Climate | Resilience | Europe
SPARCCLE

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Socioeconomic Pathways, Adaptation and Resilience to a Changing CLimate in Europe

Understanding climate risk and pathways to resilience in Europe: concepts and first results from SPARCCLE

Dr. Rosanne Martyr, Ann-Kathrin Petersen
Climate Analytics – SPARCCLE WP4

Ambition

- **Support risk-based decision making for a climate resilient Europe**

- deliver the **next generation** of **climate impacts frameworks** to explore, quantify, and inform societal transformations towards climate resilient futures

- **probabilistic, multi-sectoral assessment** of climate impacts and extremes across Europe integrated with **multidimensional vulnerabilities** and societal capacities to respond to develop climate resilient strategies

- **support** decision-making for **action on climate-driven socioeconomic risks** and enable the better identification of adaptation strategies and sustainable transformations that are robust and resilient to climate and socioeconomic uncertainties

Project pillars and partners

- Probabilistic climate hazards and impacts modelling
- Multi-dimensional projections of population and vulnerability
- Direct & indirect damages assessment, with sectoral adaptation
- Integrated assessment of macro- and socio-economic implications, mitigation
- Stakeholder scenario co-development

Risk analysis with Climada

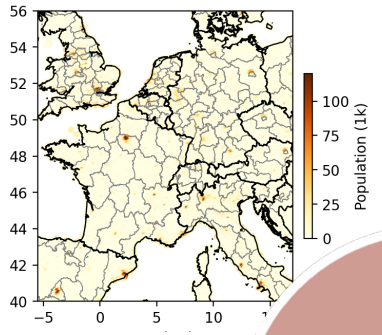
CLIMADA
Economics of Climate Adaptation

Climada is a **platform** used to *calculate climate risk* by combining:

- **Hazard**,
- **Exposure,** and
- **Vulnerability**

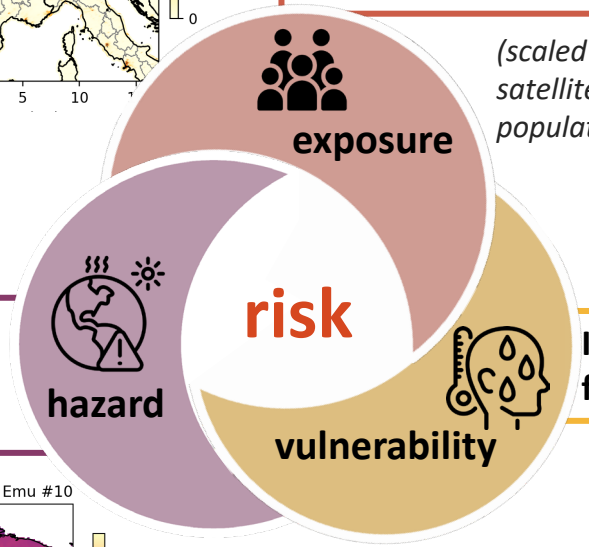
It allows to

- create **probabilistic impact** data from event sets,
- look at how **climate change** affects these impacts,
- See how effective **adaptation measures** are



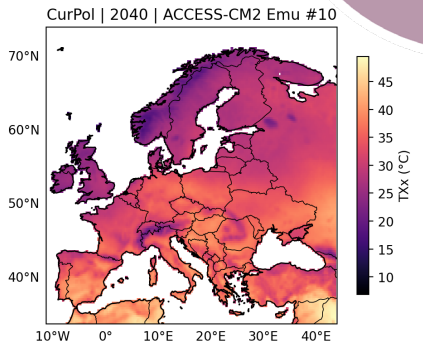
European **population at NUTS2** level

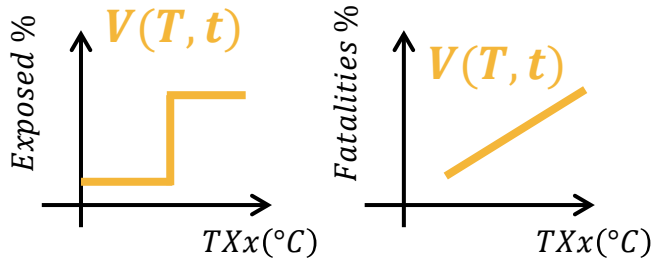
(scaled nightlight satellite images + population census)



Extreme heat (TXx), **Extreme precipitation** (Rx1day)

Impact function





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Fast track: climate impact analysis

