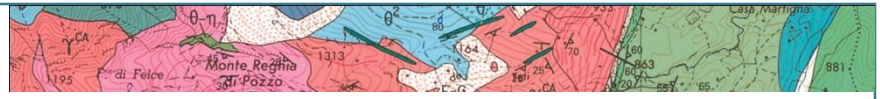


Global analysis of uncertainty in global-scale assessment of coastal impacts under sea-level rise

Jérémy Rohmer[1] j.rohmer@brgm.fr
With : D. Lincke[2], J. Hinkel[2], G. Le Cozannet[1], E. Lambert[3]

3: Universiteit Utrecht **2:** Global Climate Forum **1:** Géosciences pour une Terre durable brgm

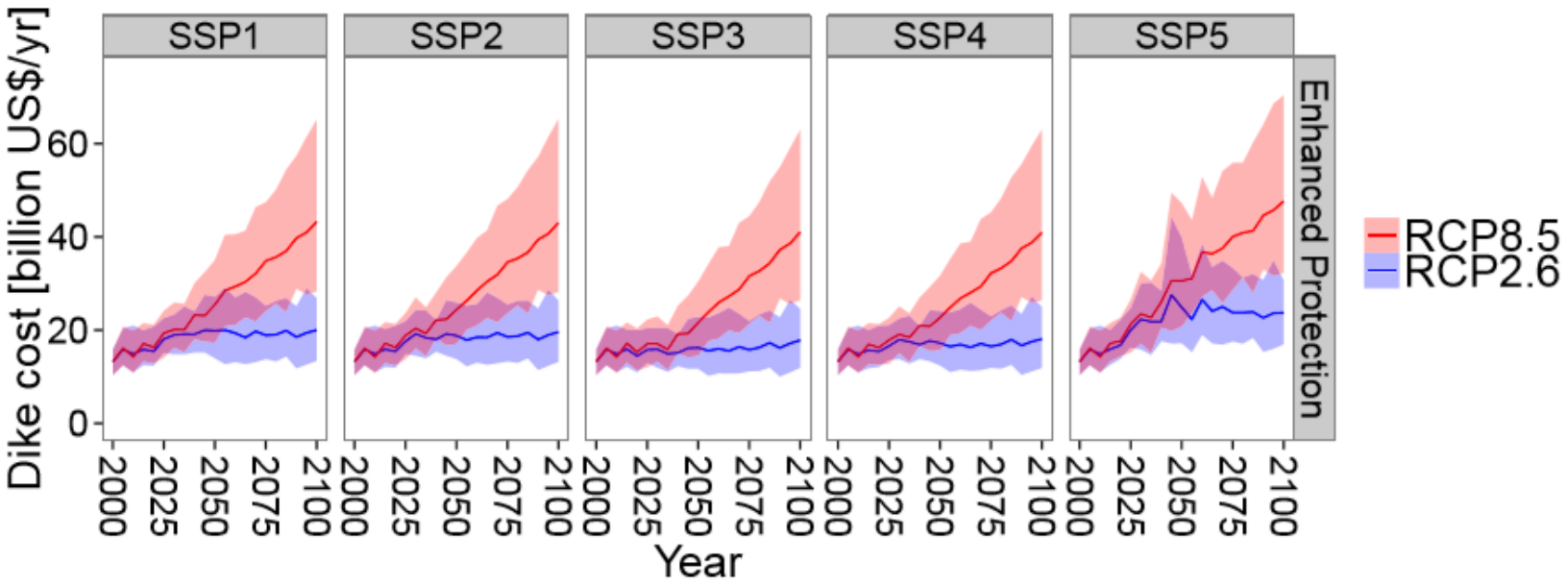
‘For every dollar
that is spent trying to quantify uncertainty,
we should spend 10 dollars collecting and
analyzing data
that would reduce uncertainty.’

Gail Atkinson (2004 World Conference on Earthquake Engineering)

Study case

Coastal flood damage and adaptation costs under 21st century sea-level rise

Jochen Hinkel[a,1], Daniel Lincke[a], Athanasios T. Vafeidis[b], Mahé Perrette[c], Robert James Nicholls[d], Richard S. J. Tol[e,f], Ben Marzeion[g], Xavier Fettweis[h], Cezar Ionescu[c], and Anders Levermann[c,i]



Global annual dike cost (capital and additional maintenance cost)*

*Average impacts across the range of DEMs, population datasets, GCMs, and land-ice scenarios used.

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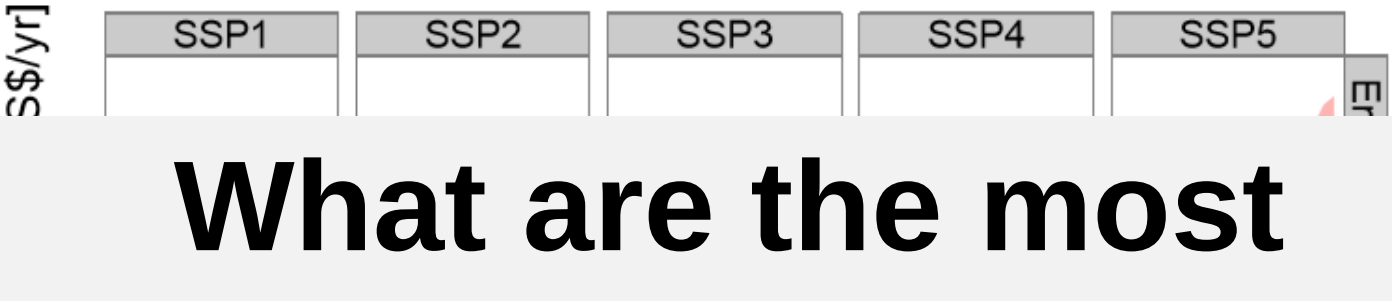

What are the most important uncertainties i.e. those that should be reduced in priority?

Study case

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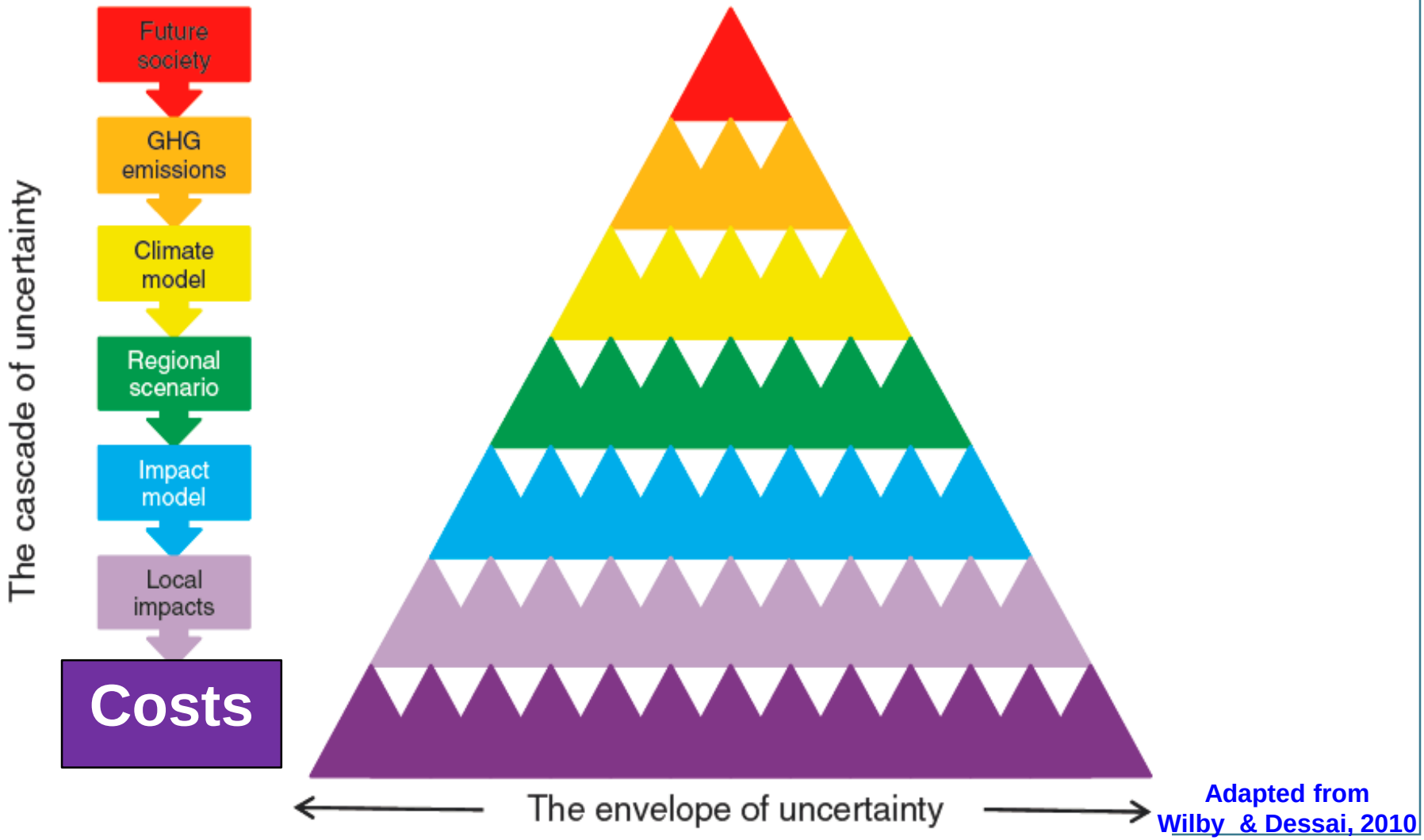

