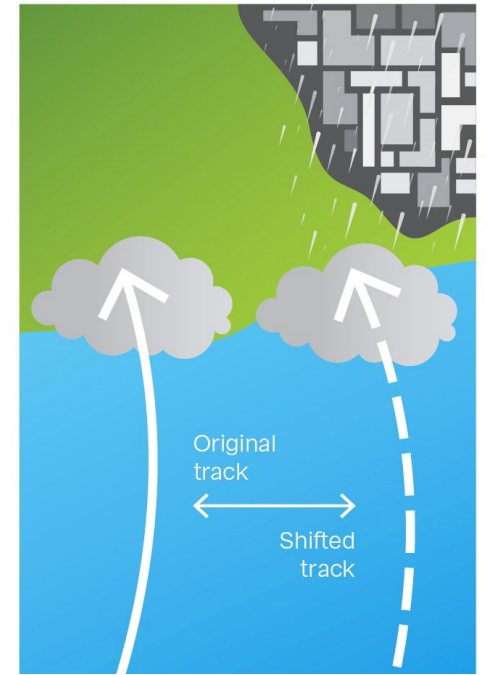1. Set of scenarios;

2. Modelling framework.

Set of scenarios

Climate scenarios

Sea level rise (SLR) scenarios

Maximised precipitation (MP) scenarios

Surge

Sea level

Original track

Shifted track

Climate scenarios

- Spectrally nudging technique:
  - Forces large scale atmosphere to reanalysis;

  - Changes boundary conditions to global warming levels;

  - 3 global warming levels: pre-industrial, present day and +2C;

 - 3 members in each global warming level for climate variability.

Sea level rise scenarios

- IPCC multi-model projections:
  - +2C warmer world;

  - Different time periods (uncertainty in core processes of ice mass loss):
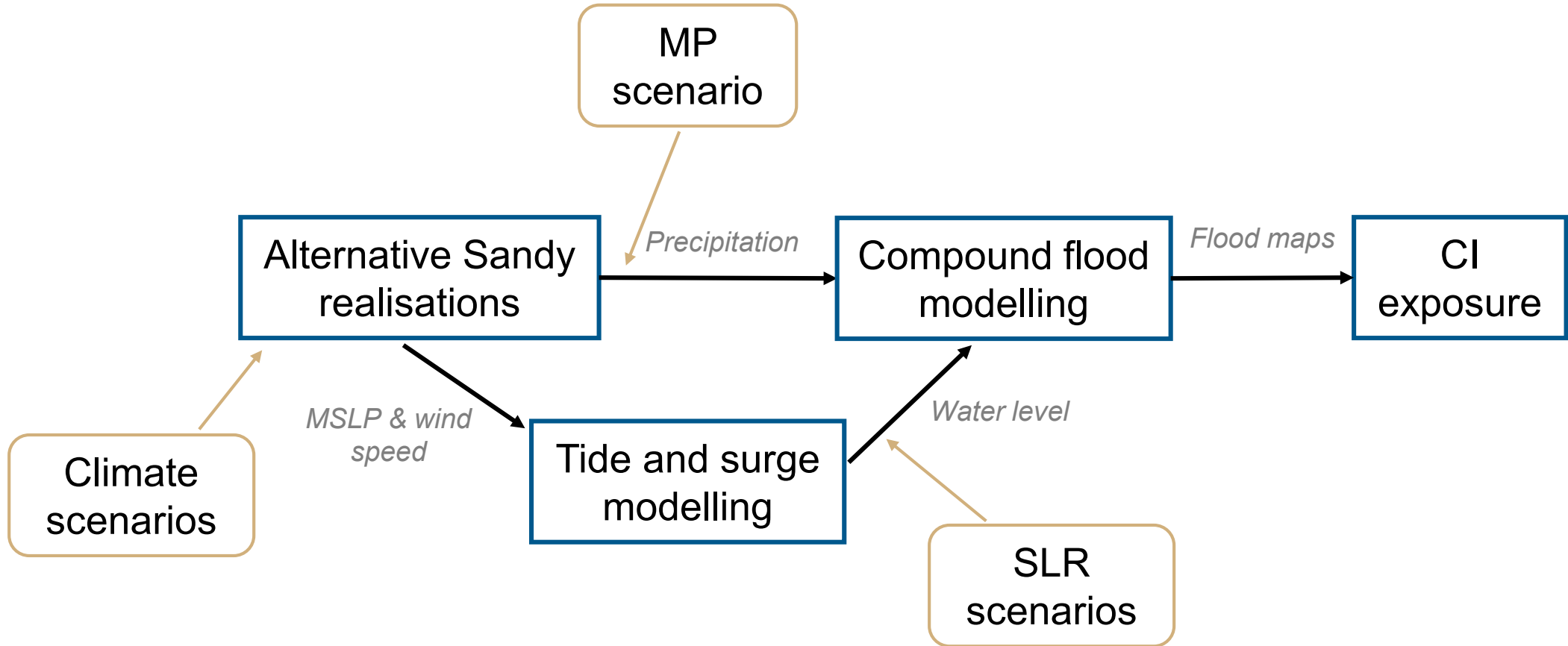   - 2100 – 0.71m;
    - 2150 – 1.01m.
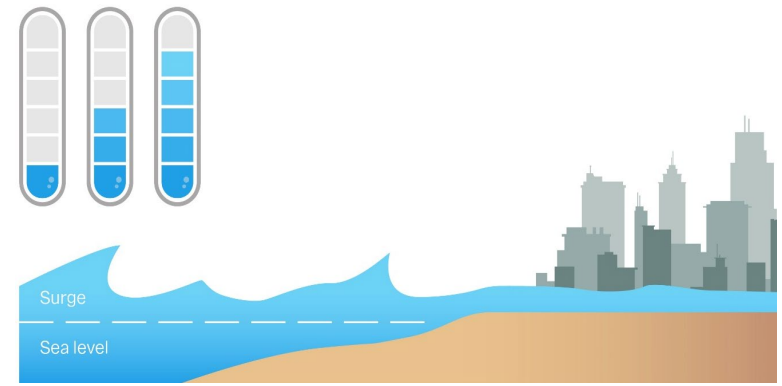
Maximised precipitation (MP) scenario

