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Promoting disaster preparedness and resilience by co-developing stakeholder support tools for managing the systemic risk of compounding disasters

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Stakeholders in disaster risk management are faced with the challenge to adapt their risk reduction policies and emergency plans to cascading and compounding events, but often lack the tools to account for the cross-sectoral impacts and dynamic nature of the risks involved. The EU Horizon Europe PARATUS project, which started in October 2022 and will run to October 2026, aims to fill this gap by developing an open-source online platform for dynamic risk assessment that allows to analyze and evaluate multi-hazard impact chains, dynamic risk reduction measures, and disaster response scenarios in the light of systemic vulnerabilities and uncertainties. These services will be co-developed within a transdisciplinary consortium of 19 partners, consisting of research organizations, NGOs, SMEs, first and second responders, and local and regional authorities. To gain a deeper understanding of multi-hazard impact chains, PARATUS conducts forensic analysis of historical disaster events, based on a database of learning case studies, augments historical disaster databases with hazard interactions and sectorial impacts, and exploits remote sensing data with artificial intelligence methods. Building on these insights, PARATUS will then develop new exposure and vulnerability analysis methods that enable systemic risk assessment across sectors (e.g. humanitarian, transportation, communication) and geographic settings (e.g. islands, mountains, megacities). These methods will be used to analyze risk changes across space and time and to develop new scenarios and risk mitigation options together with stakeholders, using innovative serious games and social simulations.
The methods developed in PARATUS have been applied in four application case studies. The first one is related to Small Island Developing States (SIDS) in the Caribbean. This case study considers

the cross-border impacts of tropical storms, tsunamis, volcanic eruptions, and space weather, and focuses on the development of impact-based forecasting, directed at humanitarian response planning, the telecommunication sector, and tourism. The second case study deals with the local and regional economic impact of hazardous events such as extreme wind, floods, rockfall, mudflow, landslides, and snow avalanches on cross-border transportation in the Alps. The third case study relates to the multi-hazard impact of large earthquakes in the Bucharest Metropolitan Region and focuses on systemic vulnerabilities of the city and emergency response. The fourth application case study is the Megacity of Istanbul which is prone to earthquake hazard chains, such as liquefaction, landslides, and tsunami, as well as to hydrometeorological hazards (extreme temperatures, fires, and flooding). Population growth rates, urban expansion speed, composition, and integration of new migrants (native, foreign, and refugees from countries like Syria and Afghanistan) contribute to the increasing disaster risk.

The project results will be hosted on two stakeholder hubs related to crisis management and humanitarian relief, and provide stakeholders with a set of tools for risk reduction planning in dynamic multi-hazard environments. The service-oriented approach with active stakeholder involvement will maximize the uptake and impact of the project, and help to increase Europe's resilience to compounding disasters.