Adapted from Wilby & Dessai, 2010

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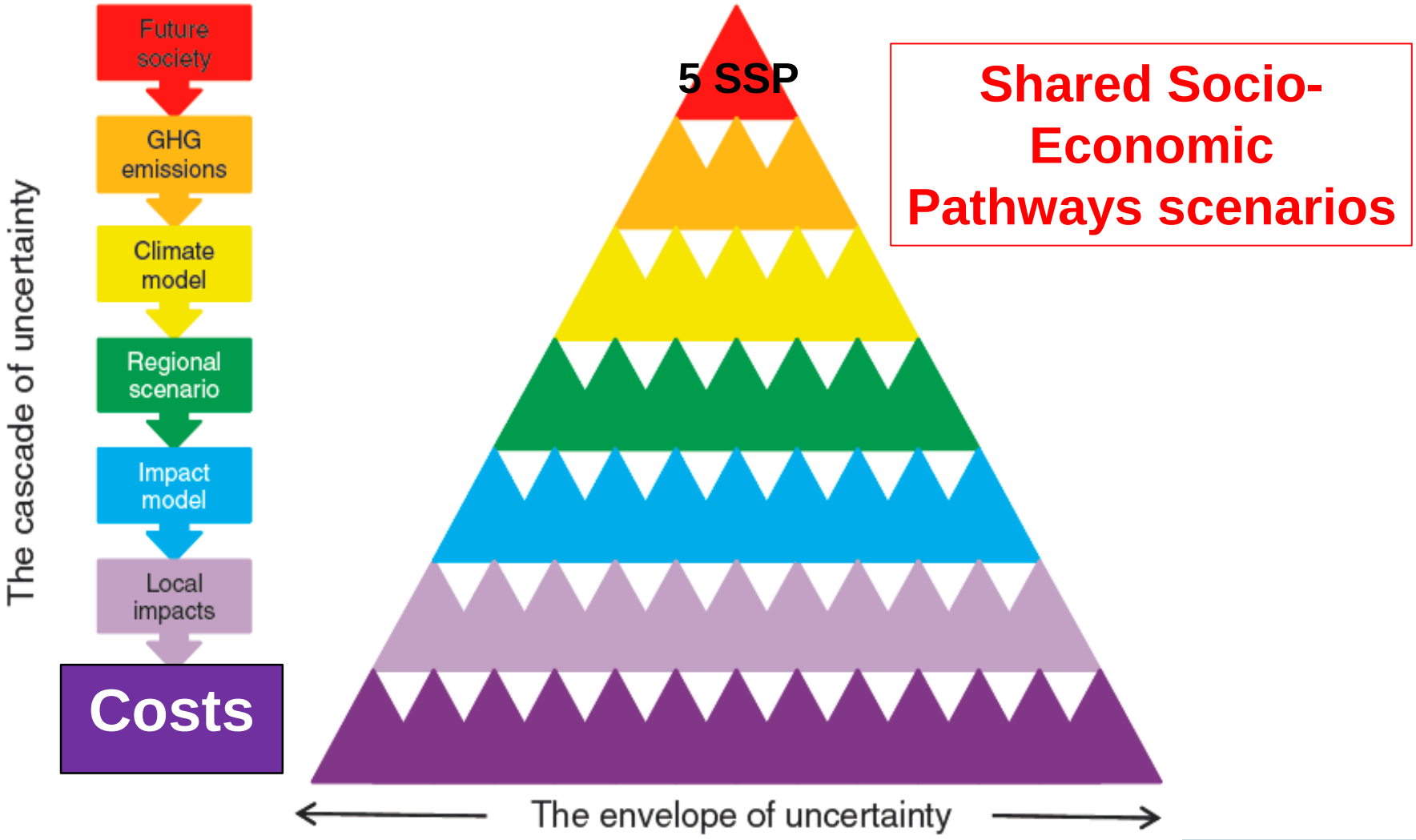

Shared Socio-Economic Pathways scenarios

Study case

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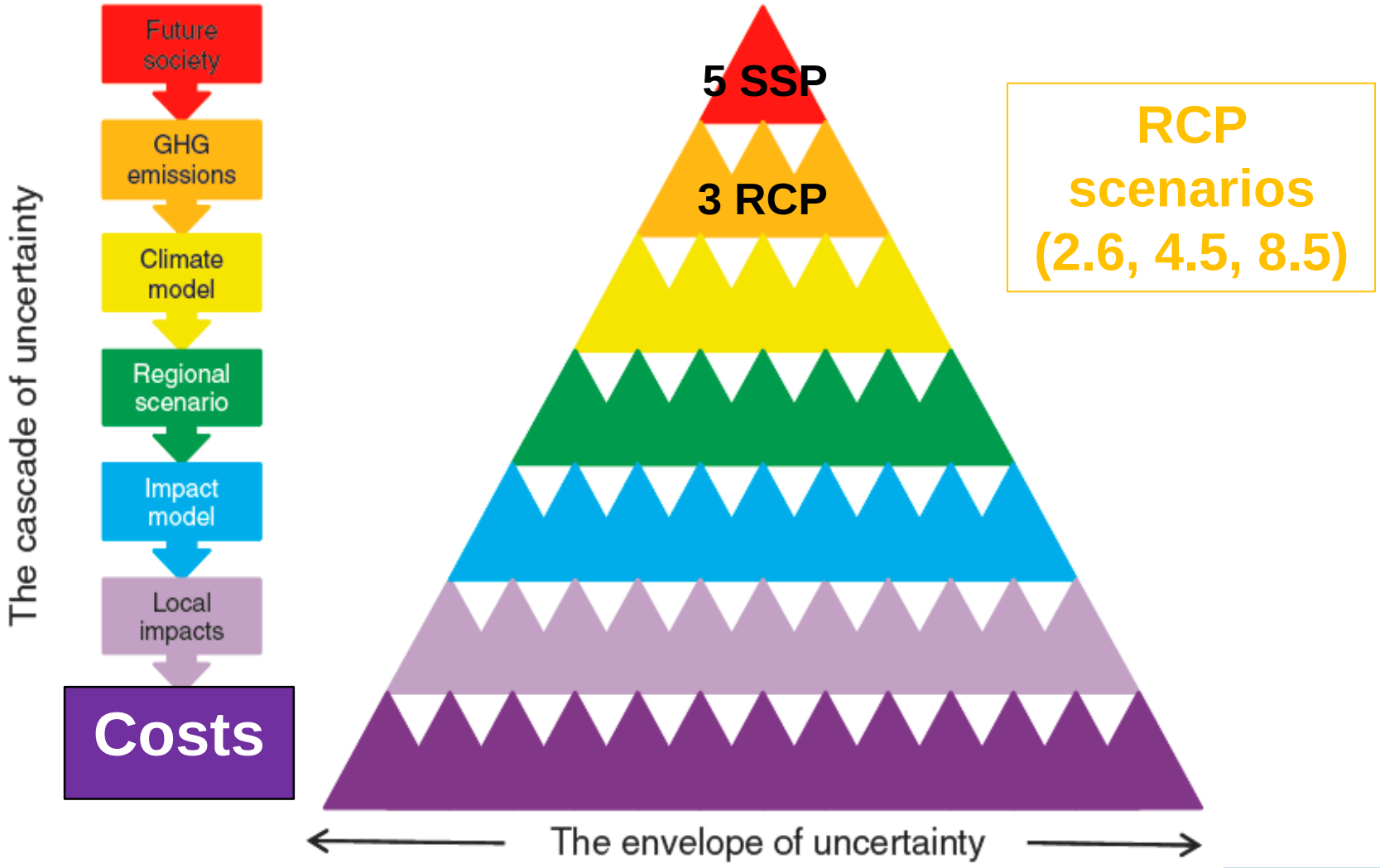

