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A database of volcanic hazards and their physical impacts to critical infrastructure

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Approximately 10% of the world's population lives within 100 km of historically active volcanoes. Consequently, considerable critical infrastructure is at risk of being affected by volcanic eruptions, where critical infrastructure includes: electricity and wastewater networks; water supply systems; transport routes; communications; and buildings. Appropriate risk management strategies are required to minimise the risk to infrastructure, which necessitates detailed understanding of both volcanic hazards and infrastructure parameters and vulnerabilities. To address this, we are developing a database of the physical impacts and vulnerability of critical infrastructure observed during/following historic eruptions, placed in the context of event-specific volcanic hazard and infrastructure parameters. Our database considers: volcanic hazard parameters for each case study eruption (tephra thickness, dynamic pressure of PDCs, etc.); inventory of infrastructure elements present within the study area (geographical extent, age, etc.); the type and number of impacts and disruption caused to particular infrastructure sectors; and the quantified assessment of the vulnerability of built environments. Data have been compiled from a wide range of literature, focussing in particular on impact assessment studies which document in detail the damage sustained by critical infrastructure during a given eruption. We are creating a new vulnerability ranking to quantify the vulnerability of built environments affected by volcanic eruptions. The ranking is based upon a range of physical impacts and service disruption criteria, and is assigned to each case study. This ranking will permit comparison of vulnerabilities between case studies as well as indicate expected vulnerability during future eruptions. We are also developing hazard intensity thresholds indicating when specific damage states are expected for different critical infrastructure sectors. Finally, we have developed a data quality index to address the varying data quality between source reports. An auxiliary aim of this database is to provide guidelines for researchers for what impact data should be collected following an eruption. As a repository of infrastructure impact data, our database will be a valuable resource for researchers and organisations engaged in volcanic risk assessment, vulnerability studies and development of mitigation strategies.