Duration-amplitude distribution of volcanic tremor at Erebus volcano, Antarctica

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Most phenomena in nature show a relationship between their numbers and their sizes and this relationship can be used to identify their source processes. In this respect, we investigated duration-amplitude distribution for 233 tremor episodes during May 2002-December 2003 recorded at Erebus volcano, Antarctica. We computed reduced displacement (D_R) to normalize the data, then generated duration-amplitude plots. A total of 225 tremor episodes fit with an exponential law and eight tremor episodes fit with a power law model. For these eight tremor episodes, power law behavior can be explained in three ways: (a)they were generated by iceberg activity around the volcano, (b)their source processes were not scale bounded, and (c)they were corrupted by noise. Further, we only examined 225 tremor episodes which were following an exponential law. From these tremors, we found three tremor groups : (1)harmonic tremor, (2)broadband tremor, and (3)mixed between harmonic and broadband tremor. In particular, all of the tremor groups showed similar characteristic amplitude value from 0.04-42 cm^2. We presumed that these tremors were generated by fluid-flow oscillations inside the conduit during the magma movement to the surface. Therefore, we performed minimization of the difference between observed and theoretical reduced displacement to obtain tremor source depths and overpressure. Volcanic tremor consists of surface waves, hence we used surface wave expression to derived theoretical D_R. The result showed that tremor depths spread from 334-4892 m with overpressure range from 0.02-7.5 MPa.

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