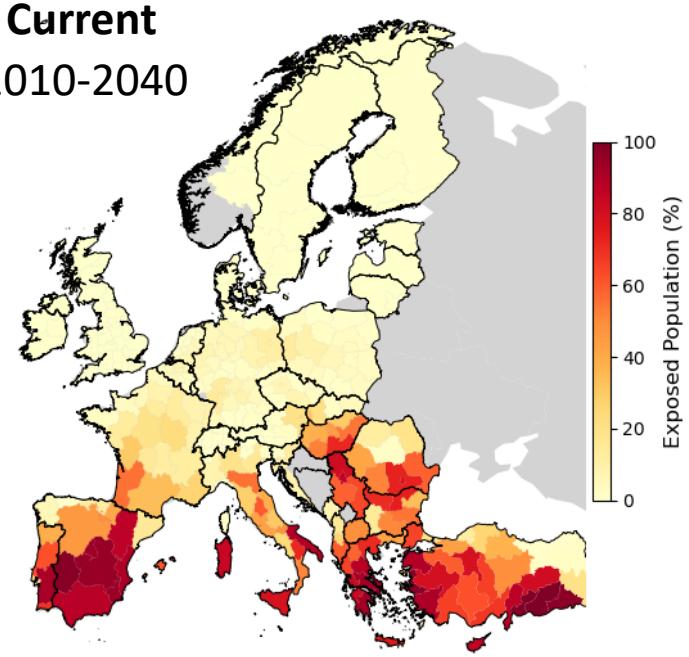
- Climate realizations provided by the emulator **MESMER**
- The many realizations allow to explore **spatiotemporal patterns** and create **storylines**

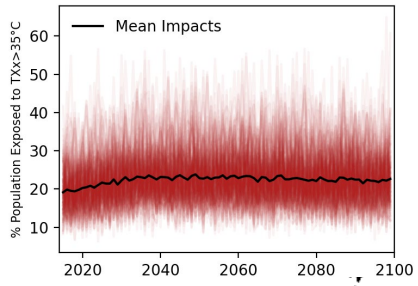
Ingredients

- Downscaled Mesmer TXx emulations (200)
- 3 ESMs
- Demographic Changes
- CurPol GMT median trajectory
- Step Function for vulnerability

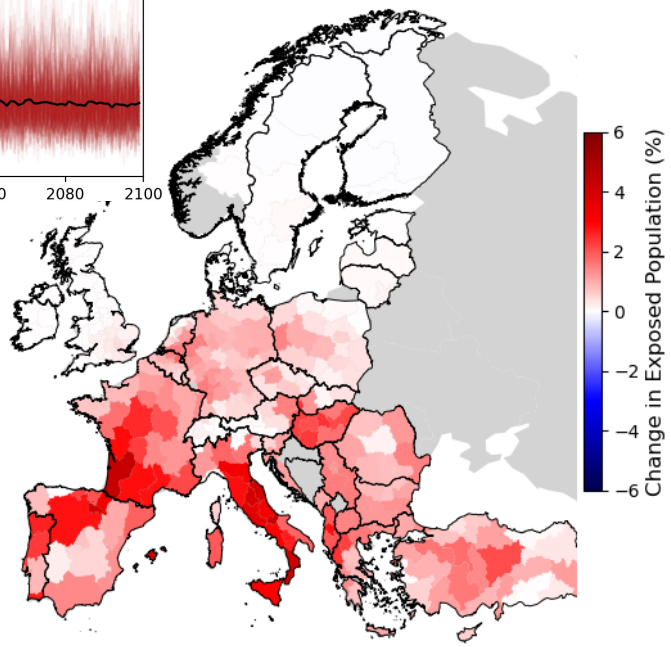
Average Annual % of Regional Population Exposed to TXx>35 °C

