Determination and evolution of source parameters in volcanic eruptions; the FUTUREVOLC supersite approach

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Recent explosive eruptions in Iceland and South America have highlighted the need for reliable near real time estimates of eruption rates. At present the method most frequently used for all but the smallest events, is applying the theoretically and empirically derived relations between eruption plume height and mass eruption rate; often using weather radar data to derive plume heights. In recent years several new methods have been developed that provide independent estimates of volumetric flow rate, plume particle concentrations, exit velocities, electric field generation, gas fluxes, lightning intensity in eruption clouds as well as satellite based methods for plume tracking and atmospheric mass loading. Each method has its strengths and drawbacks. By combining measurements of the all the above parameters into a single system, a much more reliable estimate of eruption rate should be obtained. The compilation of such a system is one of the aims of FUTUREVOLC, a European collaborative project funded through the EU FP7 Environment call encompassing 26 partners in 10 European countries. The main objectives of FUTUREVOLC are to establish an integrated volcanological monitoring procedure, develop new methods to evaluate volcanic crises, increase scientific understanding of magmatic processes and improve delivery of relevant information to civil protection and authorities. FUTUREVOLC is a supersite project, where Iceland has been selected as the target area. In its comprehensive approach to the study of volcanic phenomena, subsurface magma tracking is combined with physical volcanology and atmospheric science. The integrated system for estimation of eruption source parameters will be composed of arrays of sensors that are already in place will be set up in the summer of 2013. The components of the monitoring system include continuously recording real time devices: two C-band weather radars, two mobile X-band radars, radiosondes for ambient atmosphere monitoring, infrasound arrays, arrays of time lapse cameras, electric field sensors, automated tephra samplers and analysers, gas monitoring systems and lightning detection systems. The signals from these systems will be supplemented by aircraft observations and the deployment of a mobile field lab for rapid characterization of tephra. The data from all these sources will be fed into an integrated near real-time system that will evaluate the eruption rate. New algorithms for analysis of radar backscatter and both physics-based and empirical plume models will be implemented as a part of the system. Various data from previous eruptions, including ground truth information, will be used to calibrate the system, which is expected to be operational in 2016.