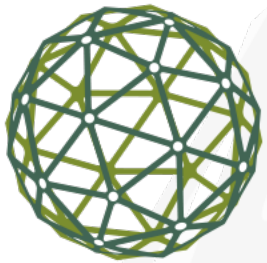

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Measuring Resilience: Big Data Approaches to Risk Assessments:

Climate Change Risk Assessment, and the Need of Data

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BC3 BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai

EXCELENCIA MARÍA DE MAEZTU 2023-2027

INE Instituto Nacional de Estadística

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THE INCREASING IMPORTANCE OF CLIMATE RISK ASSESSMENTS, ADAPTATION & RESILIENCE

INCREASING DEMAND FOR CLIMATE RISK ASSESSMENTS ACROSS DIFFERENT SECTORS

- public (from local to national)
- development organizations and financial institutions
- private sector

FRAMEWORKS EXIST – IMPLEMENTATION IS HIGHLY VARIABLE ACROSS COUNTRIES AND SECTORS

PUBLIC SECTOR: DRIVEN BY CLIMATE POLICY AND PLANNING NEEDS

- usually high-level assessments and sectorial (See NAPS)

PRIVATE SECTOR: DRIVEN BY A DIVERSE SET OF ISSUES

- access to finance
- new regulation and reporting obligations
- factoring climate risk into internal risk management
- opportunity identification
- shareholder pressure
- strategy setting
- reputational risk
- greenwashing

REQUIRES DATA ANALYTICS

GENERAL PRINCIPLES FOR THE APPLICATION OF CLIMATE CHANGE RISK ASSESSMENTS

SCIENTIFIC BASIS

ROBUSTNESS FOR UNCERTAINTY

SYSTEMIC APPROACH

PROPORTIONALITY

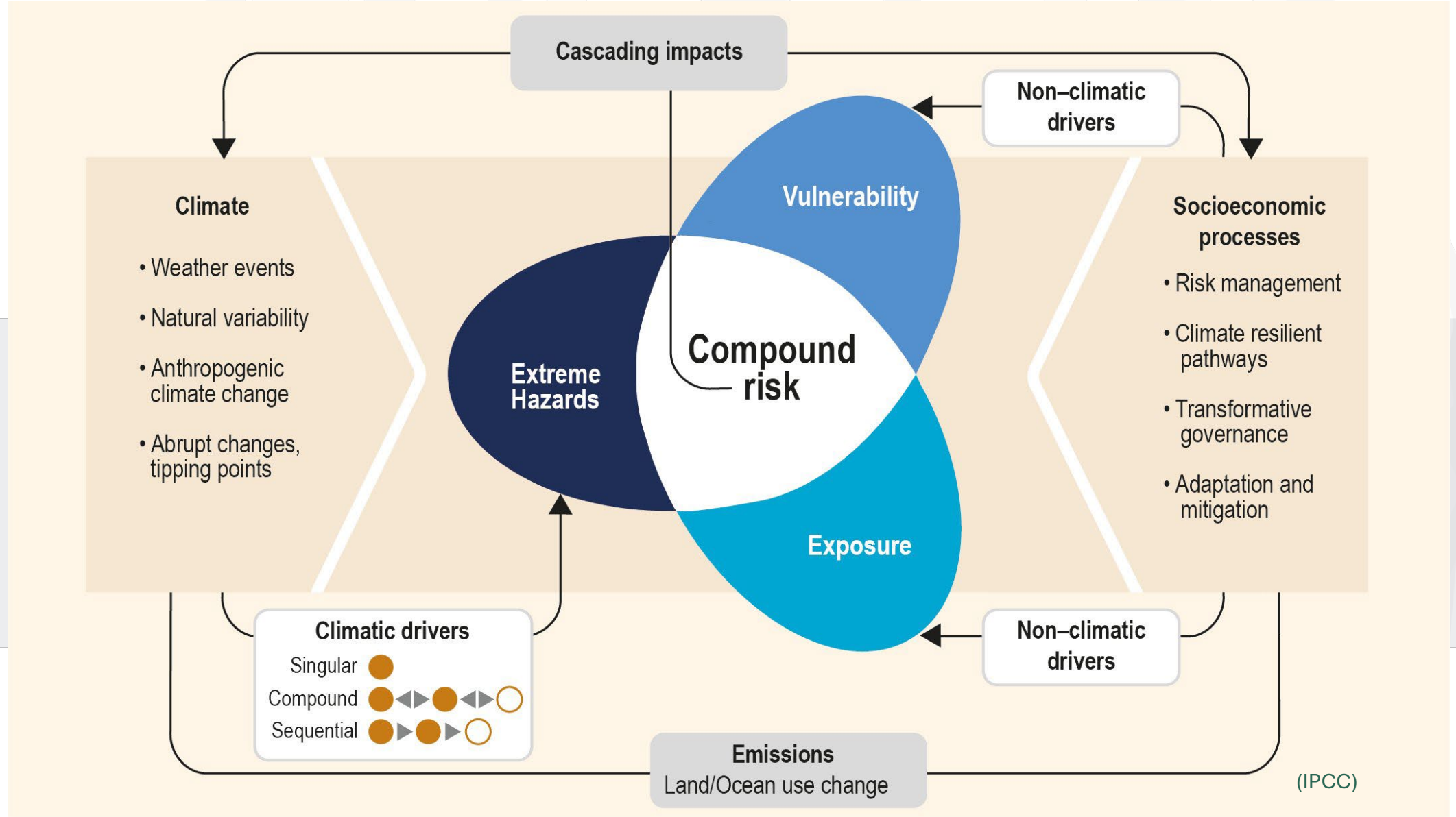
PRECAUTIONARY PRINCIPLE

PLANNED ADAPTATION, FROM INCREMENTAL AND FLEXIBLE TO TRANSFORMATIONAL

SYNERGIES BETWEEN ADAPTATION AND MITIGATION (CLIMATE RESILIENT DEVELOPMENT)

REQUIRES A COMBINATION OF KNOWLEDGE, TECHNICAL CAPACITY AND DATA ANALYTICS

FRAMEWORKS EXIST – IMPLEMENTATION IS HIGHLY VARIABLE ACROSS COUNTRIES AND SECTORS



DATA NEEDS

DEFINE THE RISK ASSESSMENT BOUNDARIES – (system, subsystems, relevant processes, stakeholders, interrelations..)

COLLECT HISTORICAL INFORMATION – (hazards, impacts, consequences..)

HAZARDS (multihazard, compound, extremes, variability, long-term changes, hindcasts, projections, downscaling..)

EXPOSURE (characterization of exposed elements within the system and subsystems, downscaling, projections..)

IMPACT MODELLING (expert-judgement, impact indicators, models..)