Current
2010-2040





Future
2070-2100



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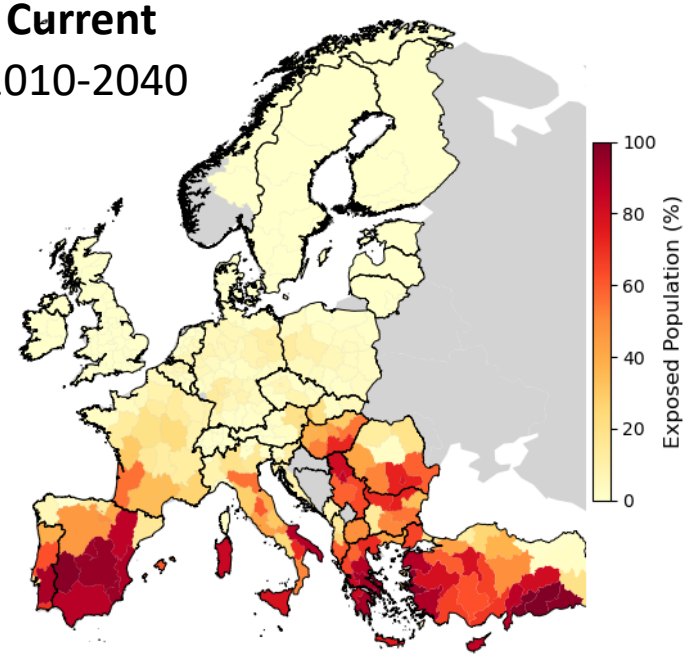
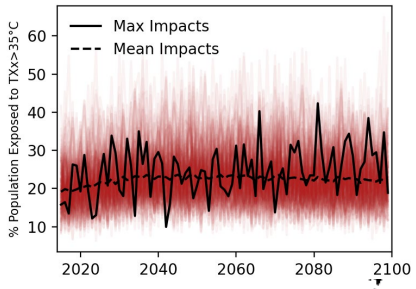
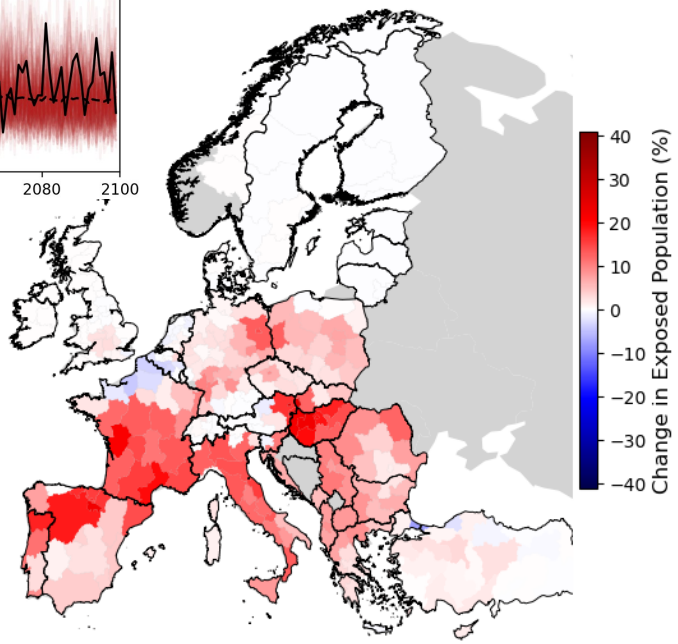




Worst Case Realization
2070-2100



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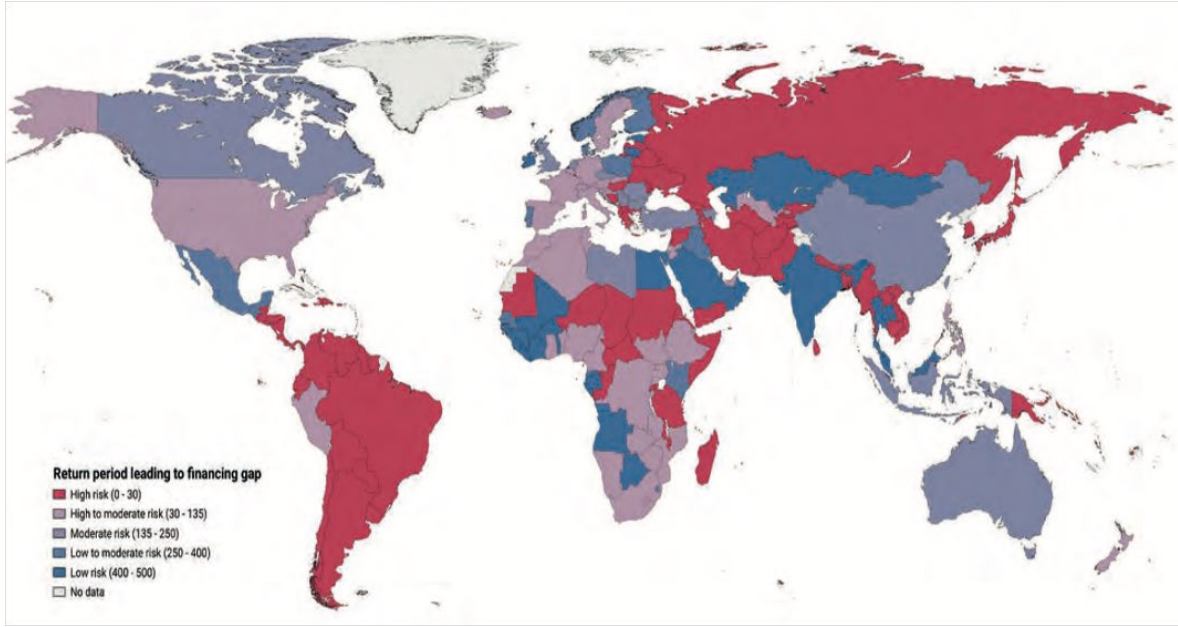
CATSIM