- TCs have spatial variability due to stochastic processes;

- Plausability: The landfall location could be slightly different;

- Move the highest precipitation part of the storm during landfall to NYC;

- Exploration of internal variability.

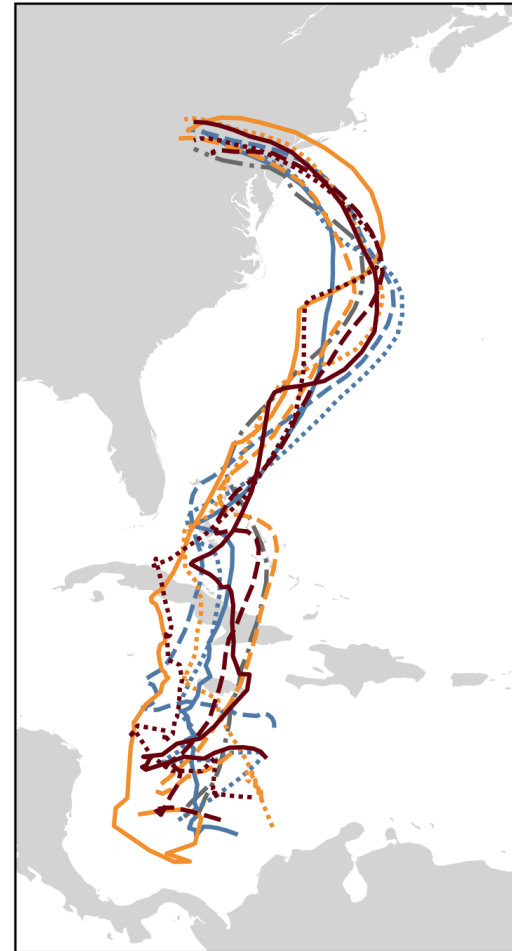Original track

Shifted track
