CLIMADA

Economics of Climate Adaptation

@EGU 2021

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  - Hazards
  - Exposures
  - Impact and adaptation
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CLIMADA
Economics of Climate Adaptation

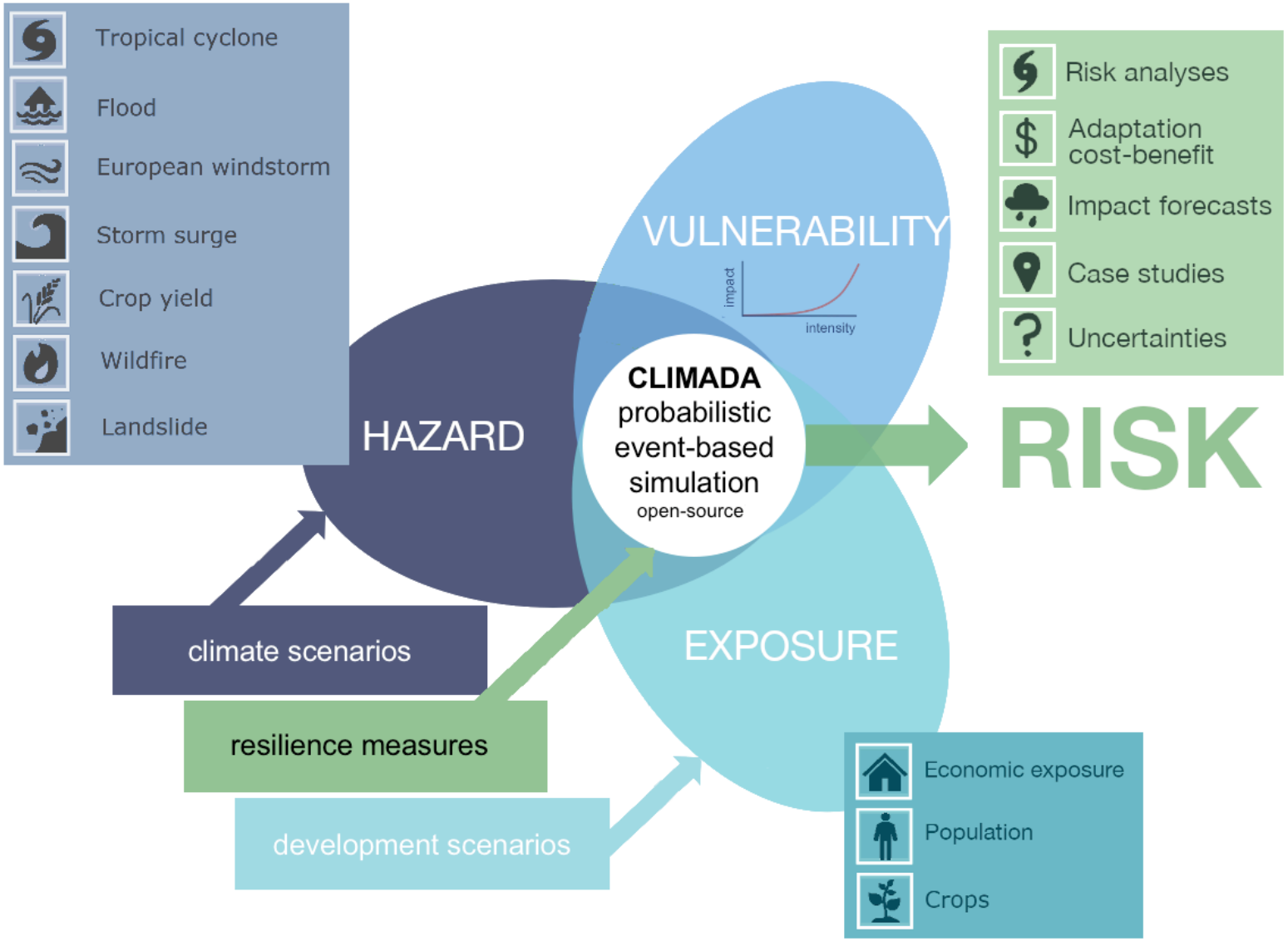
The open-source catastrophe risk model

wcr.ethz.ch/research/climada

Open source // globally consistent // fully probabilistic // peer-reviewed // active development community

CLIMADA's risk framework lets you describe any risk as a combination of Exposure, Hazard and a vulnerability function.