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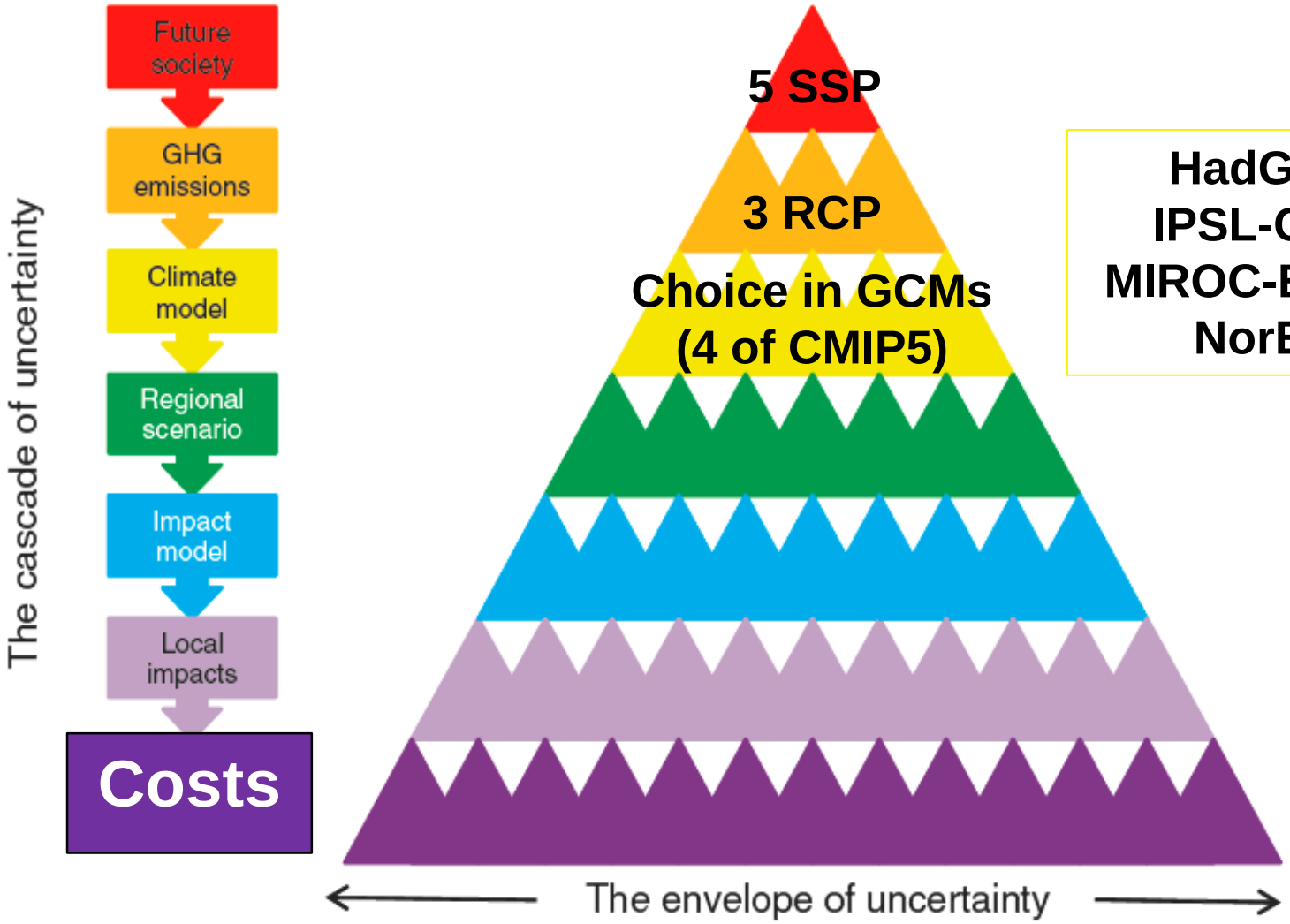

HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, NorESM1-M

Study case

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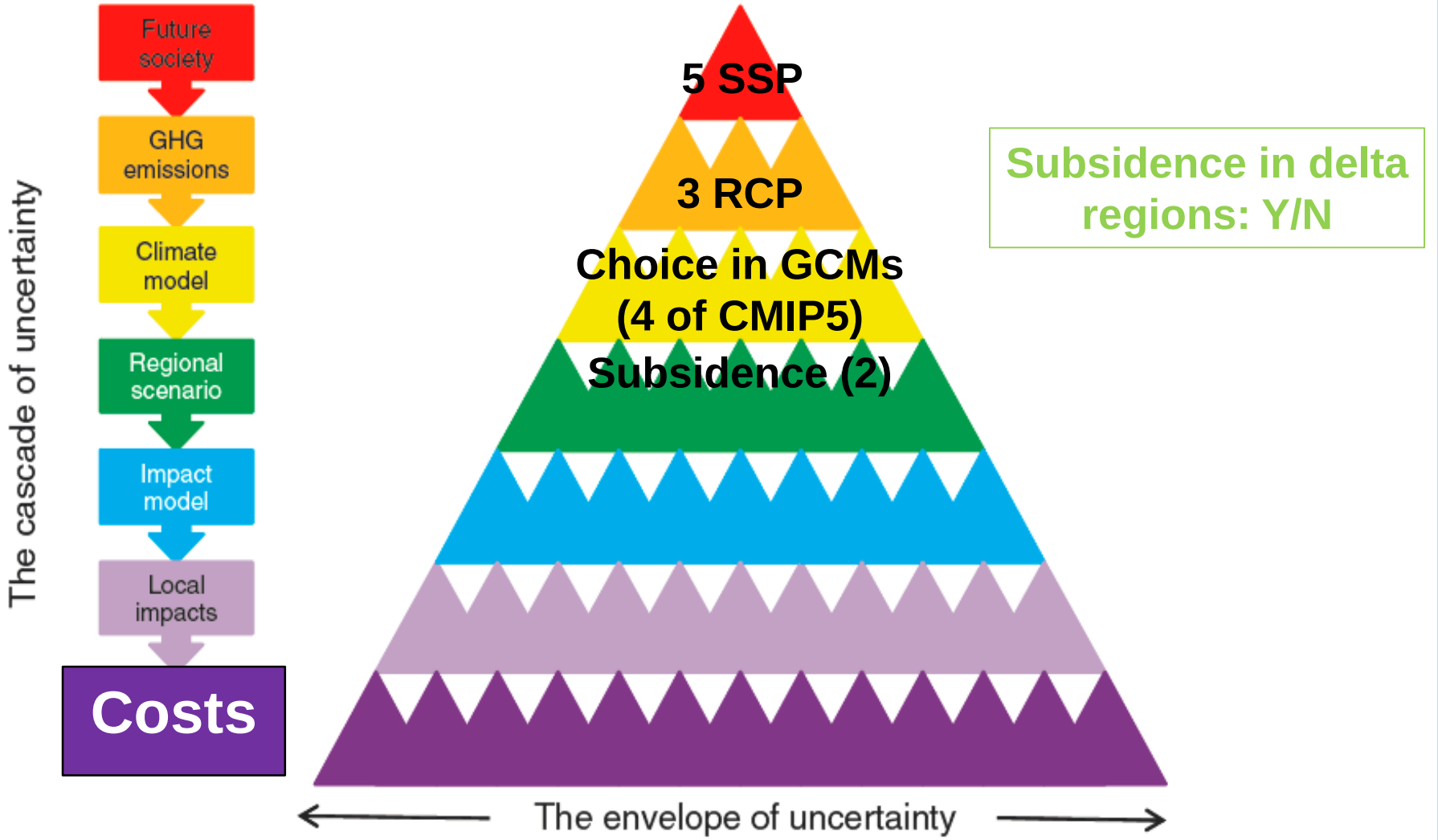