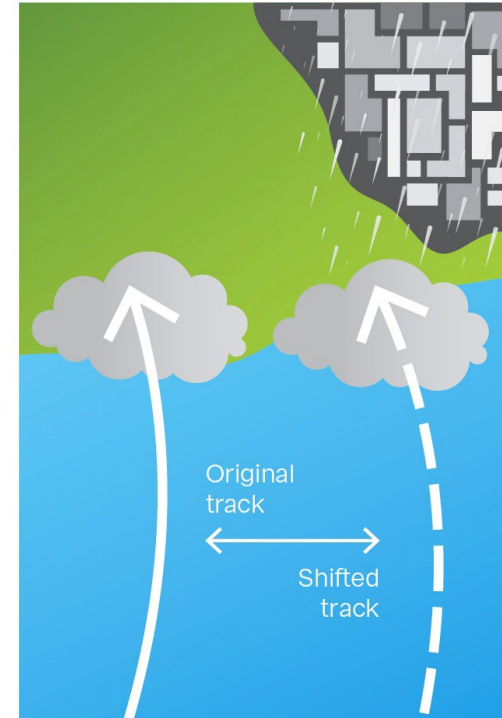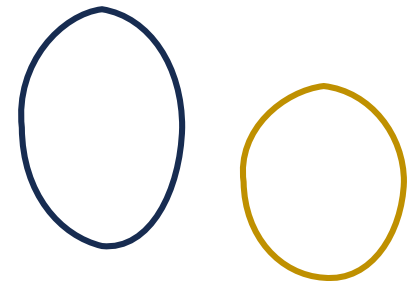
Modelling framework

Results

Sepctrally nudged storms

- Synthetic runs show **spatial variability**;

- GW **increases** precipitation at peak values;
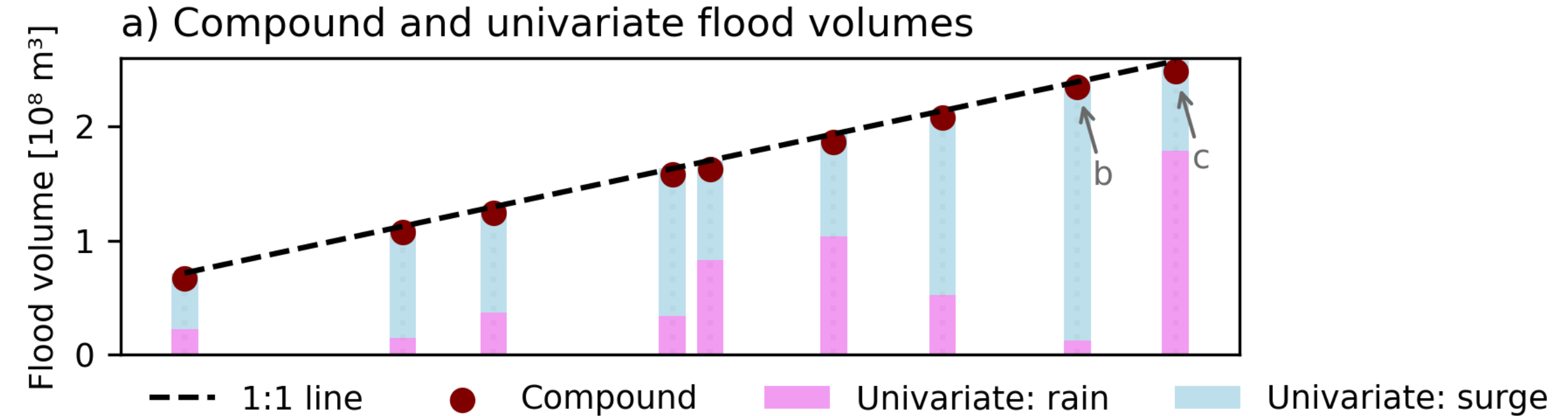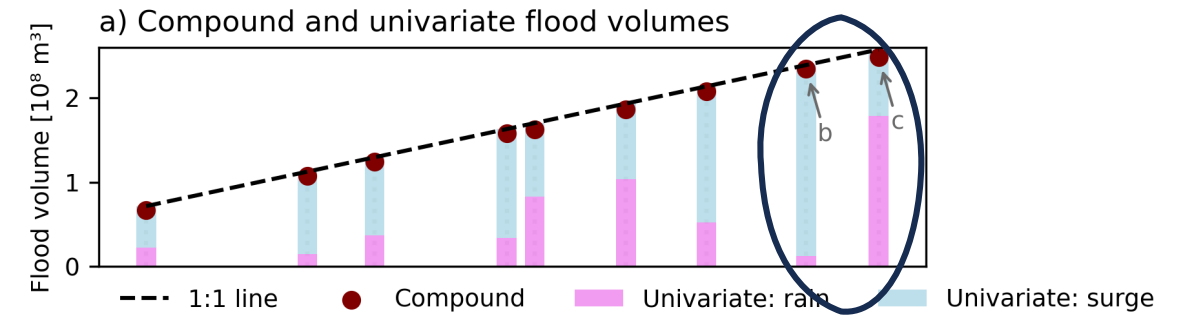
- **No changes in NYC** between GW levels.

a)

