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GIS-based tool for long-term risk management of civil aviation during explosive volcanic eruptions

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We present a software tool (yet under development) for the long-term management of risk from explosive volcanic eruptions on civil aviation. The tool covers the needs of stakeholders involved in the long-term civil aviation management and interested in taking long-term decisions based on a range of possible tephra dispersal scenarios. The main utility of the tool is the visualization of data from several sources. Geographic Information Systems (GIS) are the best instruments for the visualization of spatial phenomena and variables. The GIS-based tool performs three main actions: i) display of hazard and vulnerability information, ii) overlay of maps and, iii) estimation of expected impacts (airports disrupted, routes canceled, etc) on a probabilistic basis. We present the structure of the tool underlining the scientific background and technical aspects of each element.

First, hazard and vulnerability data are stored in a spatial database specifically designed to store probabilistic hazard data and vulnerability parameters efficiently. Hazard maps are stored in the database, which has a central role for the risk management process acting as a repository of maps that may be useful for different purposes and to a wide range of stakeholders. The relationship between the database and the GIS is explored showing the advantages for volcanic risk management. To our knowledge, this is the first *ad hoc* database proposed to store information about tephra dispersal hazard and vulnerability.

Second, and using spatially-based rules, the tool automatically estimates vulnerability and expected impacts for each map. Vulnerability and impact assessments are implemented by means of plugins embedded in the GIS main interface. GIS and plugins GUIs are friendly and enhance the accessibility for non-scientific users. The analysis has been automated for the European air traffic management during explosive eruptions. Results are relevant for the long-term risk assessment in the European area.

This tool improves the long-term risk management by automating the operations, making them faster and repeatable. The use of an open-source GIS enhances the capabilities of this tool as a data repository, due to the high interoperability with other software and formats. Although this is only a prototype and still needs further development, the up-to-date work can be a relevant contribution to the scientific community.