Subsidence in delta regions: Y/N

Study case

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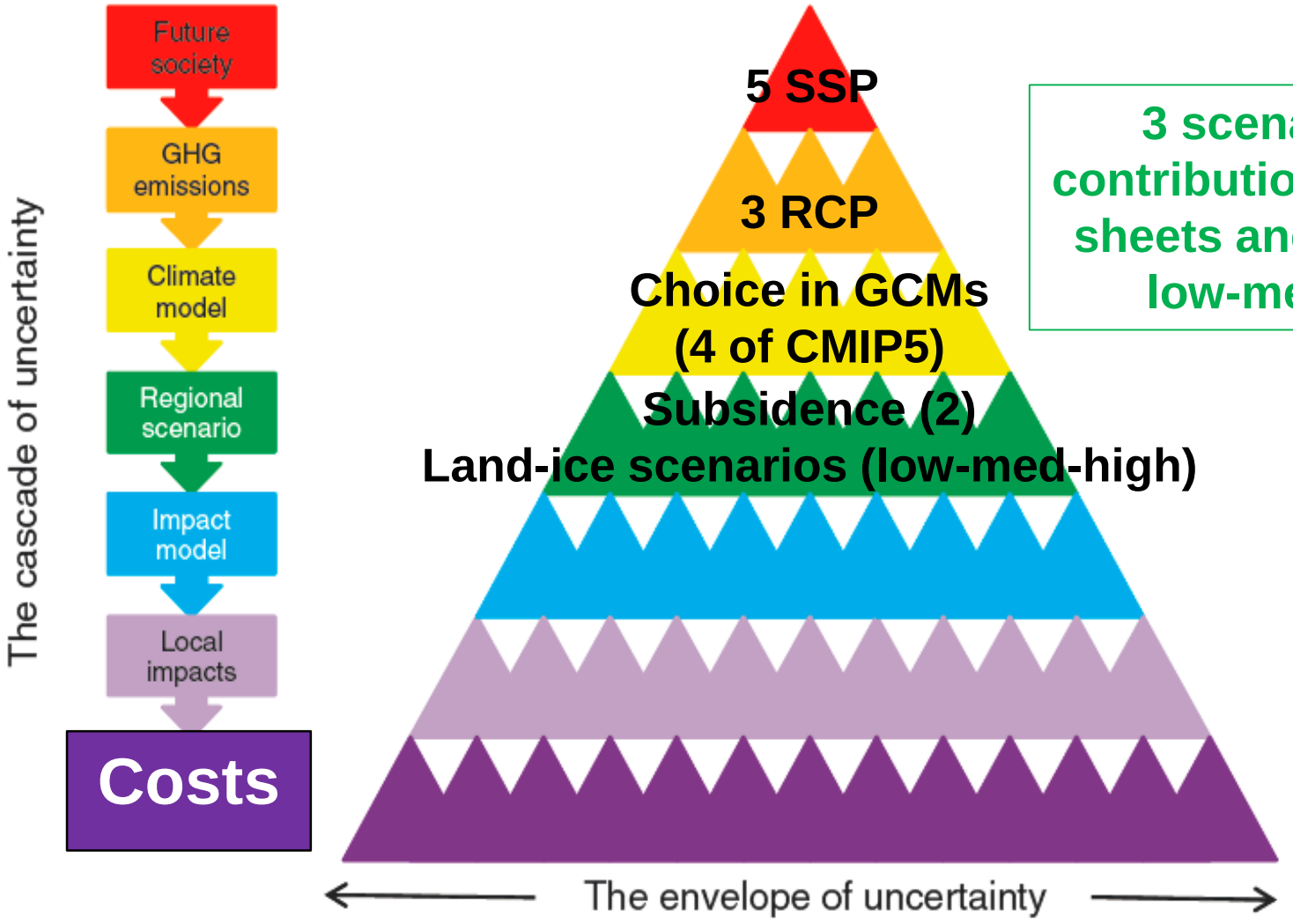
PNAS

DIVA



3 scenarios of contributions from ice sheets and glaciers: low-med-high

Study case

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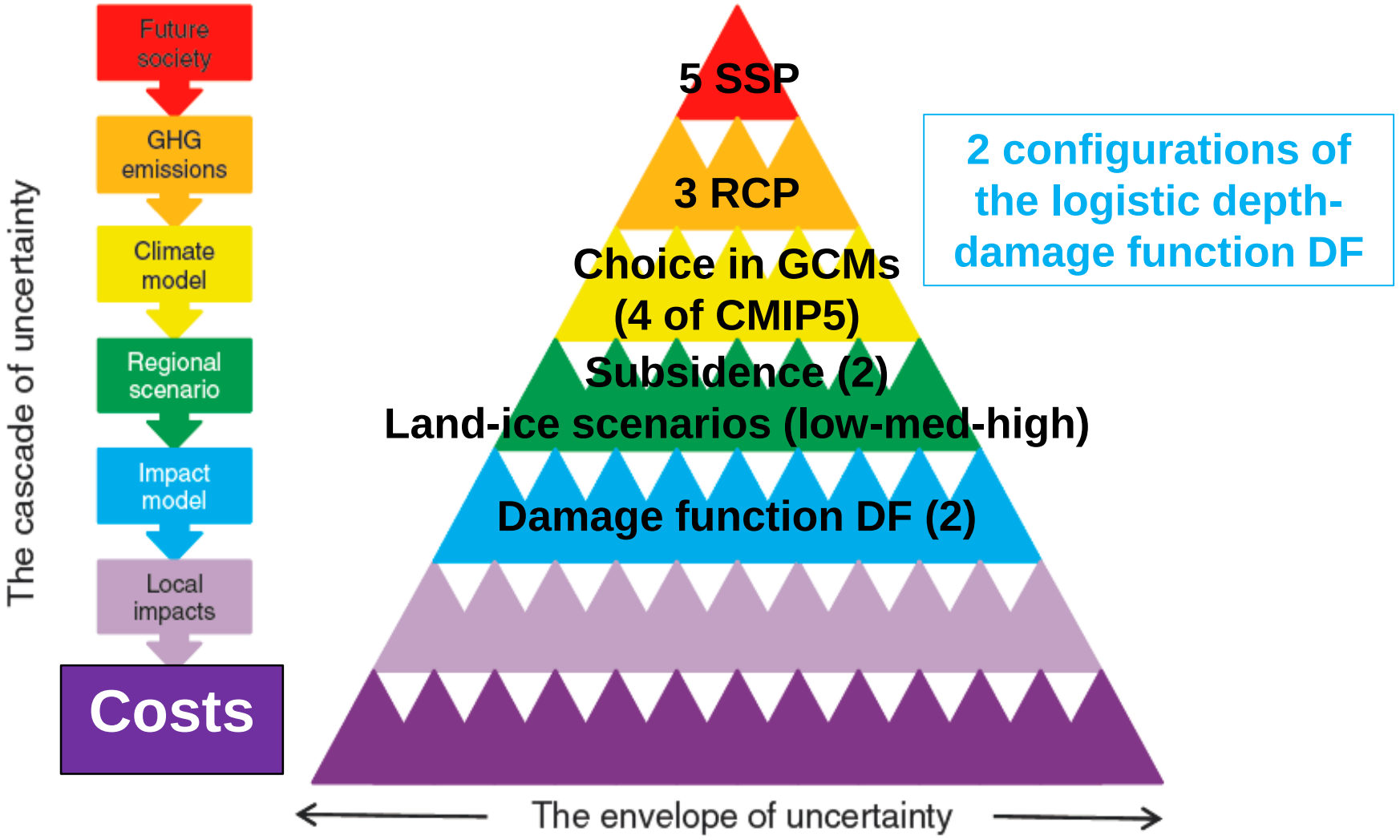

