



Simulating extreme multi-hazard events with decentralized Web-processing services: Towards a better understanding of cascading impact

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The RIESGOS Project (Multi-Risk Analysis And Information System Components for the Andes Region) funded by the German Ministry of Science and education (BMBF) has, as one of its main goals, the design and development of distributed software components for multi-hazard and risk analysis in particular by simulating hypothetical future high-impact events and their consequences. Implemented as an open library of interacting Web-services, these components will cover a full range of multi-hazard and risk related data acquisition and simulation services. These services include, for example: query of a seismic catalog, simulation of a shake map, simulation of a tsunami inundation scenario and assessment of expected damage and loss under consideration of cascading effects to critical infrastructure. Individual Web-services can be flexibly combined to produce multi-hazard scenarios with the ultimate goal to assist local authorities and decision makers to explore factors influencing the risk in their specific multi-hazard environments, thus improving disaster risk reduction and disaster management activities.

To facilitate the development of a project which encompasses diverse hazard and risk components of various nature, our research is organized along a set of pre-described 'event stories' representing realistic, complex multi-hazard events with cascading effects in selected pilot regions of Chile, Peru and Ecuador. For each story, a storyboard is developed, which provides a narrative description of a hypothetical crisis evolution, defines the specific hazards involved, the related exposed assets and the expected consequences. In particular, these event stories target the following topics:

- earthquake and tsunami (Chile and Peru);
- heavy rain and river flooding (Peru);
- volcano instability, lahar event and subsequent flooding via temporary river blockage (Ecuador).

Each story can then be analysed in a more quantitative way by estimating different scenarios through numerical analysis and simulation of the different risk components. Remarkably, the consideration of vulnerability in a multi-hazard risk assessment framework is significantly more challenging with respect to the single hazard case, especially when interaction may occur at the vulnerability level due to physical damage accumulation. Furthermore, the project also aims at considering cascading effects to critical infrastructure such as power grids, roads and bridges. In order to ease up the visual exploration of such a complex multi-risk framework, a Web-based demonstrator platform integrating decentralized OGC Web Processing Service instances into multi-hazard and risk scenarios is being developed. To better meet the requirements of end-users, a thorough analysis of users' needs and continued user participation during the whole development process is assured.