Provide the elements you have, and CLIMADA's out-of-the-box datasets can fill in the rest.



ETH zürich

Weather and Climate Risks Group: www.wcr.ethz.ch

Aznar-Siguan & Bresch, 2019
https://doi.org/10.5194/gmd-12-3085-2019
Bresch & Aznar-Siguan, 2021
https://doi.org/10.5194/gmd-14-351-2021

Getting started with CLIMADA

- CLIMADA at the Weather and Climate Risks Group, ETH Zürich: https://wcr.ethz.ch/research/climada.html
- CLIMADA on GitHub: https://github.com/CLIMADA-project/climada_python
- CLIMADA ReadTheDocs, including installation guide and introductory tutorials: https://climada-python.readthedocs.io
- CLIMADA papers repository, including code to reproduce publications: https://github.com/CLIMADA-project/climada_papers
- In-depth descriptions of the model's structure and core functionality:
  - Aznar-Siguan & Bresch, 2019 https://doi.org/10.5194/gmd-12-3085-2019
  - Bresch & Aznar-Siguan, 2021 https://doi.org/10.5194/gmd-14-351-2021

Selected recent publications

- Eberenz, S., Lüthi, S., and Bresch, D. N.: **Regional tropical cyclone impact functions for globally consistent risk assessments**, Nat. Hazards Earth Syst. Sci., 21, 393–415, https://doi.org/10.5194/nhess-21-393-2021, 2021.
- Welker, C., Röösli, T., and Bresch, D. N.: **Comparing an insurer's perspective on building damages with modelled damages from pan-European winter windstorm event sets: a case study from Zurich, Switzerland**, Nat. Hazards Earth Syst. Sci., 21, 279–299, https://doi.org/10.5194/nhess-21-279-2021, 2021.
- Eberenz, S., Stocker, D., Röösli, T., and Bresch, D. N.: **Asset exposure data for global physical risk assessment**, Earth Syst. Sci. Data, 12, 817–833, https://doi.org/10.5194/essd-12-817-2020, 2020.
- Kam, P. M., Aznar-Siguan, G., Schewe, J., Milano, L., Ginnetti, J., Willner, S. N., McCaughey, J. W. and Bresch, D. N.: **Global warming and population change both heighten future risk of human displacement due to river floods,** Env. Res. Lett., https://doi.org/10.1088/1748-9326/abd26c, 2021.
- Sauer, I.J., Reese, R., Otto, C. *et al.* **Climate signals in river flood damages emerge under sound regional disaggregation**. *Nat Commun* **12,** 2128. https://doi.org/10.1038/s41467-021-22153-9, 2021

CLIMADA hazards

CLIMADA provides pre-built extensions to its Hazard class that read in or generate data for numerous hazards. Depending on the maturity of the module, it will include historical events, stochastic event sets, forecasts and/or climate change scenarios.

- **Tropical cyclone wind:** multiple global stochastic hazard sets for tropical cyclone events, created with statistical wind fields from storm tracks, methods and data to calculate historical wind footprints, create forecast ensembles from ECMWF tracks, and create climatological event sets for different climate scenarios.
- **Storm surge:** (under development) global surge hazard for tropical storms. Runs the GeoClaw surge model to create and plot hazard from tropical storm tracks.
- **European windstorms:** methods to read and plot footprints from the Copernicus WISC dataset and for DWD and ICON forecasts.
- **River flooding:** global water depth hazard for flood, including methods to work with ISIMIP future climate simulations.
- **Crop modelling, drought:** combines ISIMIP crop simulations and UN Food and Agricultre Organization data. The module uses crop production as exposure, with hydrometeorological ‘hazard’ increasing or decreasing production.
- **Wildfire:** global wildfire historical and probabilistic hazard built from satellite fire imagery
- **Landslide**: historic landslides based on NASA COOLR and probabilistic landslides from UNEP/NGI

CLIMADA exposures

CLIMADA provides pre-built extensions to its Exposures class that read in or generate data for different types of exposure.