- CatSim estimates the total available financing resources of each governments to address climate risk and identifies their expected annual fiscal gaps.
- Probabilistic stress testing method
- Enables a translation of probabilistic loss estimates and resources into fiscal contingent liabilities
- Available public financing resources for disaster relief and recovery encompass a) budget diversion, b)credit buffer, c) contingent credit, and d) domestic credit
- Comparing the hazard-induced government expenditure needs to the available financing resources, CatSim reports the **Fiscal Gap Year**: the probability of running out of financing resources due to hazards



Fiscal Resource Gap Return Period. GAR 25. Results prepared by IIASA

CATSIM

Initial results from Fast-track scenarios

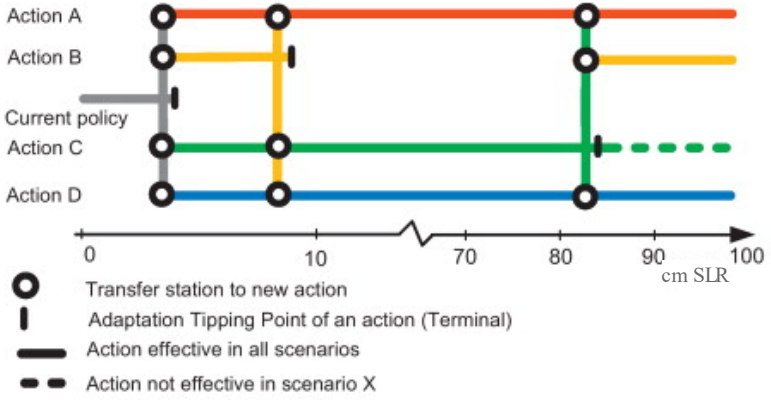
- Total available financing resources: € 260 billion (sum of every EU country)
- Average fiscal gap year in Europe: 27 years
- On average, Europe will incur fiscal gap every 27 years
- Annual average fiscal gap in Europe: € 10.35 billion
- The expected shortfall of public financing resources each year is € 10.35 billion

Climate change adaptation

- range of possible futures requires **robust** and **flexible** adaptation

Adaptation Pathways

- to support robust and adaptive long-term planning & decision-making
- "*sequences of actions, which can be implemented progressively, depending on how the future unfolds and the development of knowledge*" Werners et al. 2021
- Dynamic Adaptive Policy Pathways Haasnoot et al. 2019



Adaptation Pathways Map

	Path actions	Relative Costs	Target effects	Side effects
1		+++	+	0
2		+++++	0	0
3		+++	0	0
4		+++	0	0
5		0	0	-
6		++++	0	-
7		+++	0	-
8		+	+	- - -
9		++	+	- - -

Scorecard pathways

Haasnoot et al. 2013

- Under what conditions do we need to adjust/ add adaptation measures?
  - Adaptation threshold
  - Possible sequences of options -> solution space

Climate change adaptation

Adaptation pathways development in SPARCCLE

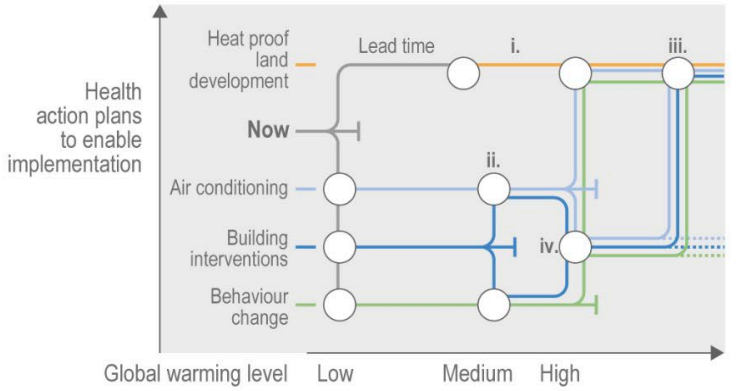
- case-specific → generic adaptation pathways

Key risks and sectors:

- Heat extremes and human health
- Flooding and settlements
- Forestry and wildfires
- Drought and energy infrastructure

