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Geophysical monitoring and hazard assessment at the Elbrus Volcano (Northern Caucasus, Russia)

A. Sobissevitch (1), A. Gurbanov (2) and C. Pshenichny (3)

(1) Institute of Physics of the Earth, Moscow, Russia, (alex@ifz.ru/+70952556040), (2) Insti-tute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry, Moscow, Rus-sia, (gurbanov@igem.ru), (3) Levinson-Lessing Earthcrust Institute (NIIZK), St. Petersburg State University, Russia (pshenich@kp1306.spb.edu)

Despite the commonly accepted standpoint that magmatic activity has ceased in the Northern Caucasus, recent geological and geophysical studies show that Elbrus Volcano re-mains active, the historic eruptions being clearly determined. Along with the direct hazard of explosive eruption, the ice caps and glaciers (more than 130 sq.km with ice thickness about 60 - 80 m) on the volcano edifice, loose pyroclastic and other deposits on its slopes and in the vicinity represent a severe threat for densely populated surroundings and industrial infrastruc-ture. A resumption of volcanic activity might be accompanied by catastrophic lahars. Here-with we present the results of geological and geophysical observations and mathematical modeling of magma chamber behavior. We assumed that the chamber should respond to the waves generated by distant earth-quakes and a mathematical model of a cavity in a layered medium should sufficiently well describe this response. The analytical solution of the problem has been derived. According to this model, a cavity in a layered half-space activated by external wave emits a secondary wave field. Eigen frequencies of oscillations of a cavity activated by incident of a harmonic wave or a pulse signal in a layered half-space were calculated. We also estimated the size of the chamber using genuine method of satellite imagery processing, seismic reflection tech-nique and magneto-telluric probing. Examination of seismograms of about 40 distant earth-quakes recorded near the volcano revealed the components in the spectrum that are well ex-plained in terms of the accepted model as resonance phenomena produced by a cavity of the size equal to the estimated size of the chamber. Geological and geophysical studies at Elbrus Volcano resulted in development of an original monitoring technology and a map of probabilis-

tic risk assessment. At the moment we have number of devices (geophones, tilt-meters, z- and d- magnetometers) installed in the vi-cinity of Elbrus Volcano. Multi-parameter digital data is stored on a dedicated server con-nected to the Internet. So continuous monitoring over local volcanic and seismic activity is on the way. However, for more accurate account of possible scenarios we are going to apply the technologies of knowledge engineering and logic being elaborated now. This will enable to transfer the bulk of knowledge accumulated into the most operative form understandable by non-professionals and usable in emergency planning.