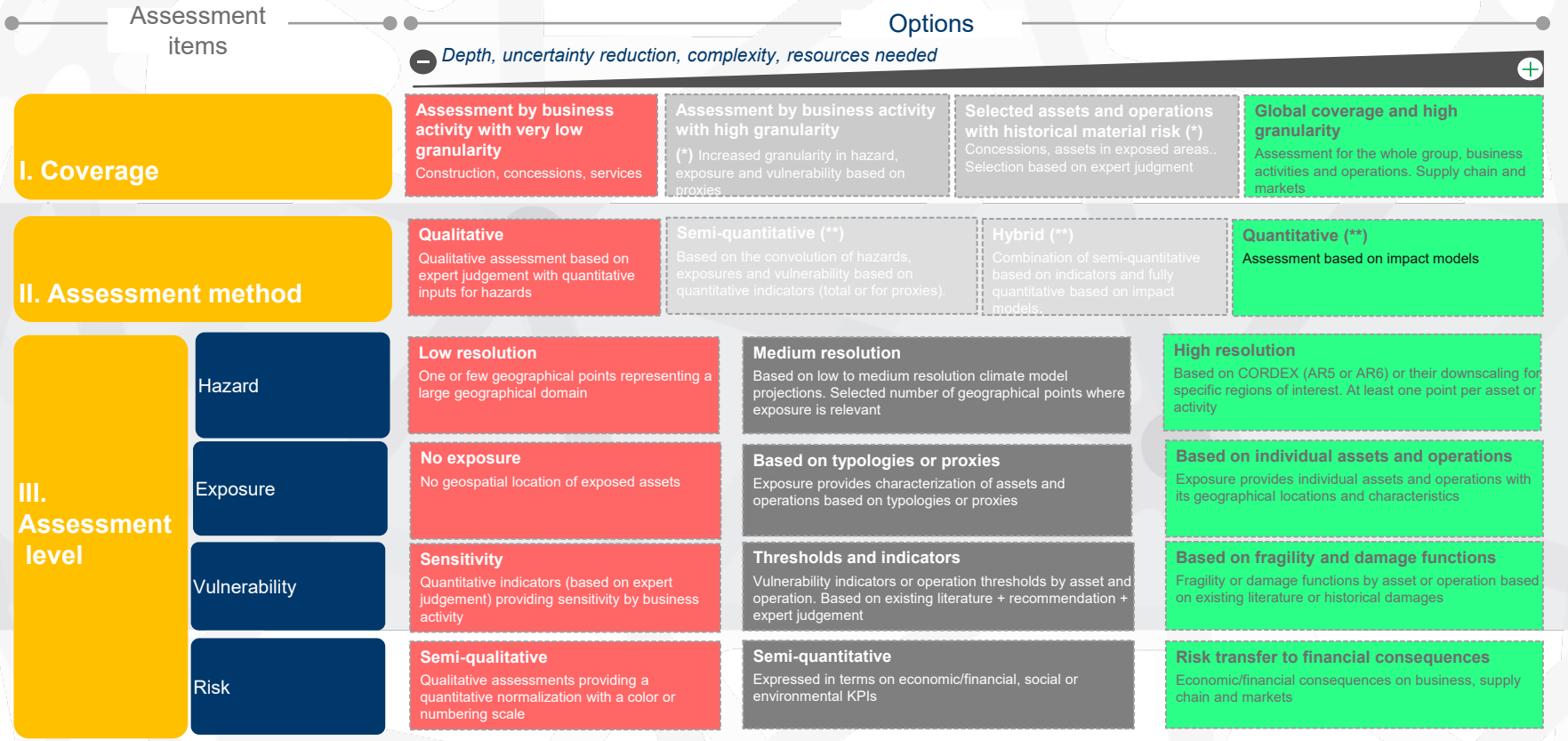
VULNERABILITY (social, environmental, physical...indicators, damage functions, fragility functions, thresholds, projections..)

RISKS & CONSEQUENCES (characterization, KPIs, probability, urgency, intensity level...)

