

Automatic program of the detection of ash plume and estimation its height using local seismicity

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Assessing volcanic hazards using remote methods, regardless of weather condition and the presence of observers, remains rather critical today, especially for flight safety. Seismicity has long been one of the most commonly monitored aspects of active volcanoes because of its 24 hours per day reliability regardless of weather. Kamchatkan Branch of Geophysical Survey RAS began to use an original empirical method for detecting ash plumes and estimating plume heights using local seismicity in 2003. We collected many video, photo and visual data of ash plumes. Our database includes the ash plumes and corresponding seismic signals for four active volcanoes in Kamchatka. Sheveluch data includes more than 350 events, Karymsky data is more than 100, Kizimen data is more than 20, Bezymianny data is 9. To detect seismic signals, corresponding to ash plumes, we use a program (author is Dmitry Droznin), which allows us to study a spectral of seismic signal and to calculate the integral of absolute ground velocity for ash plume height estimation. Since June 2012 our laboratory began to use the automatic program (author is Vitaly Bliznetsov) to detect ash plumes from seismic data, which run every 15 minutes. This program uses the seismic signal amplitudes after application of band-pass filters and calculates the frequency index FI. FI is equal of decimal logarithm of the ratio the amplitude of high frequency band to the amplitude of low frequency band. This index FI allows to detect 75 percent of all ash plumes. Height H of ash plume is estimated from $H=K*FI*(A*\ln A - A)$, where K is the coefficient, FI is the frequency index, A is amplitude of signal, $\ln A$ is natural logarithm of the ratio of the amplitudes of any two successive peaks. Retrospective analysis of the ash plumes of Sheveluch allowed to estimate the coefficient of correlation between real observed by video system height of plume and the height calculated by the program. The coefficient of correlation is equal 0.69 for 240 events, which were registered by video observation since 2007. The use of this program in real-time monitoring allowed to detect and to estimate correctly new strong explosive eruptions of Bezymianny volcano on September 01, 2012, and of Plosky Tolbachik volcano on November 27, 2012. Now this program controls the explosive events of active volcanoes (Sheveluch, Bezymianny, Plosky Tolbachik, Kizimen, Karymsky) and send the messages to laboratory staff by email every 15 minutes. If an estimated ash plume height is more than 3500 m above sea level, program send special message.