2 configurations of the logistic depth-damage function DF

Study case

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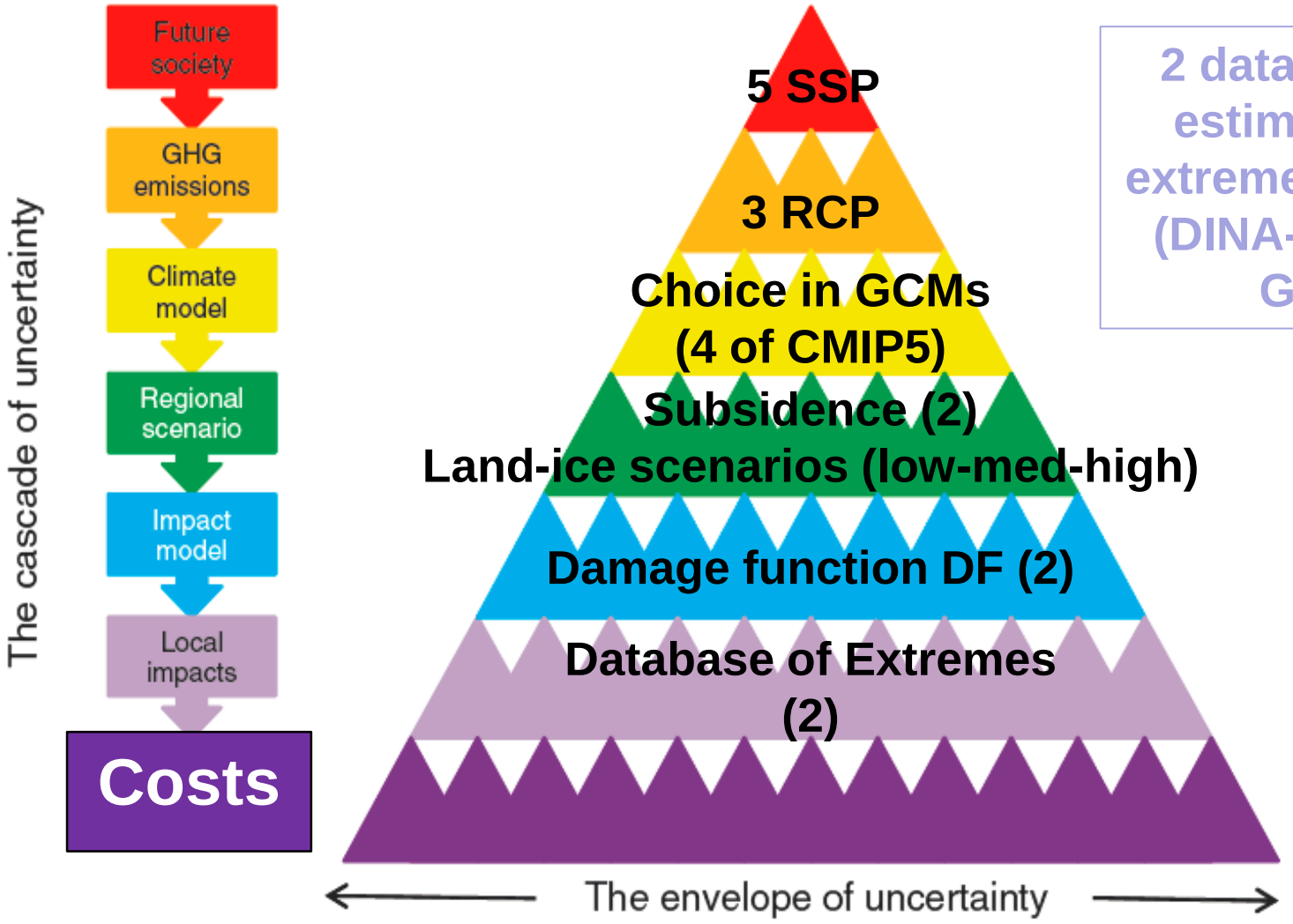

2 databases for estimating the extreme sea levels (DINA-COAST & GTSR)

Study case

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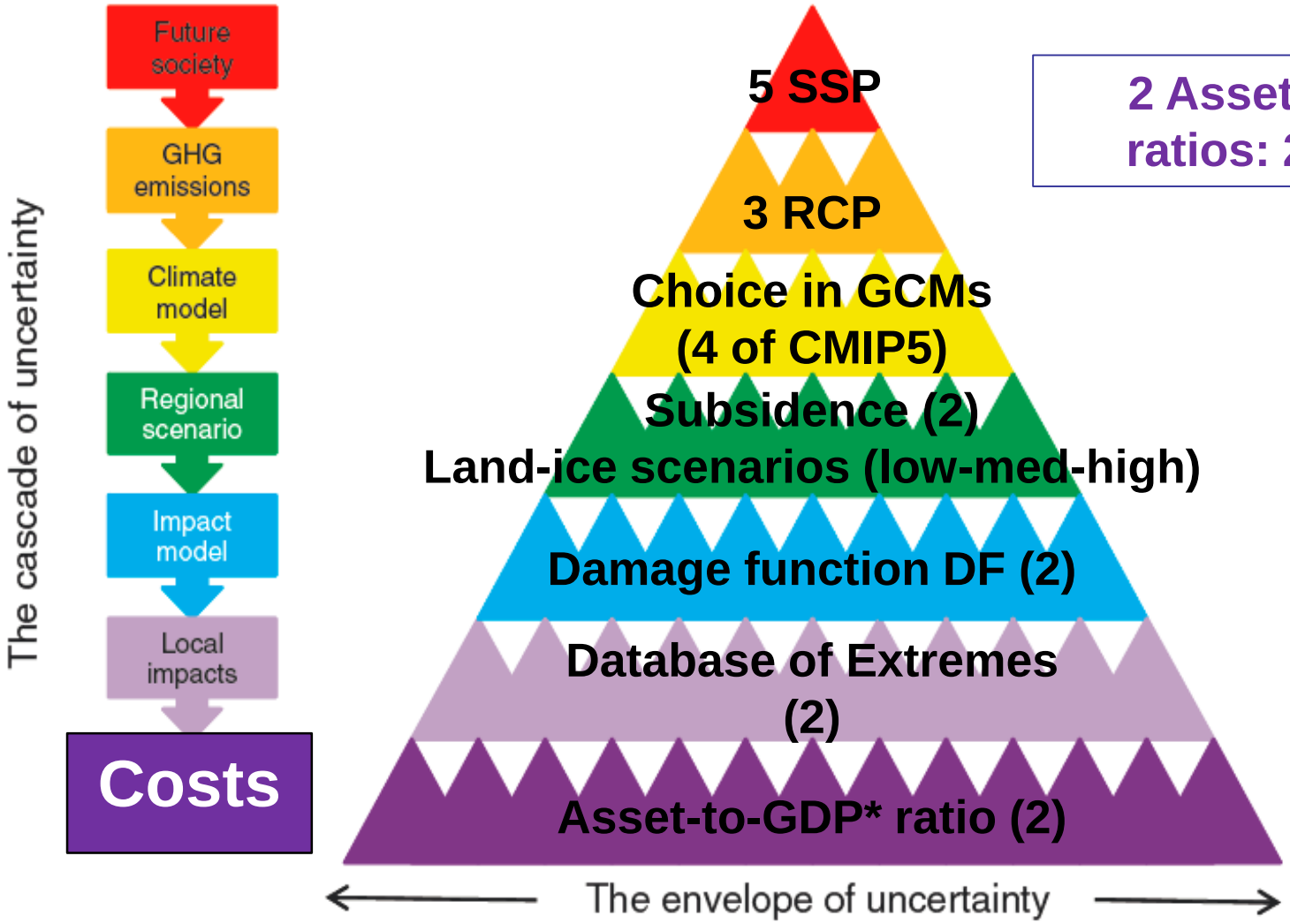