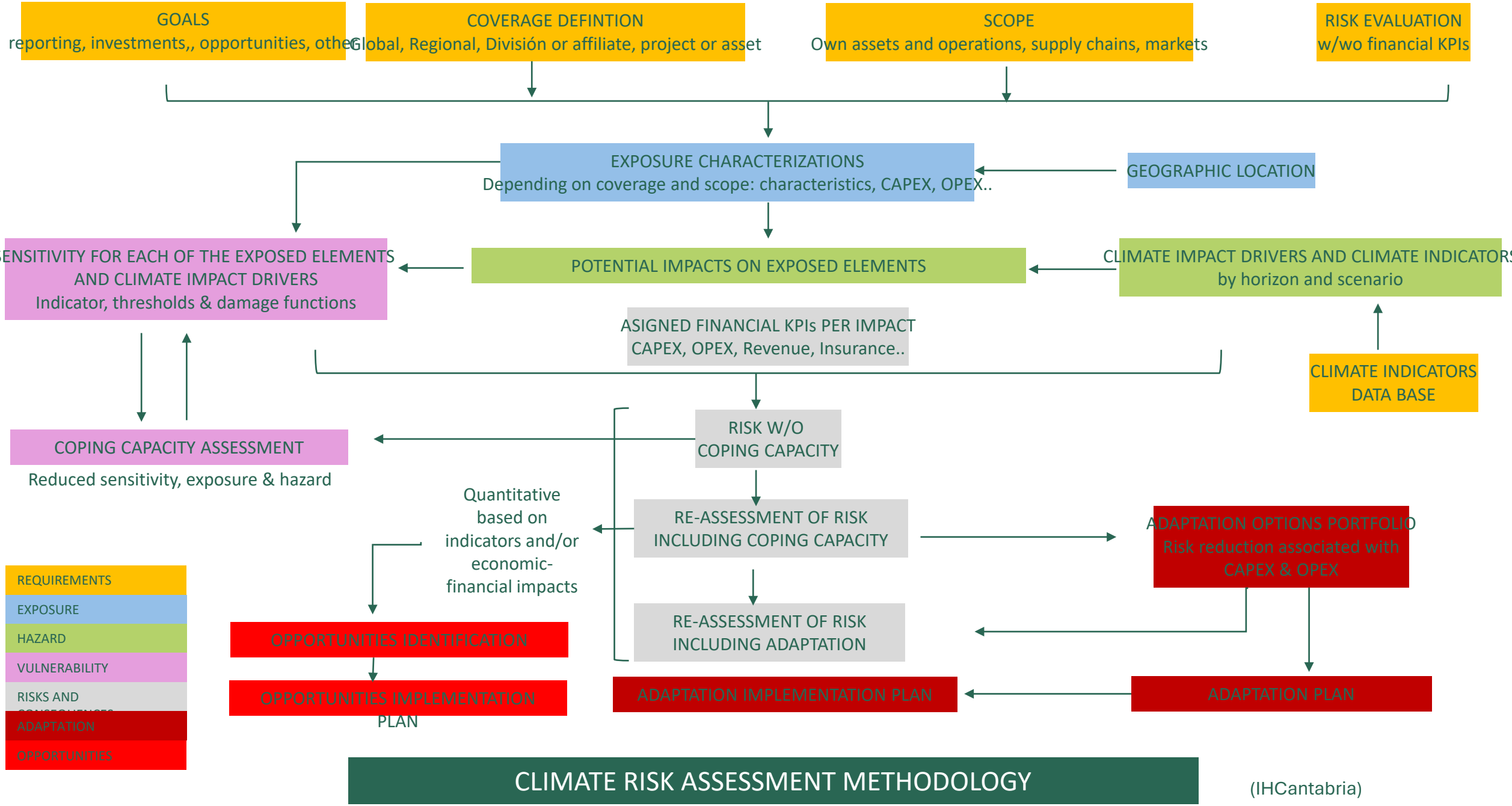
ASSESS ADAPTATION SOLUTIONS

BIG GAP BETWEEN CURRENT NEEDS AND PRESENT AVAILABILITY

PROPORTIONALITY-PRIVATE SECTOR CASE



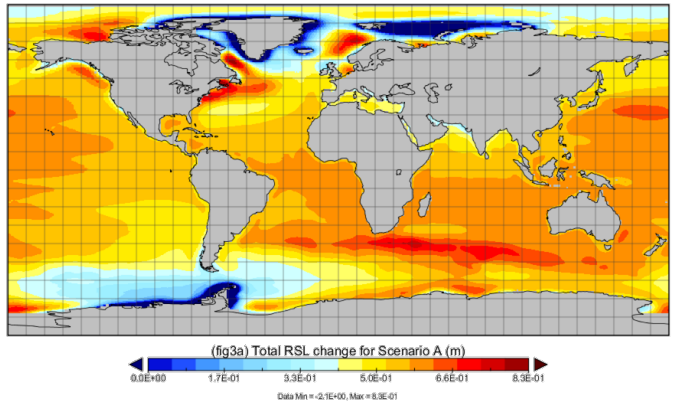
(IHCantabria)



CLIMATE RISK ASSESSMENT METHODOLOGY

(IHCantabria)

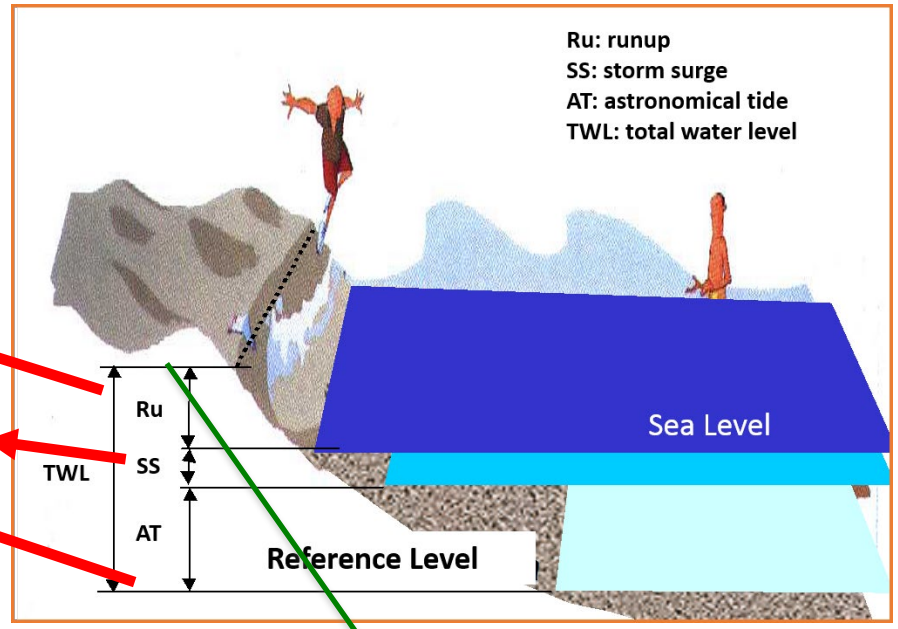
COMPOUND HAZARDS_ COASTAL FLOODING

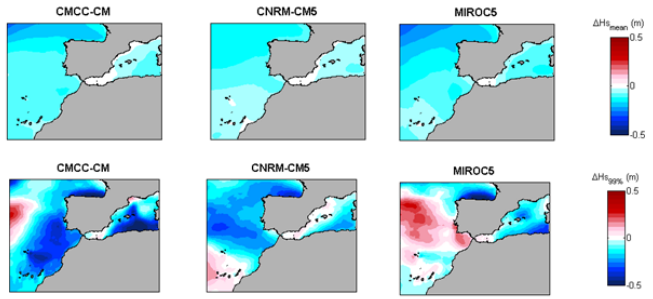


EXTREME SEA LEVEL COMPONENTS

Combined effects!!!