- **LitPop:** a globally consistent module for estimating population density and economic asset value from satellite night light intensity and various aggregated economic and population statististics.
- **Crop module:** global crop assets
- **OpenStreetMap:** an interface to the OpenStreetMap API to generate custom exposures

CLIMADA impact and adaptation

CLIMADA includes tools to analyse risk and risk mitigation:

- **Risk analysis:** estimations of exceedance curves, return periods, average annual impacts, both spatially and in aggregate. Also applicable to case studies and forecast ensembles.
- **Adaptation measures and cost-benefit analyses:** specify adaptation measures in terms of how they affect hazard, exposure and vulnerability. CLIMADA's financial model allows for full cost-benefit analyses.
- **Risk breakdown:** disaggregate your risk into historical/climatological risk, risk from changes to exposure over time, risk from climate change and changes to hazard, and risk offset by adaptation measures
- **Uncertainty:** a new module which allows repeated evaluation of risk to explore a parameter space, quantifying uncertainty and sensitivity.

Get in touch!

CLIMADA is fully open source, and you don't need permission to use it, regardless of whether it's for academic, personal or corporate use. However, we're always excited to meet new users and collaborators!

- For **collaboration questions** and big projects, contact Prof David Bresch dbresch@ethz.ch or Chahan Kropf ckropf@ethz.ch
- For questions about CLIMADA's **capabilities, design and functionality**, if you'd like to **contribute to the model** (regardless of your programming skills) or if you just want to **say hello** and tell us what you're working on, contact Chahan Kropf ckropf@ethz.ch or Chris Fairless cfairless@ethz.ch
- For **bugs, problems, or questions about running CLIMADA**, submit a GitHub Issue here: https://github.com/CLIMADA-project/climada_python/issues

CLIMADA – Collaborations (1/3)

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology
MeteoSwiss

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

ADB
ASIAN DEVELOPMENT BANK

THE WORLD BANK

InsuResilience
Solutions Fund

NGFS
Central Banks and Supervisors
Network for Greening the Financial System

CCRIF
The Caribbean Catastrophe Risk Insurance Facility

The Nature Conservancy

MSCI | CARBON DELTA
An MSCI Company

cascades
Cascading climate risks:
Towards adaptive and
resilient European Societies

THE ROCKEFELLER FOUNDATION

u b
b
UNIVERSITÄT
BERN

UNIVERSIDAD CATÓLICA DE EL SALVADOR
Litterae Sine Moribus Vanae
UNICAES
"La Ciencia sin Moral es Vana"

KFW

United Nations University

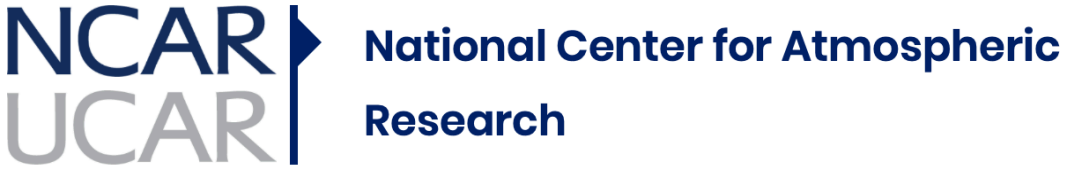
THE GLOBAL GOALS
For Sustainable Development


iDMC
internal
displacement
monitoring
centre


Receipt


PIK
POTSDAM-INSTITUT FÜR
KLIMAFOLGENFORSCHUNG


Atlantic Council
Adrienne Arsht-
Rockefeller Foundation
Resilience Center


NCAR
UCAR
National Center for Atmospheric
Research


COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK


ISIMIP
Inter-Sectoral Impact Model
Intercomparison Project


Frankfurt School
of Finance & Management