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Testing a model-driven Geographical Information System for risk assessment during an effusive volcanic crisis

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RED-SEED stands for Risk Evaluation, Detection and Simulation during Effusive Eruption Disasters, and combines stakeholders from the remote sensing, modeling and response communities with experience in tracking volcanic effusive events. It is an informal working group that has evolved around the philosophy of combining global scientific resources, in the realm of physical volcanology, remote sensing and modeling, to better define and limit uncertainty. The group first met during a three day-long workshop held in Clermont Ferrand (France) between 28 and 30 May 2013. The main recommendation of the workshop in terms of modeling was that there is a pressing need for "real-time input of reliable Time-Averaged Discharge Rate (TADR) data with regular up-dates of Digital Elevation Models (DEMs) if modeling is to be effective; the DEMs can be provided by the radar/photogrammetry community." We thus set up a test to explore (i) which model source terms are needed, (ii) how they can be provided and updated, and (iii) how can models be run and applied in an ensemble approach.

The test used two hypothetical effusive events in the Chaîne des Puys (Auvergne, France), for which a prototype Geographical Information System (GIS) was set up to allow loss assessment during an effusive crisis. This system drew on all immediately available data for population, land use, communications, utility and building-type. After defining lava flow model source terms (vent location, effusion rate, lava chemistry, temperature, crystallinity and vesicularity), five operational lava flow emplacement models were run (DOWNFLOW, FLOWGO, LAVASIM, MAGFLOW and VOLCFLOW) to produce a projection for likelihood of impact for all pixels within the area covered by the GIS, based on agreement between models. The test thus aimed not to assess the model output, but instead to examine overlapping output. Next, inundation maps and damage reports for impacted zones were produced. The exercise identified several shortcomings of the modeling systems, but indicates that generation of a global response system for effusive crises that uses rapid-response model projections for lava inundation driven by real-time satellite hot spot detection – and open access data sets – is within the current capabilities of the community.