Lifeline disruptions & basic service losses - A globally consistent natural hazard impact model

Proposed: Day 2 – Advances in Modeling Socio-Economic Impacts

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Critical infrastructure systems across the globe are more exposed than ever to the risks of extreme weather events in a changing climate. Their large scales may further connect seemingly unconnected disasters, leading to remote or unexpected impact distributions. Traditional risk assessment methods often fail to capture impact cascades and feedback loops in these highly interdependent systems. Last-mile impacts on people, such as resulting loss of basic service access, are rarely considered as a metric of evaluation.
We demonstrate a globally consistent and spatially explicit implementation of critical infrastructure failure cascades and their impacts on basic service losses from natural hazards at national scales. First results will be illustrated on real-world disasters.
The model is embedded within a state-of-the-art open-source natural hazard risk modelling platform (CLIMADA) and integrates a graph theoretical-functional hybrid model to capture both infrastructure-specific failure dynamics, cascades triggered by interdependencies, and human-centric impacts. The end-to-end risk calculation chain starts from spatio-temporally explicitly modelled hazard events such as tropical cyclones and floods. Direct infrastructure impacts are propagated through the constructed power, transport, telecom and social infrastructure networks. We use this information to provide a spatial estimate of people's loss of power, access to mobility, healthcare and communication.
Our model is built on publicly available infrastructure asset, demand and supply data, uses transferrable dependency heuristics and is automated for use at user-specified locations. This way we aim to enable consistent hot-spot analyses for rapid emergency assessments under ever-increasing threats from extreme weather events.
I look forward to a fruitful discussion on the challenges of including impact cascades in hazard modelling, capturing indirect impacts such as basic service access and other approaches dealing with complex network models.

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