2 Asset-to-GDP ratios: 2.8* ; 3.8

*Hallegate et al., 2013 ; *Gross Domestic Product

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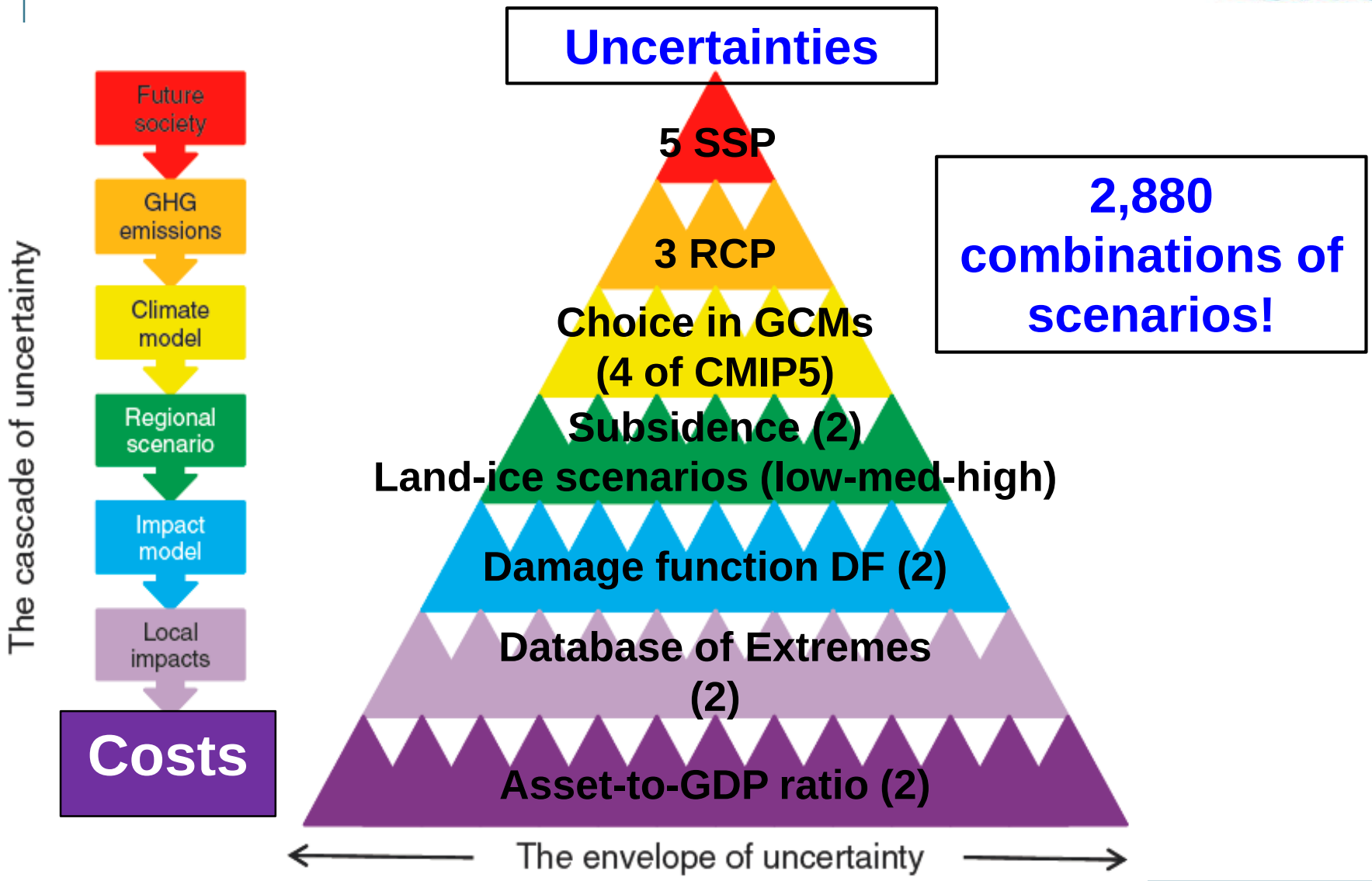
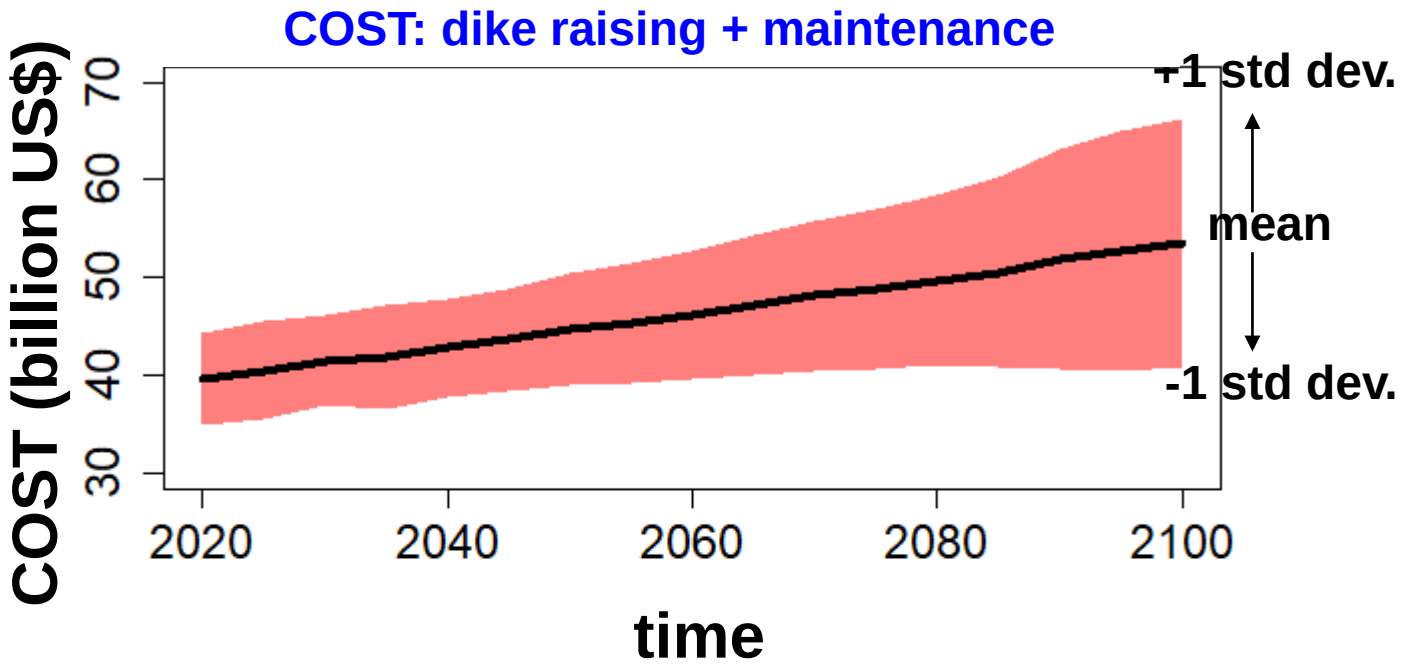
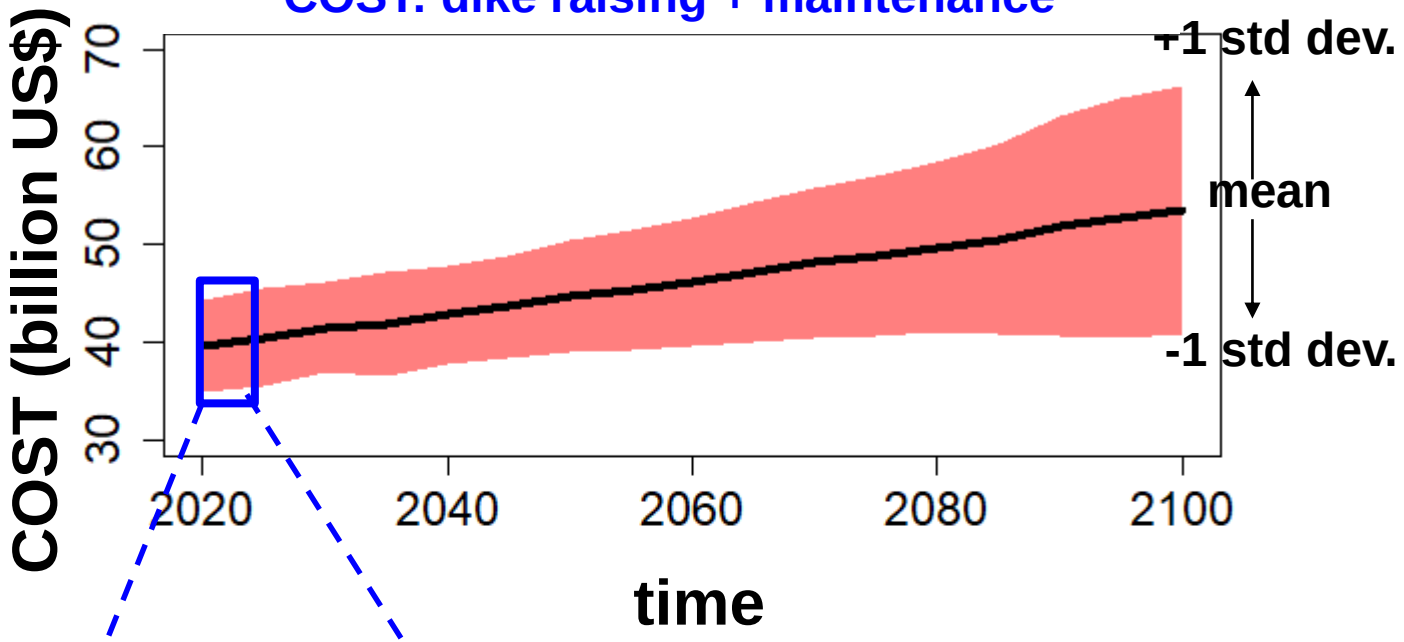
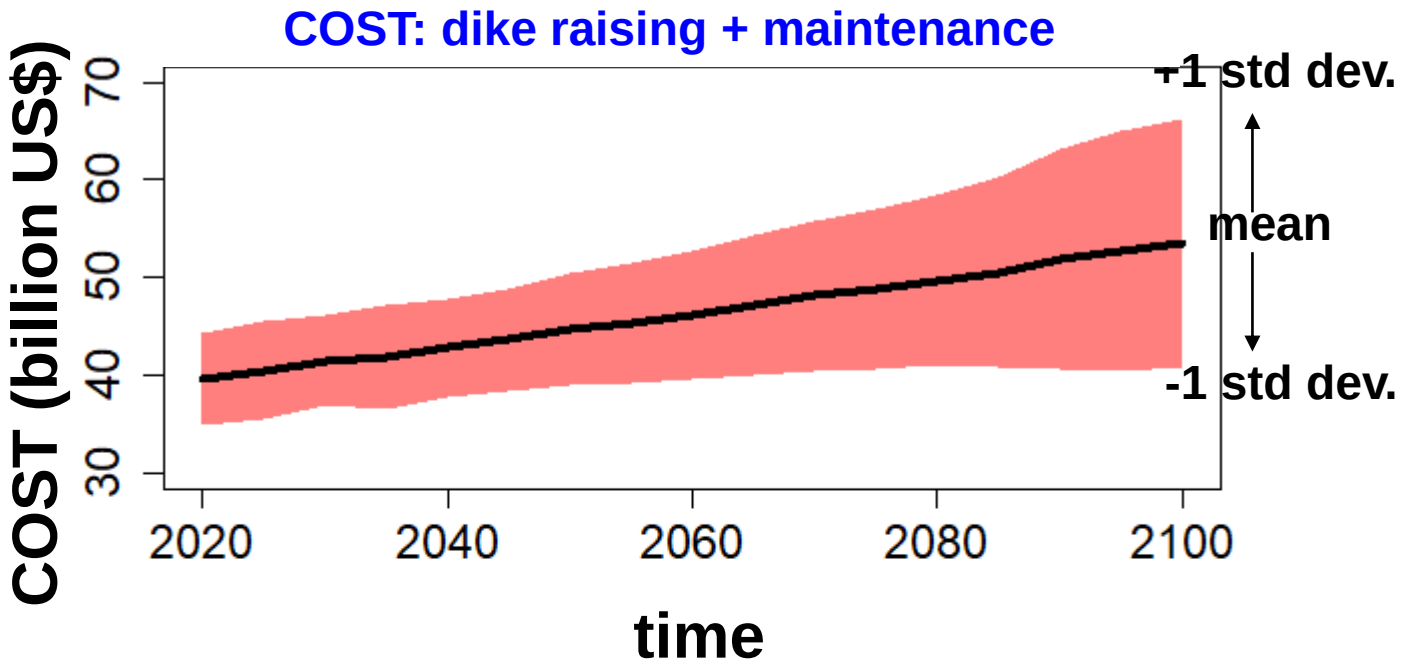
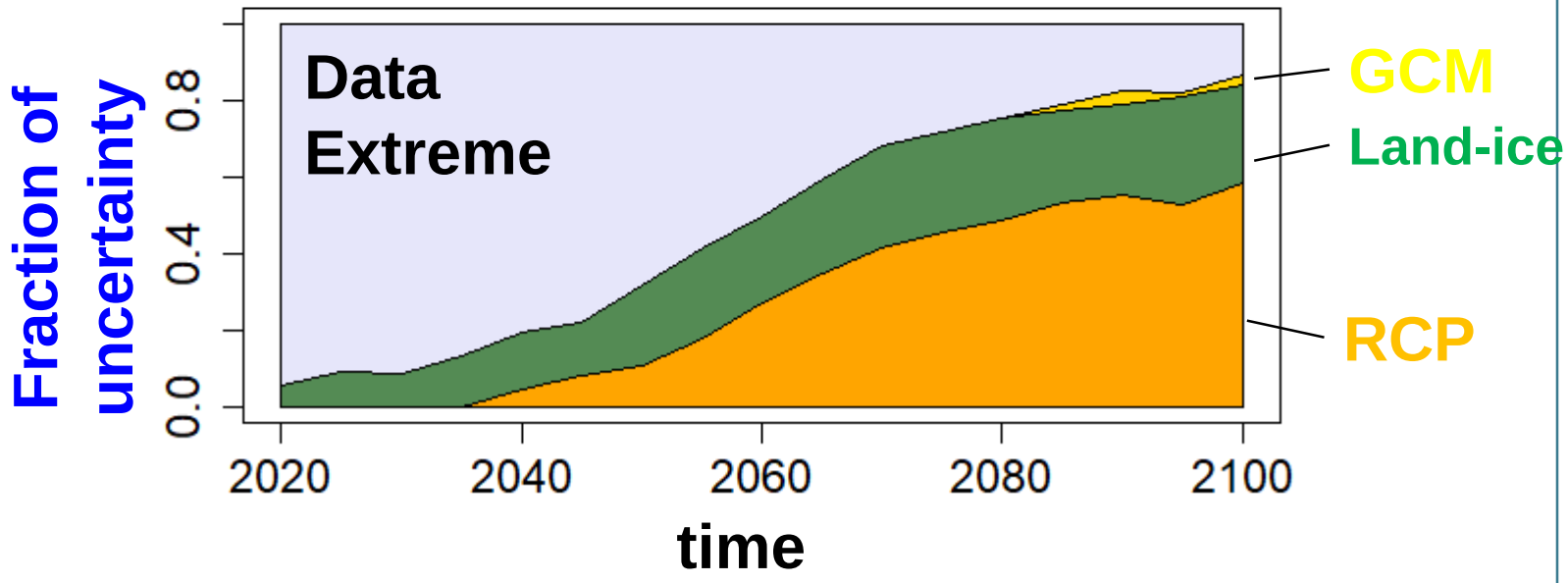