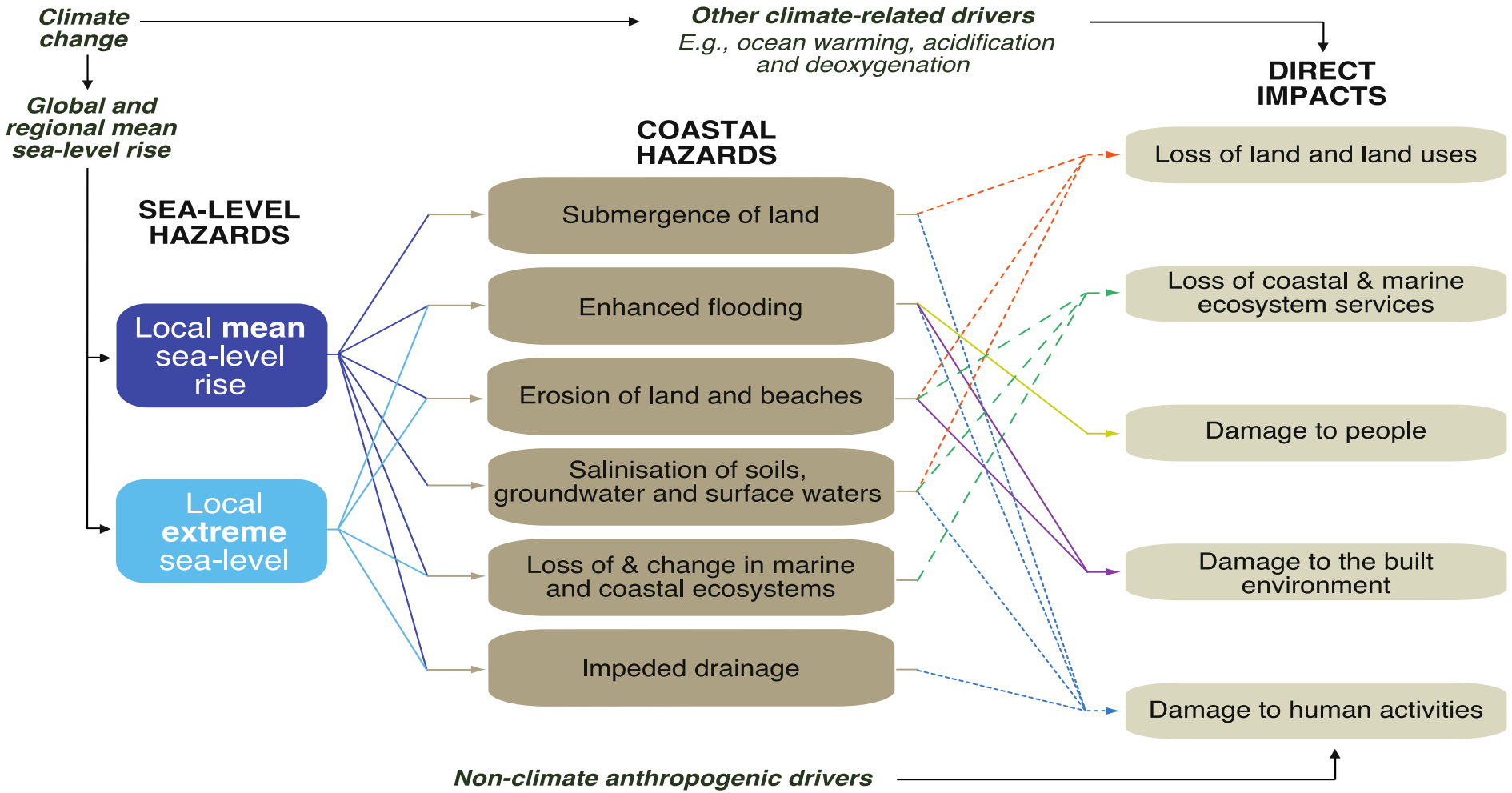
- Waves
- Wind
- Atmospheric Pressure
- Mean Sea Level





DOWNSCALING IS ALWAYS NEEDED

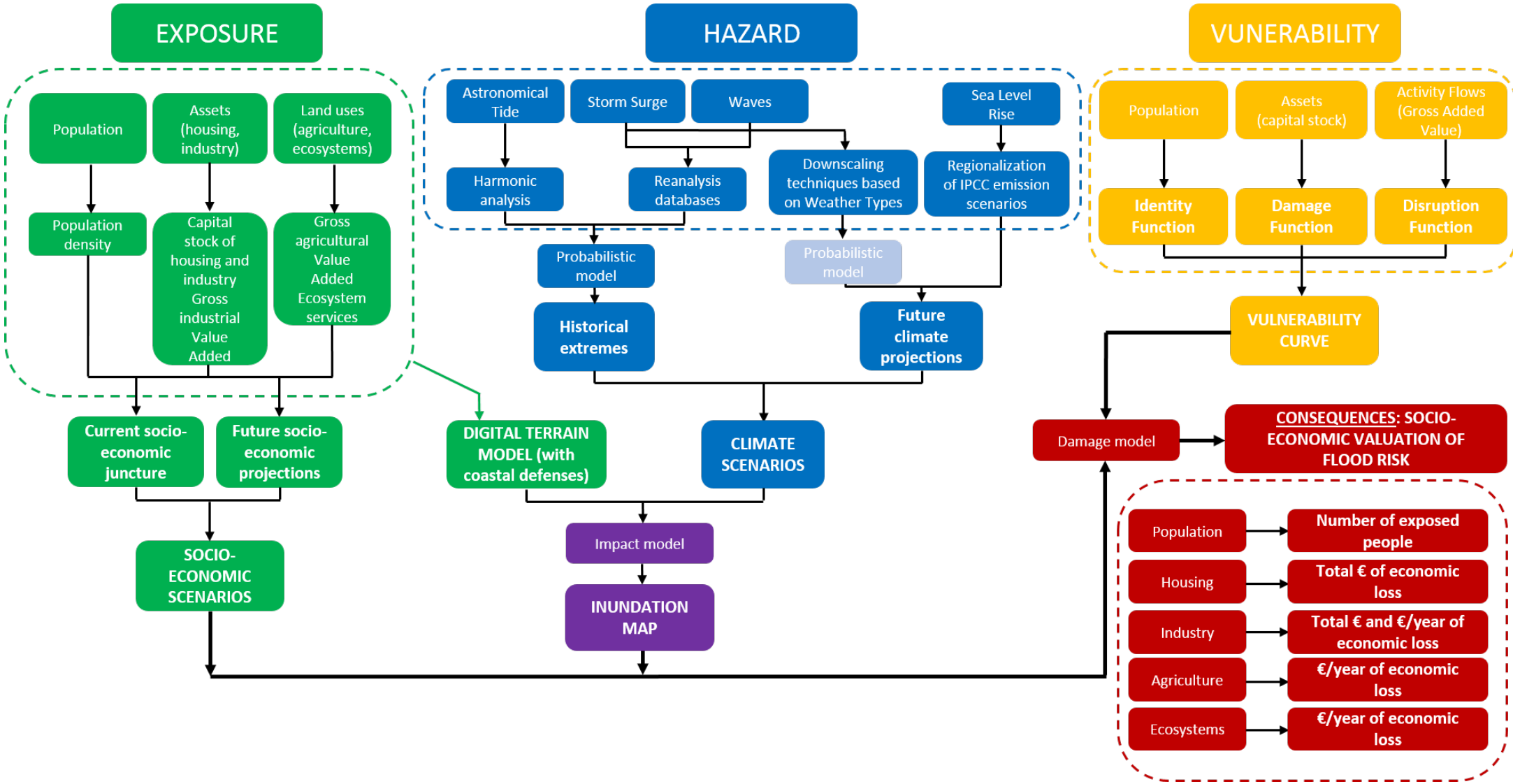
CASCADING IMPACTS



N.B.: Colours and styles of lines (dotted/continuous) and boxes are used only for the readability of the figure.