Legend: IBTrACS, PI, PD, 2C, 1, 2, 3

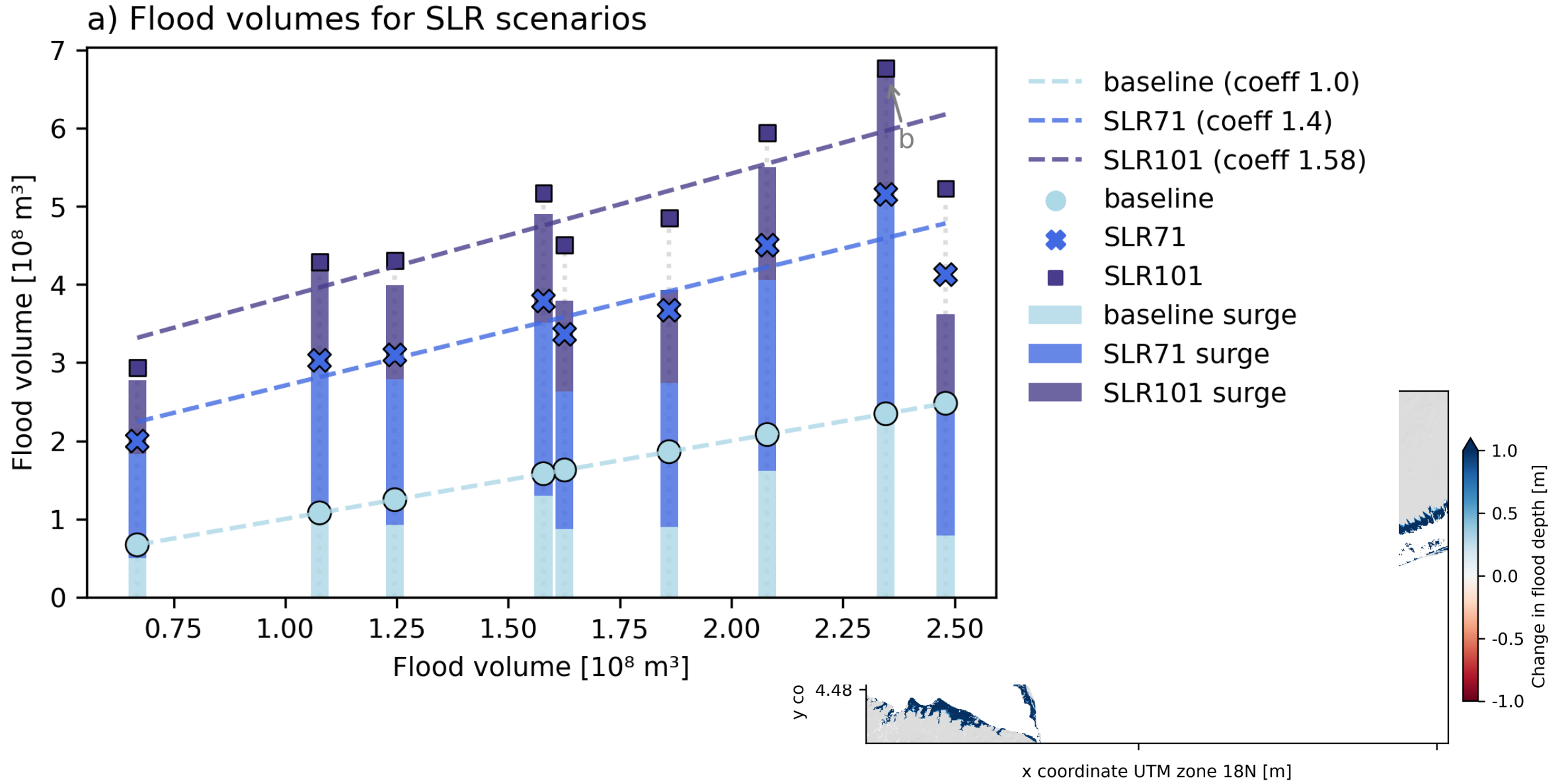# Coastal flooding

- Coastal flood is **compound**

a) Compound and univariate flood volumes

a) Compound and univariate flood volumes

Flood volume [10⁸ m³]