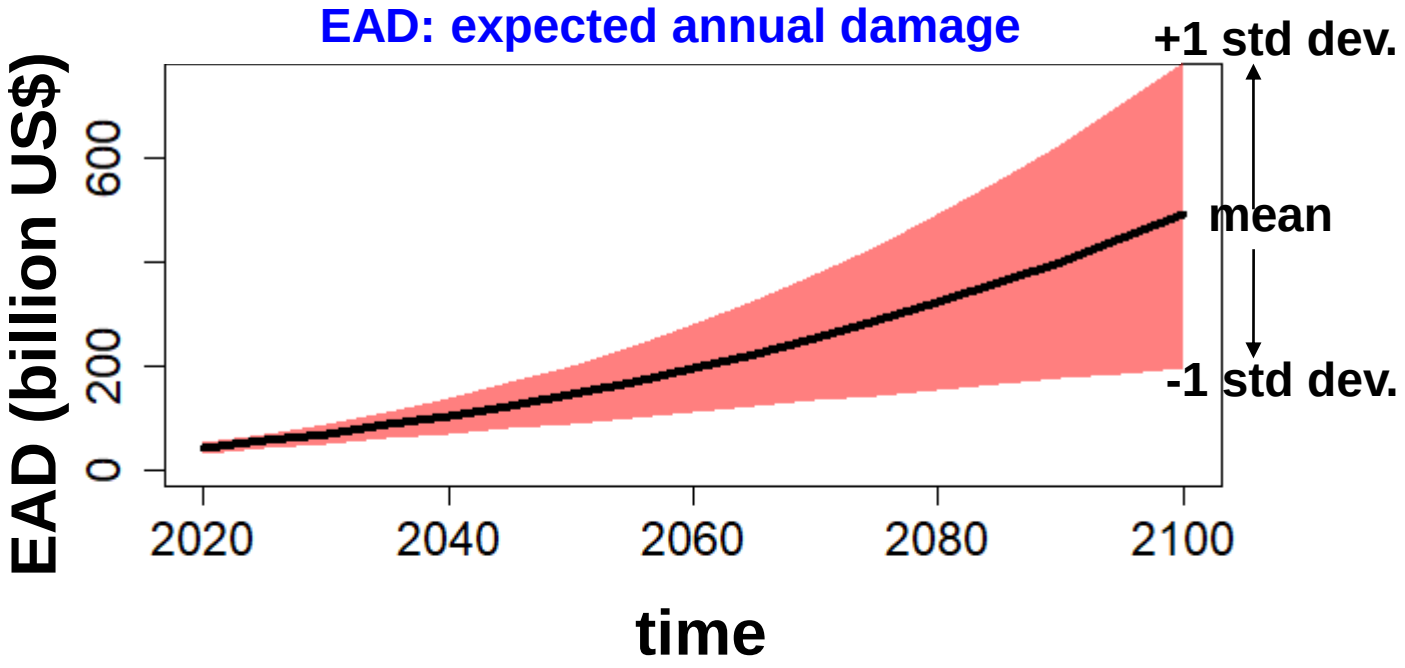

COST: dike raising + maintenance
COST (billion US$)
30
40
50
60
70
2020
2040
2060
2080
2100
time
+1 std dev.
mean
-1 std dev.