COASTAL FLOODING

MULTI-SECTORAL METHODOLOGY



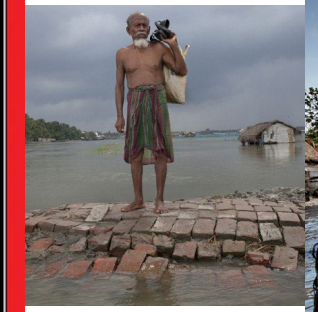
EXPOSURE AND VULNERABILITY CHANGES

EXPOSURE

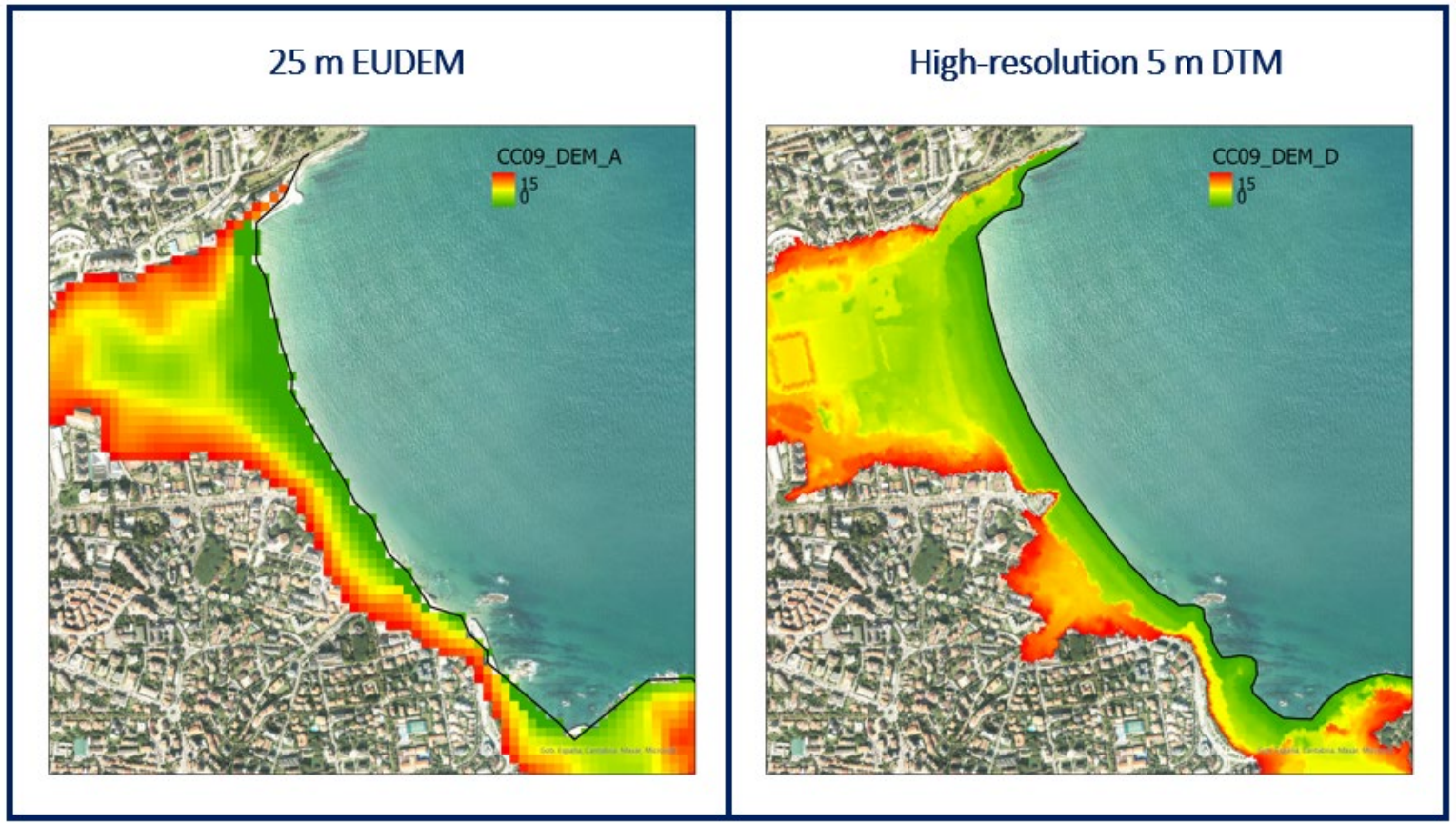
La Manga 50’

Benidorm 60’