- - - 1:1 line   ● Compound   ■ Univariate: rain   ■ Univariate: surge
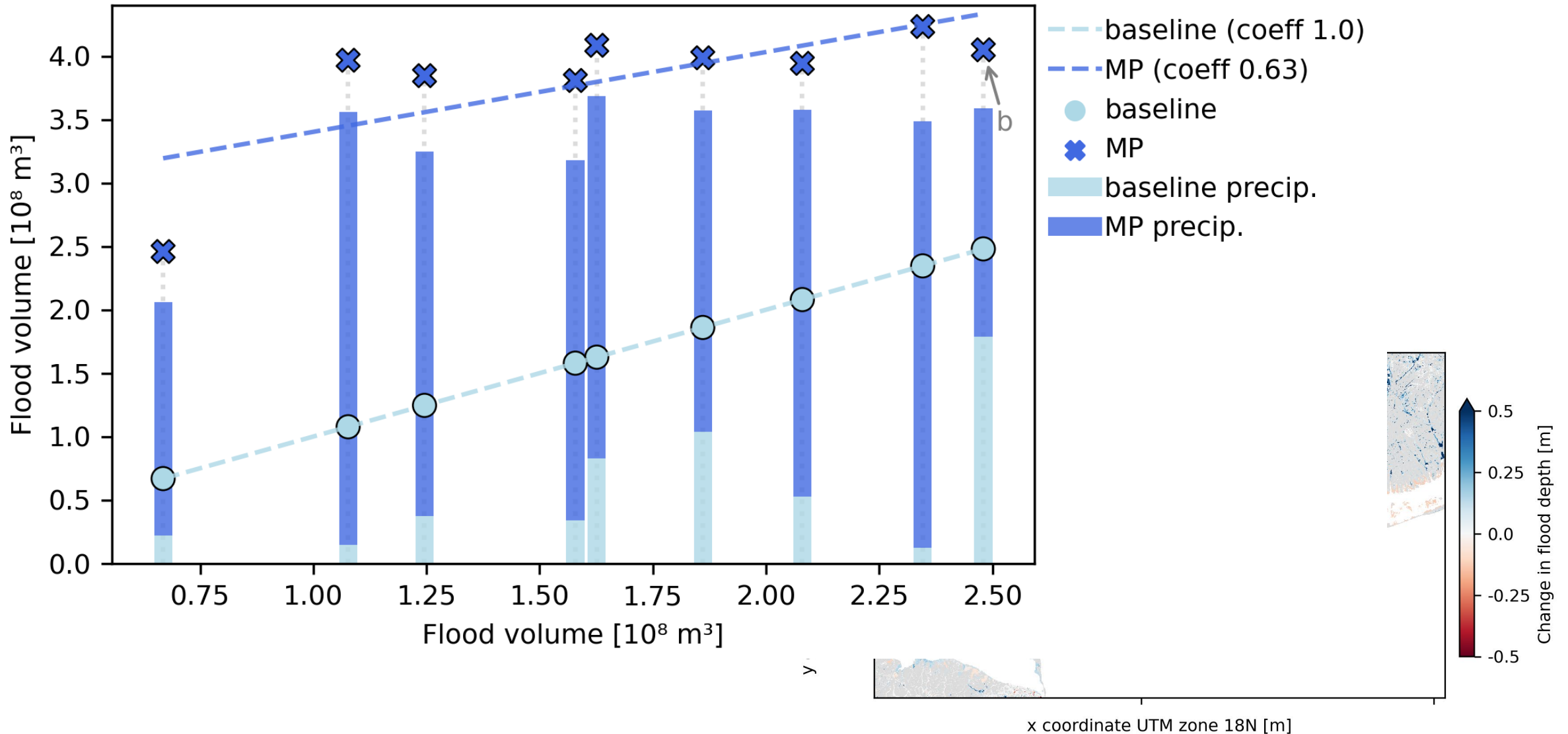
Sea level rise scenarios

