

Air vibrations recorded on eruption movies

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At an explosive volcanic eruption, it is well known that a strong atmospheric pressure vibration is generated and it is propagated as sound and infrasound waves to the range of several hundreds km away from volcano. These waves have been observed by microphones and barographs at many volcanoes all over the world.

Among the waves, a strong pressure wave like a shock wave is occasionally visualized at just above the crater. For example, a frontal part of shock wave was visualized at Vesuvius by a change of refractive index of the air, as the flashing arc. Vulcanian eruption of Ngauruhoe volcano in 1975 produced a temporal condensation cloud clearly which was considered to correspond to a rarefaction phase of shock wave. On the other hand, disappearance of a part of preceding cloud caused by passing of a compression phase was recorded on a movie at Sakurajima volcano. Both of these phenomena, appearance and disappearance of clouds, were also observed simultaneously at the eruptions at there. Even if we cannot directly recognize them like above, we also have a chance to visualize weak pressure waves in the movies using a digital image processing; that is a focusing the change of luminance data.

The pressure wave is one of important key to understand source dynamics and/or mechanism of volcanic explosions. Therefore, we applied these methods to Sakurajima and Suwanosejima eruption movies to try to derive some characters of the waves. The propagation of pressure waves produced by these eruptions was clearly recognized as the changes in luminance even for the case that we could not see them by bear eyes. We estimated the apparent speeds of propagation around 340-570 m/s at Sakurajima, and about 300 m/s at Suwanosejima. Furthermore, some characters of pressure waves have been investigated quantitatively; such as time-spatial dimension of the waves. We consider that these characters will become one of strong constraints for modeling volcanic explosions, although we have to grasp the 3D propagation pattern of the wave and the detailed relations between the waves observed by apparatuses and those on the movies.