VULNERABILITY

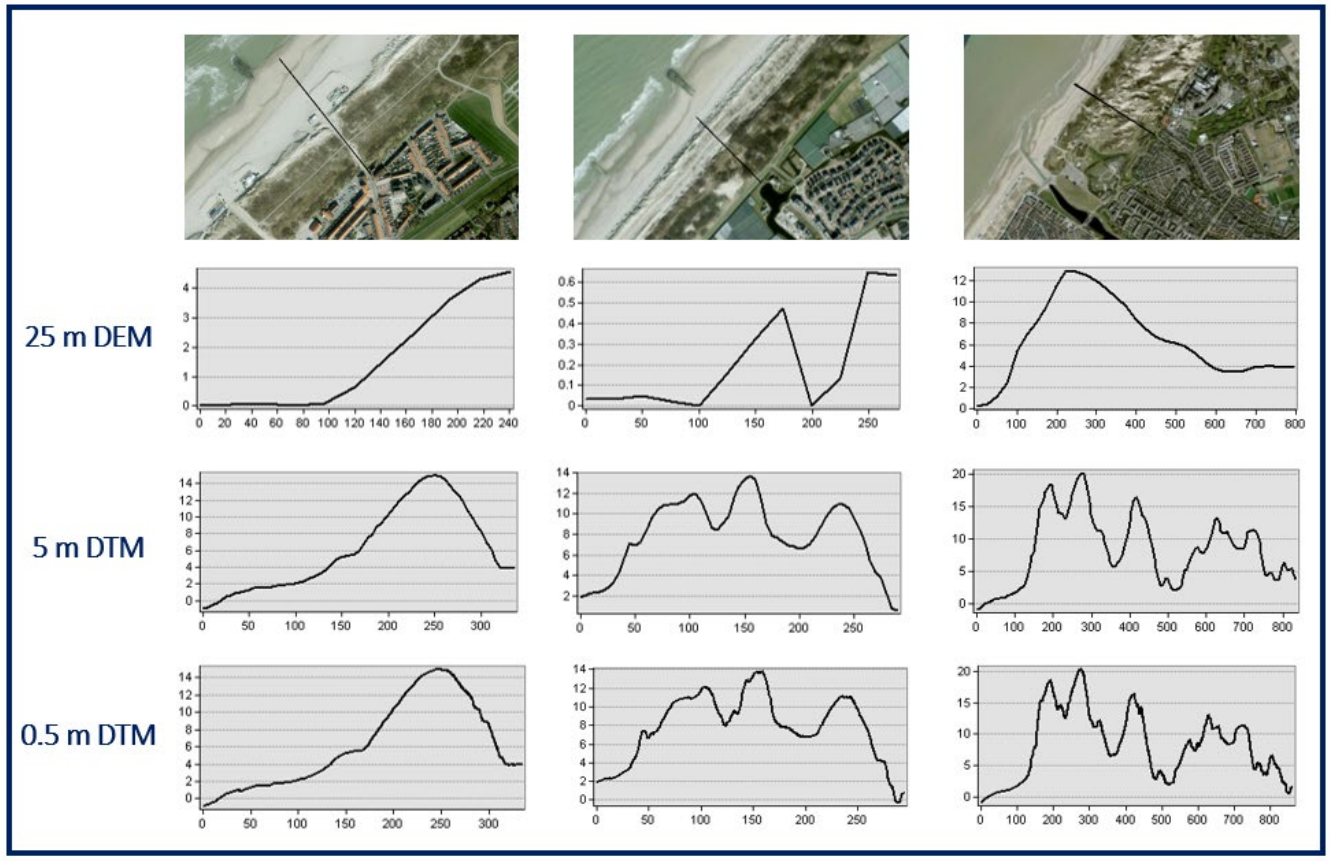


USING INAPPROPRIATE DATA SETS OR IMPACT MODELS CAN LEAD TO A WRONG ASSESSMENT



DEMs used in the control case of El Sardinero, in Santander. The right panel shows the 25 m DEM (sourced by Copernicus) and the left panel shows the high-resolution 5 m DTM (sourced by the Spanish UGN).

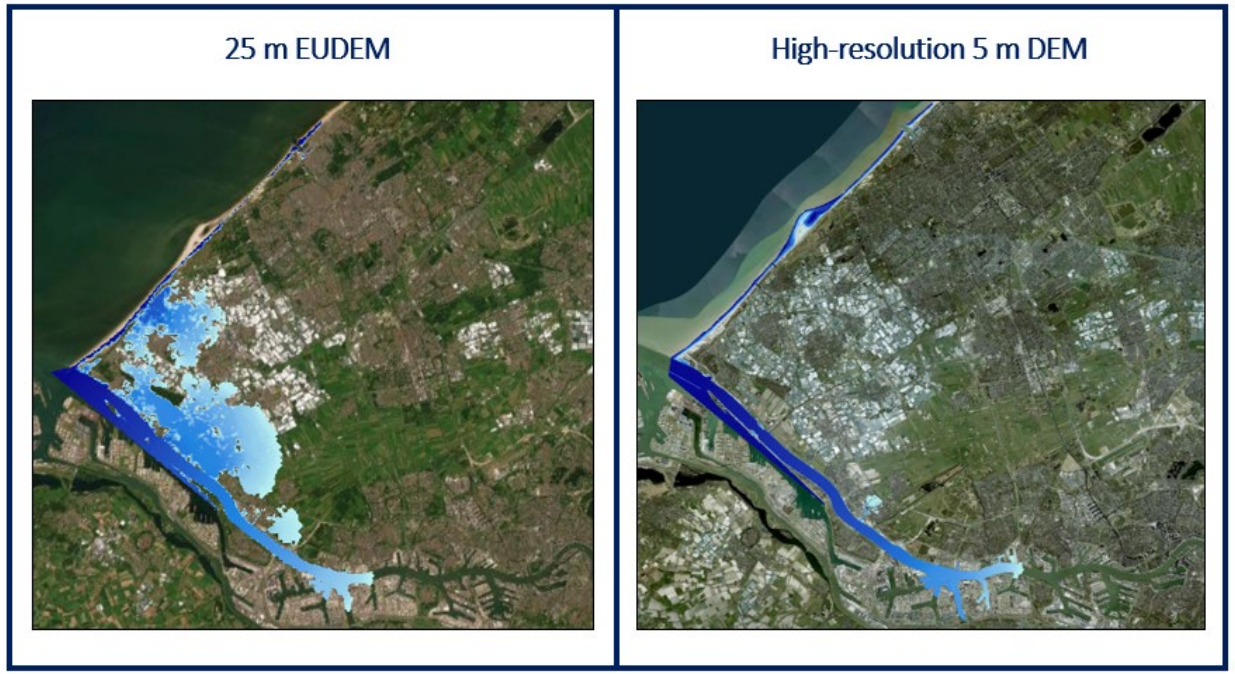
USING INAPPROPRIATE DATA SETS OR IMPACT MODELS CAN LEAD TO A WRONG ASSESSMENT



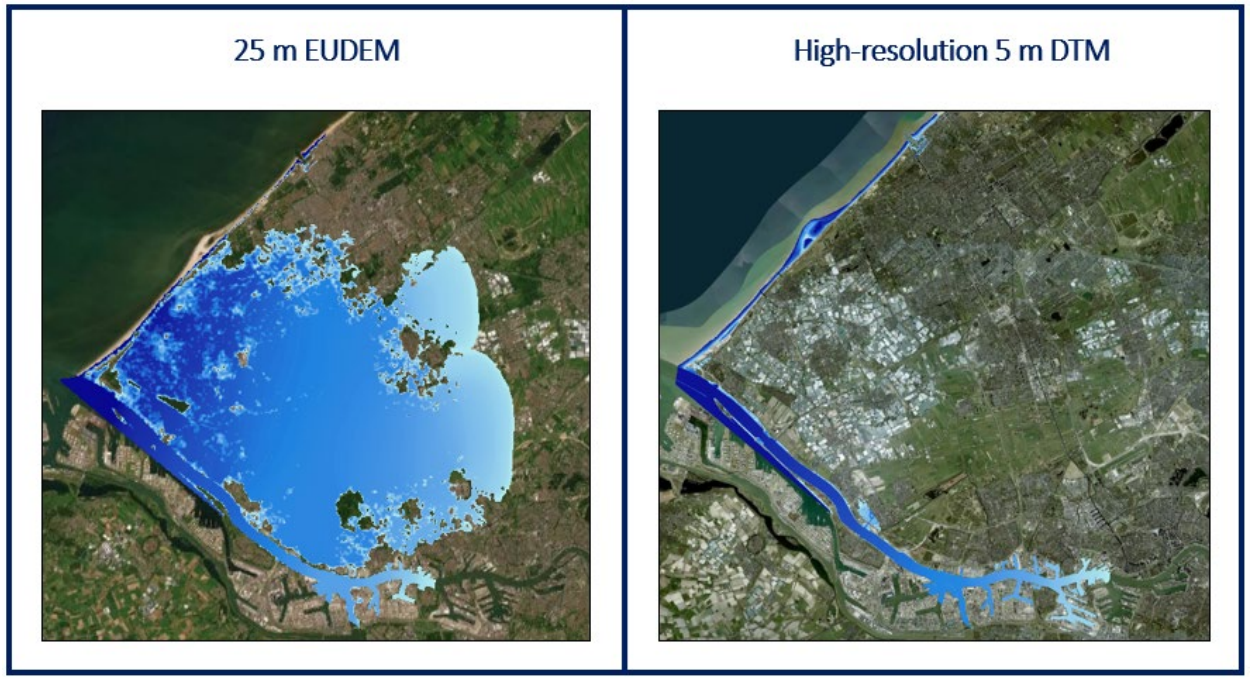
Approach:

- Analysis of how the dune ring is represented in the 25 m DEM and 5 m DTM and how this poor/good representation can affect flooding.
- Simulation of dune breaching at two locations and comparison of our results with those of a study published in the region. Use of a hydrograph whose peak corresponds to a TWL of 10,000 years (dune protection standard)

USING INAPPROPRIATE DATA SETS OR IMPACT MODELS CAN LEAD TO A WRONG ASSESSMENT



Flood maps obtained with RFSM-EDA (with irregular subgrid) in Ter Heijde (the Netherlands) considering the 25 m DEM (left panel) and the 5 m DEM (right panel).

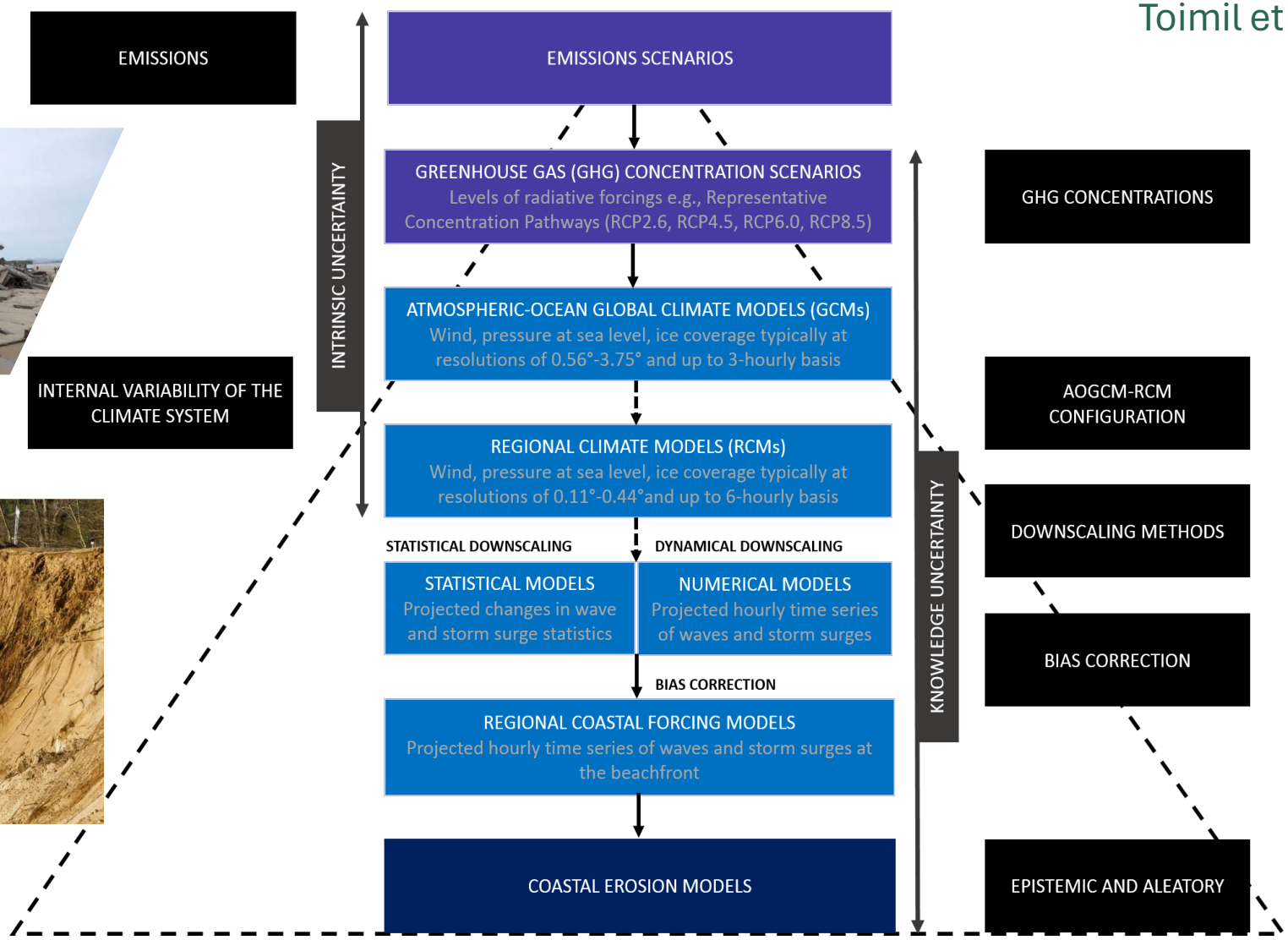


Flood maps obtained with SFINCS (without subgrid) in Ter Heijde (the Netherlands) considering the 25 m DEM (left panel) and the 5 m DEM (right panel).

