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Technical Documentation

IAIS Natural Catastrophes Assessment Tool

Developed by CLIMADA Technologies

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1. Introduction

The present documentation outlines the data and methodology employed by CLIMADA Technologies to estimate risk globally from coastal floods, riverine floods, wind storms and tropical cyclones for a baseline and future climate under RCP8.5 in 2030, 2050 and 2080. The estimated risk profiles are used to assess risk premium as well as their expected changes under climate change globally.
Section 1 of the present documentation introduces the global exposure data used; section 2 outlines the features of the employed hazard datasets; section 3 describes the adopted vulnerability functions, differentiated per hazard and region; section 4 explains the derived impact metrics.

2. Exposure

Exposure is modelled for 255 countries globally using the *LitPop* global high-resolution asset exposure dataset. *LitPop* is a globally consistent methodology developed by Eberenz et al., (2020) to estimate asset value data by distributing national estimates to the grid-level proportionally to a combination of nightlights intensity (*Lit*) and geographical population data (*Pop*).

By appropriately setting the values of the exponents *m* and *n* in the Figure, *LitPop* allows assigning more importance to *Lit* or *Pop* in the disaggregation process. For the present application, we used the *LitPop* dataset available from the CLIMADA Data API, which provides exposure value at a resolution of 150 arc-seconds (~5 km at the equator), based on the 2014 value in USD for GDP and assigning equal weights to *Lit* and *Pop* by setting values of *n* and *m* equal to one.

3. Hazard

3.1 Coastal Flood

The used coastal flood data are computed in the Aqueduct Floods project. Therein, coastal floods are simulated for the 2, 5, 10, 25, 50, 100, 250, 500, and 1,000-year return periods events.

3.2 Riverine Flood

The river flood dataset used for this project was derived within the second phase of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) and used in numerous peer-reviewed scientific publications (Dottori et al., 2018; Willner et al., 2018; Sauer et al.; 2021). Data is available via ISIMIP.

3.3 Tropical Cyclones

Tropical cyclone data are based on CLIMADA Technologies' proprietary product, built using the open-source CLIMADA software. The product provides simulated tropical cyclones' activities under historic and future climate conditions at ~5 km resolution globally.

3.4 Winter Storms

The winter storm dataset used for this project is built by CLIMADA Technologies by retrieving, downscaling and bias-correcting daily maximum wind speed data from Global Climate Models (GCMs) from the 6th Coupled Model Intercomparison Project (CMIP6).

4. Impact Functions

Impact functions are used to model damage-related impacts induced by the hazard event sets for coastal and riverine floods, tropical cyclones and wind storms. Such functions indicate the damage that would occur at specific hazard intensities, where the damage is typically expressed as a ratio from zero (no damage) to one (maximum damage).

4.1 Riverine and Coastal Floods

The analysis of flood impacts employs the impact functions compiled and published by Joint Research Centre (JRC) (see Huizinga et al., 2017), the science and knowledge service of the European Commission. The functions are continent-specific and were developed based on an extensive literature survey.

4.2 Winter Storms

The impact computation for winter storms is based on the impact function developed by Schwiertz et al. (2017), which was derived based on European storm loss data and was used in various scientific publications (e.g., Welker et al. 2021).

4.3 Tropical Cyclones

Impacts from tropical cyclones are modelled by employing the impact functions developed by Eberenz et al., (2021), which calibrated them based on EM-DAT data for macro geographical regions globally.

5. Impact Analysis

5.1 Individual Hazards' Impacts

By combining hazard, exposure and impact functions, various loss metrics were derived at each exposure grid point as well as at the country level, or the state level for the USA. These metrics included the Average Annual Loss (AAL), and the 10-, 25-, 50-, 100-, 200-, 250- and 500-year return period losses for each of the hazards introduced above, under current and future climate for RCP 8.5 in 2030, 2050 and 2080.

5.2 Aggregated Impacts

The annual exceedance frequency curves for individual hazards have been combined at both country and state levels, taking into account varying statistical dependencies among the hazards.

References:

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