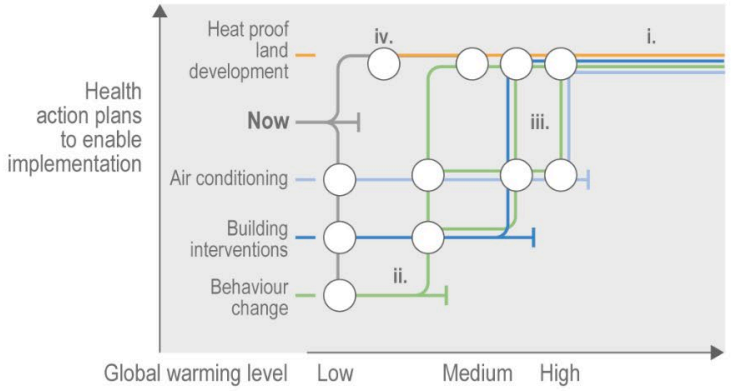
- Link adaptation pathways to SSPs
- Quantification of (future) effectiveness of options

(b) Pathway to achieve high adaptation to heat stresss, mortality and morbidity in Northern Europe



i. Heat proof land development takes time to become effective (•••) and is bundled with other measures to achieve high adaptation as warming increases (•••).
ii. Air conditioning alone is not enough and is combined with behaviour changes and/or building interventions (••).
iii. For high warming heat proof land development might still be needed (••).
iv. Building interventions have low to medium effectiveness and need to be combined with other measures at higher warming (••).

(c) Pathway to achieve high adaptation to heat stresss, mortality and morbidity in Southern Europe



i. Measures are to be implemented and combined earlier in Southern Europe due to higher risk (••).
ii. There is less that can be achieved with behaviour change because there is already extensive culture of heat in Southern Europe (••).
iii. Building interventions are crucial to be combined with other measures earlier since they have low to medium effectiveness (••).
iv. Heat proof land development is needed for high warming levels (•••).

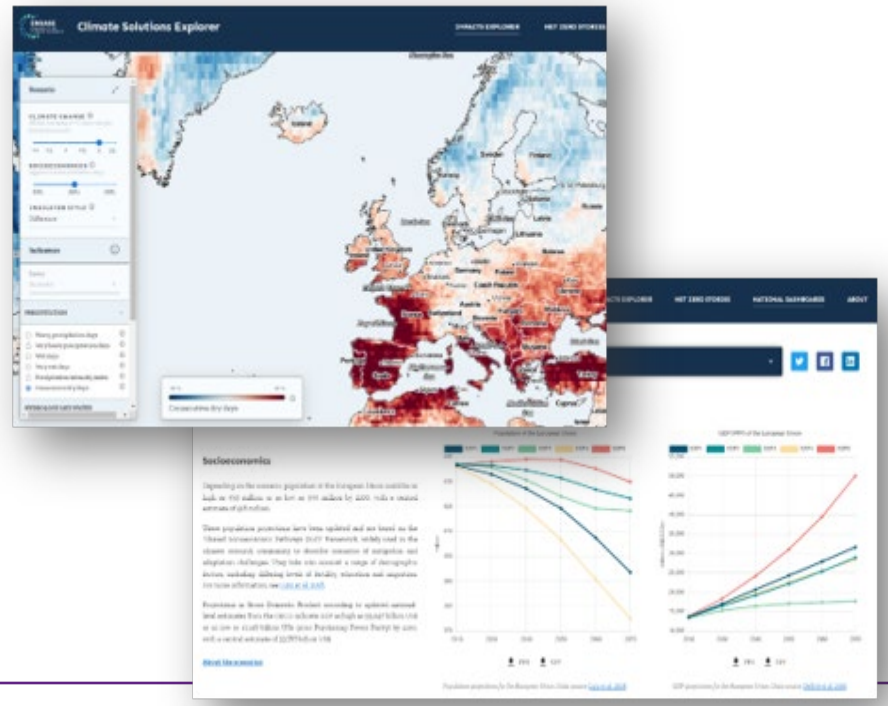
Bednar-Friedl et al. 2022

Ongoing research & Outlook

- **Climate risk assessment**
  - Add vulnerability component to analysis
- **Response**
  - Assessment of fiscal gap and risk with CATSIM
  - Finalisation of adaptation pathways and scenarios and integration in Climada and IAMs

- **Stress-test scenarios**
- **Understand implications from exceptional yet plausible changes in climate & socioeconomic risk factors**

- **EU-Scoreboard**



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Thank you for your attention!

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