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VOLCWORKS: A suite for optimization of hazards mapping

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Making hazards maps is a process linking basic science, applied science and engineering for the benefit of the society. The methodologies for hazards maps' construction have evolved enormously together with the tools that allow the forecasting of the behavior of the materials produced by different eruptive processes. However, in spite of the development of tools and evolution of methodologies, the utility of hazards maps has not changed: prevention and mitigation of volcanic disasters.

Integration of different tools for simulation of different processes for a single volcano is a challenge to be solved using software tools including processing, simulation and visualization techniques, and data structures in order to build up a suit that helps in the construction process starting from the integration of the geological data, simulations and simplification of the output to design a hazards/scenario map.

Scientific visualization is a powerful tool to explore and gain insight into complex data from instruments and simulations. The workflow from data collection, quality control and preparation for simulations, to achieve visual and appropriate presentation is a process that is usually disconnected, using in most of the cases different applications for each of the needed processes, because it requires many tools that are not built for the solution of a specific problem, or were developed by research groups to solve particular tasks, but disconnected. In volcanology, due to its complexity, groups typically examine only one aspect of the phenomenon: ash dispersal, laharic flows, pyroclastic flows, lava flows, and ballistic projectile ejection, among others. However, when studying the hazards associated to the activity of a volcano, it is important to analyze all the processes comprehensively, especially for communication of results to the end users: decision makers and planners. In order to solve this problem and connect different parts of a workflow we are developing the suite VOLCWORKS, whose principle is to have a flexible-implementation architecture allowing rapid development of software to the extent specified by the needs including calculations, routines, or algorithms, both new and through redesign of available software in the volcanological community, but especially allowing to include new knowledge, models or software transferring them to software modules. The design is component-oriented platform, which allows incorporating particular solutions (routines, simulations, etc.), which can be concatenated for integration or highlighting information. The platform includes a graphical interface with capabilities for working in different visual environments that can be focused to the particular work of different types of users (researchers, lecturers, students, etc.). This platform aims to integrate simulation and visualization phases, incorporating proven tools (now isolated). VOLCWORKS can be used under different operating systems (Windows, Linux and Mac OS) and fit the context of use automatically and at runtime: in both tasks and their sequence, such as utilization of hardware resources (CPU, GPU, special monitors, etc.). The application has the ability to run on a laptop or even in a virtual reality room with access to supercomputers.