



Cross correlation analysis between infrasonic and seismic signals related to the explosive activity occurring at Mt. Etna in October-November 2006

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In October - November 2006 the eruptive activity at Mt. Etna volcano was characterised by both effusive and explosive activity at the summit South East Crater. We studied the relationship between infrasonic and seismic signals, during seven time periods (some hours long) characterised by explosive activity. We analysed the signals recorded by one station (ECP) equipped with three-component seismometer and infrasonic sensor and located at a distance of about 1 km from the eruptive crater. We also used seismic data coming from other 4 three-component seismic stations (1-3 km from the eruptive crater). By performing the Continuous Wavelet Transform, we noted that at ECP the amplitude increases of the infrasonic signal, in coincidence with the explosive activity, were preceded by amplitude increases of the seismic signal. These amplitude variations of both seismic and infrasonic signals were observed in the same frequency band (1-4 Hz), suggesting a common coincident source. We carried out a cross correlation analysis between infrasonic and seismic amplitudes (calculated in moving windows), obtaining at least two different peaks of the cross correlation coefficient, corresponding to different time lags. The first peak, showing the minimum time lag between the two series (ca. 1.5 s at ECP), was dominant when we analysed the vertical component of the seismic signal at the closest stations to the summit area; however, it became secondary at the horizontal components and at the farthest stations. We suggest that these peaks could be due to the different seismic phases: P waves, the first peak, and S and/or surface waves, the other ones. We noted that the considered time periods showed similar mean values of the time lag; moreover, such time lags remained quite steady during almost every considered explosive activity episode. Comparing the observed lag values with different sets of theoretical values (obtained

by changing seismic wave velocity, depth of the free magma surface, seismic source depth), we obtained the following results: i) the seismic and the infrasonic sources were coincident; ii) the free magma surface coincided with the top of the conduit; iii) the P-waves velocity in the very shallow layer of the volcano is about 700 m/s.