a) Flood volumes for SLR scenarios

Maximum precipitation scenarios

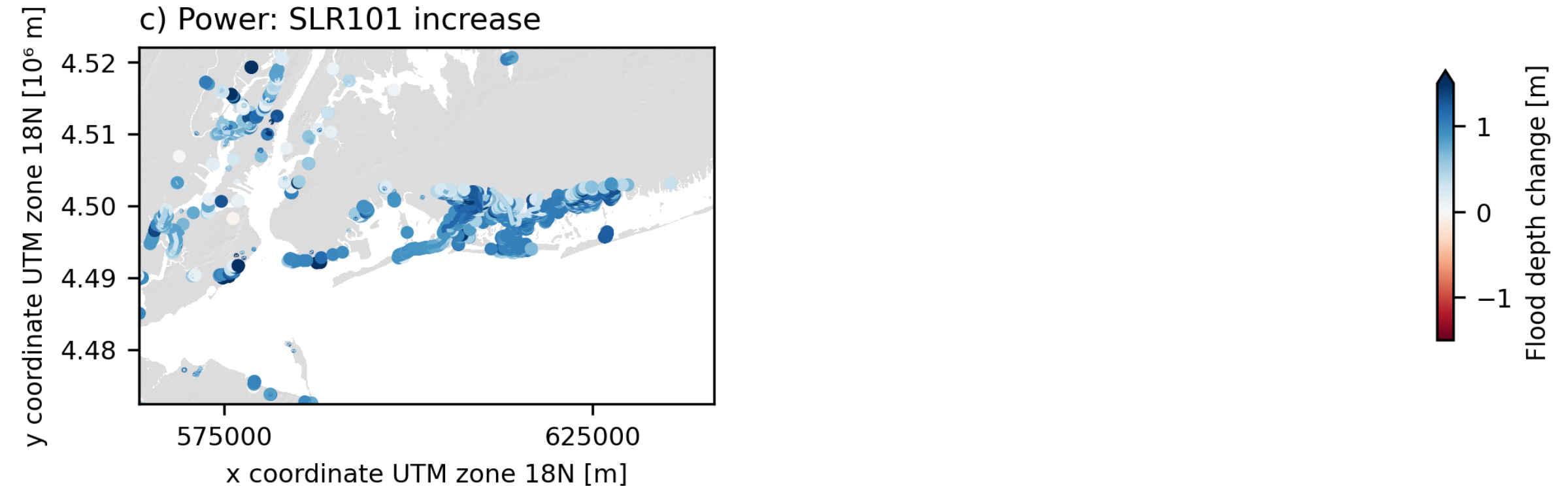a) Flood volumes for MP scenario

Critical infrastructure exposure

a) Flooded CI assets and buildings
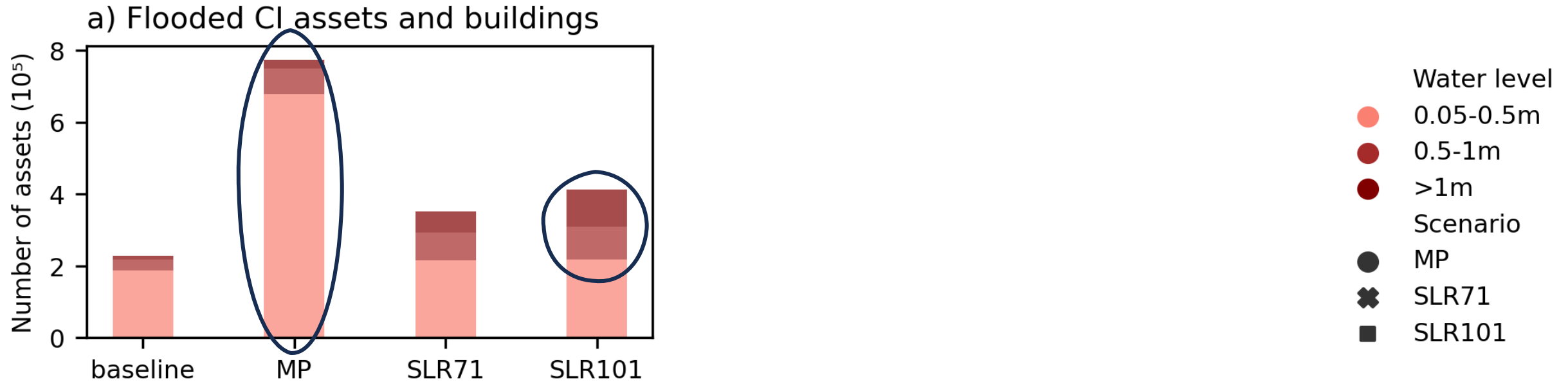
- MP leads to the highest increase in exposed assets;

- SLR leads to highest increase in assets exposed to high water levels;

- CI systems differ greatly, and decision making should account for that.

Critical infrastructure exposure

c) Power: SLR101 increase

- CI systems differ greatly, and decision making should account for that.

Take home messages

- **Societal-relevant scenarios**: set of alternative (and plausible) scenarios offering insights into **alternative impacts** of historical events;

- **Modelling framework:** providing **direct** and **accessible** information for **decision makers**.

Storylines can be a valuable tool for future risk assessment and decision making.