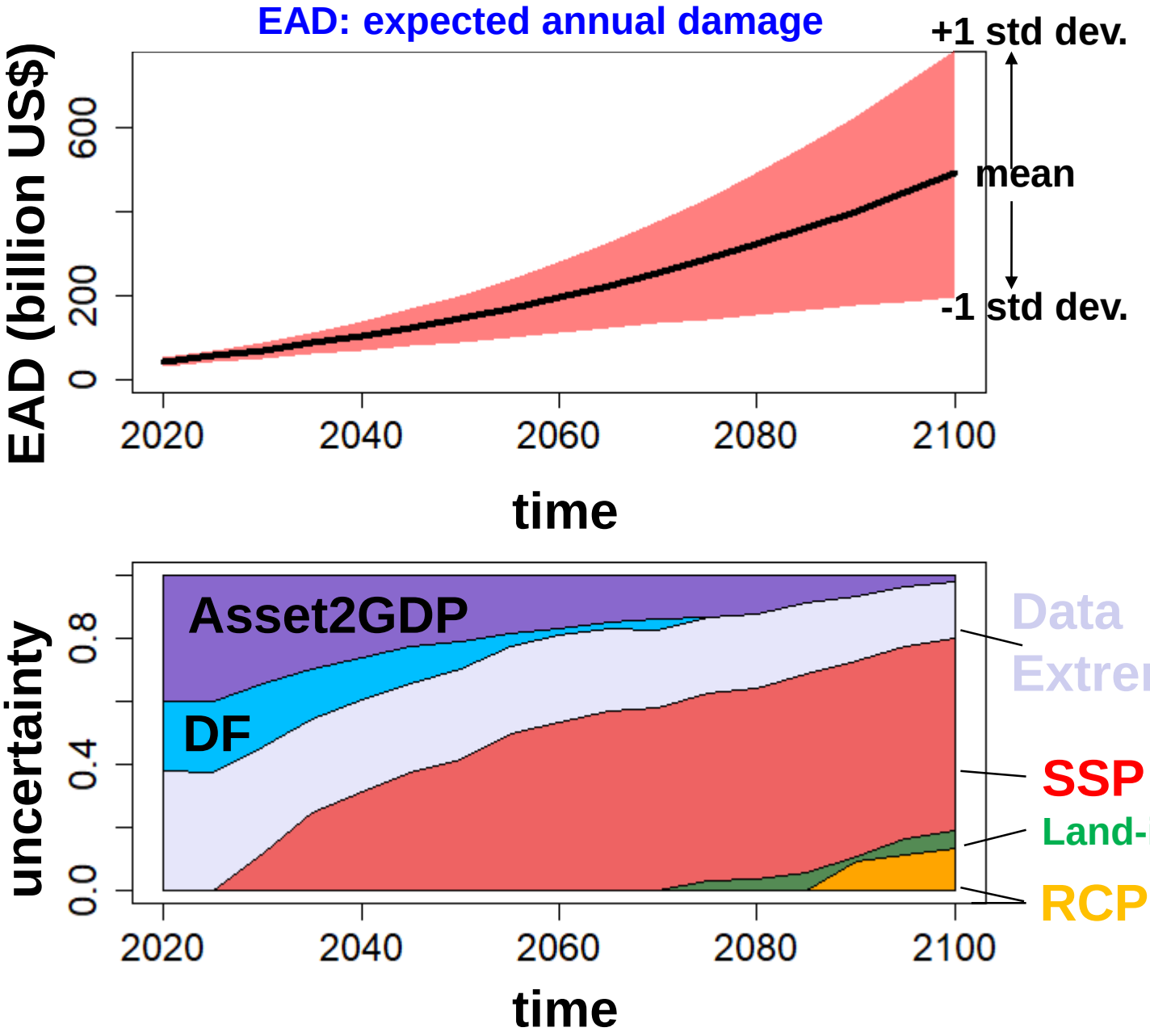


What is the contribution of each factor to the uncertainty range (=fraction of uncertainty)?


COST: dike raising + maintenance
COST (billion US$)
30
40
50
60
70
+1 std dev.
mean
-1 std dev.
2020
2040
2060
2080
2100
time


Fraction of uncertainty
0.0
0.4
0.8
Data
Extreme
GCM
Land-ice
RCP
2020
2040
2060
2080
2100
time


EAD: expected annual damage
+1 std dev.
mean
-1 std dev.
EAD (billion US$)
0
200
600
2020
2040
2060
2080
2100
time

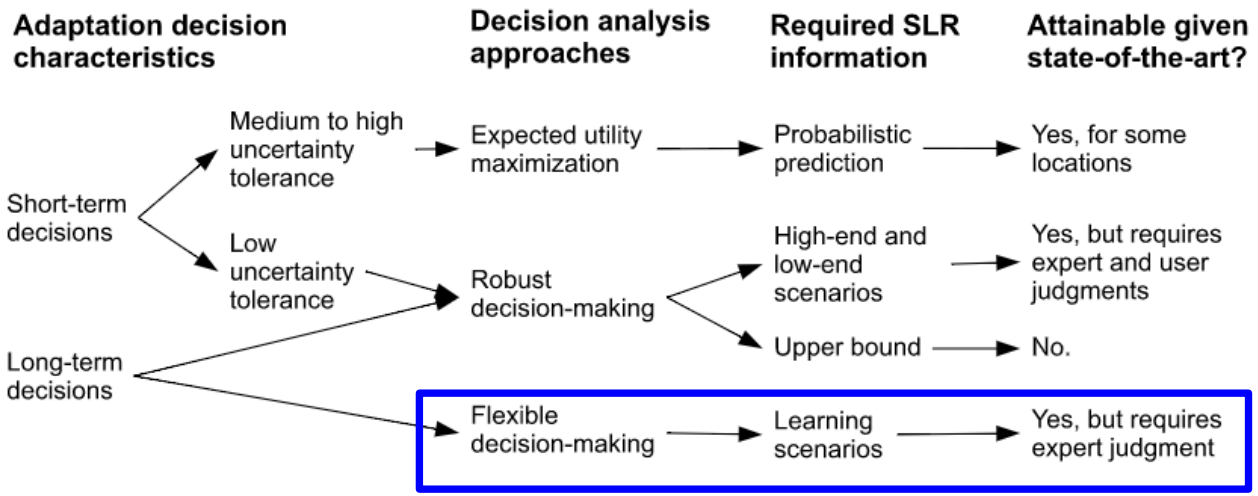

EAD: expected annual damage
+1 std dev.
mean
-1 std dev.
EAD (billion US$)
0
200
600
2020
2040
2060
2080
2100
time
Fraction of uncertainty
0.0
0.4
0.8
Asset2GDP
DF
Data
Extreme
SSP
Land-ice
RCP
2020
2040
2060
2080
2100
time

Summary

- Decreasing role over time of **extremes**
- Increasing role of **SSP** and of **RCP** after 2030 and 2080 for the damage and adaptation costs respectively.
- This means:
  - "*mitigation of climate change helps to reduce uncertainty of adaptation costs,*
  - *being able to identify SSP reduces the uncertainty on the expected damages*".

Summary

- **Towards a systematic second level information on uncertainty:**
  - Defines research priorities
  - Identifies most appropriate time-frame
  - Contributes to the definition of learning scenarios (Hinkel et al. 2019)



Summary

- **Towards a systematic second level information on uncertainty:**
  - Defines research priorities
  - Identifies most appropriate time-frame
  - Contributes to the definition of learning scenarios (Hinkel et al. 2019)

- **Further work:**
  - Update with new SLR projections (SROCC 2019)
  - Integrate additional uncertainties
    - DEM (Kulp & Strauss, 2019)
    - Extreme fitting (Wahl et al., 2017)
    - Urbanization evolution (e.g. Wolff et al., 2020)