USING A BATHTUB APPROACH OR WRONG PROTECTION STANDARDS IS EVEN WORSE

NOT ACCOUNTING FOR UNCERTAINTY CAN LEAD TO WRONG DECISIONS AND MALADAPTATION

Toimil et al. 2019



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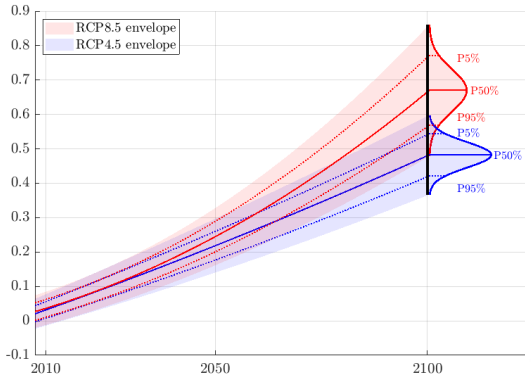
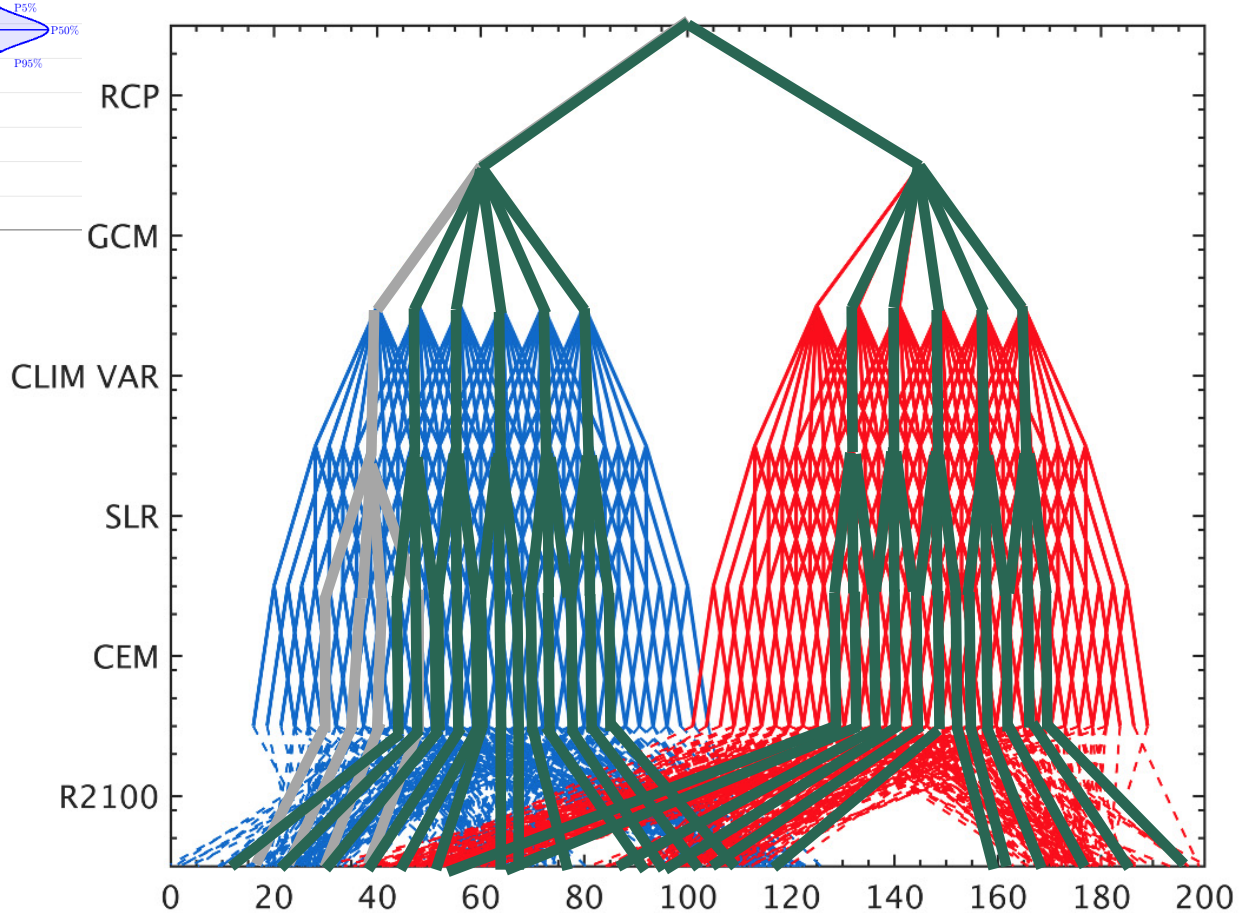


Visualisation of the uncertainty cascade in **multi-ensemble probabilistic** coastal erosion **projections**

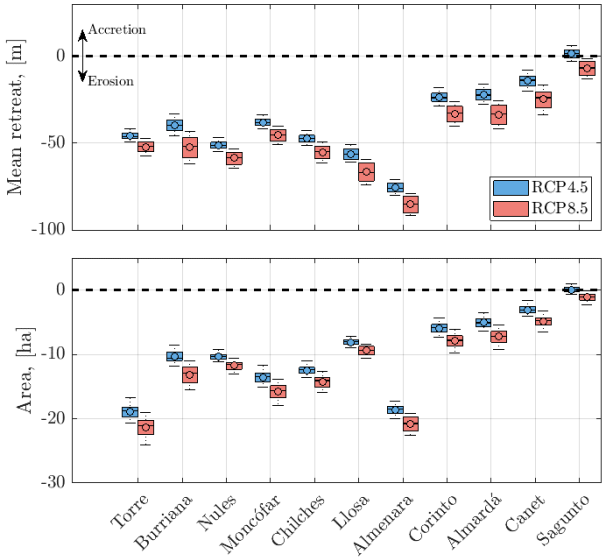


Other studies

R2100 long-term coastal recession in 2100 relative to 2015

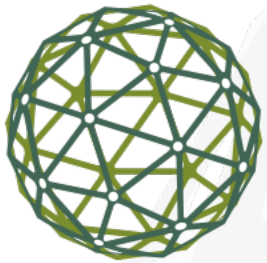
This section

Toimil et al (2021)



CONCLUSIONS

- CLIMATE PHYSICAL RISK ASSESSMENT NEEDS ARE INCREASING
- ASSESSMENTS ARE HIGHLY DEMANDING ON HIGH QUALITY DATA AND DATA ANALYTICS FOR THE DIFFERENT RISK COMPONENTS
- TO DATE:
  - LIMITED NUMBER OF HAZARDS OR INCOMPLETE CHARACTERIZATION, SIMPLIFIED APPROACHES IN IMPACT MODELLING OR VULNERABILITY ASESSMENT
  - INCOMPLETE CLIMATE INFORMATION, INSUFFICIENT LEVEL OF GRANULARITY, INACCURATE EXTREMES PROJECTIONS..
  - INCONSISTENCIES AND LACK OF HOMOGENEITY IN DATA SETS, FRAGMENTATION
  - LIMITED INFORMATION ON PROBABILISTIC ESTIMATES, INTERACTION BETWEEN HAZARDS, BESPOKE TIME HORIZONS AND CLIMATE SCENARIOS, CASCADING IMPACTS, ASESSMENT OF TIPPING POINTS, PRESENT AND PROJECTED EXPOSURE OR VULNERABILITY, ESPECIALLY FOR NATURAL SYSTEMS
  - AVAILABLE INFORMATION IS MOSTLY DEVELOPED FOR HIGHLY SPECIALIZED USERS
  - LACK OF TRANSPARENCY, UNCERTAINTY AROUND DATA QUALITY AND PROCESSING
  - LIMITED ACCESS EVEN AMONG THE SAME ADMINISTRATION IN A GIVEN COUNTRY
  - LACK OF CAPACITY BUILDING AND TRAINING INITIATIVES
  - PROMISING INITIATIVES ONGOING (COPERNICUS, IPCC ATLAS, MULTILATERAL ORGANIZATIONS' DATA REPOSITORIES..



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