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Critical infrastructures in a multi-hazard environment: identifying globally consistent heuristics to model interdependencies

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Critical infrastructures (CIs) such as powerlines, road & rail transport, and telecommunications are networked systems, through which disruptions, for instance from natural hazards, may propagate far beyond their initial incidence.

There is, however, a gap when it comes to identifying how CIs interdepend on each other (such as water for cooling power generators, and electricity for powering water pumps), and how their joint system-of-systems (SOS) character can amplify possible consequences. Anecdotal evidence on such behaviour is frequently derived from artificially generated or locally constrained cases with few CIs under consideration. A full picture of CISOS risks throughout greater geographies is absent.

This research project aims to contribute to a more consistent view on natural hazard risks from CI interdependencies by

- systematically identifying and deriving interdependency heuristics between a range of CIs,
- transferring those interdependency heuristics to a network model based on real-world, spatially explicit open-source CI data,
- combining this CISOS network layer with an open-source global risk modelling platform, CLIMADA (Aznar-Siguan, G. & Bresch, D. N. 2019), to allow for globally consistent impact calculations from a range of natural hazard scenarios.

I will give first insights on the trade-offs between identified CI interdependencies, real-world data constraints and generalisability of a CISOS modelling approach across national scales. I will also present opportunities from combining the networked layer with the risk modelling platform CLIMADA for studying CISOS disruptions in a multi-hazard space, and possible extensions to social impacts and basic service disruptions.