“Sub-plinian” column of Izu-Oshima 1986B Eruption

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The 1986B eruption, which is the climatic phase of the 1986 Izu-Oshima eruption is a sub-plinian eruption observed remotely by satellite and radar echo along with media footage on a large scale and conventional terrestrial observation for the first time in the history. Although large number of papers from a variety of perspective have been published, some details of the eruption remain still unknown. The column height, which is one of the most important parameter to describe an eruption is among them.
The column height of the 1986B eruption have been reported as 16.5 km in 17:00-17:20 (Hayakawa, 1987), 12 km in 17:02 (Hirata, 1989) and 7 km in 16:30 (Sawada, 1998) based on terrestrial observations. On the other hand, GMS, which is a meteorological satellite captured infrared images during the eruption and temperature of the coldest portion of the eruption cloud marked -33ºC. If the temperature of the eruption cloud is same as ambient, the cloud height is assumed to be from 7 to 9 km high (Sawada, 1998). Also, advection rate inferred from the image sequence (approximately 200 km/h) is same as wind velocity of approximately 8 km high.
Mannen (2006) assumed vertical eruption column, which is not affected by wind, and calculated eruption column of 13.8 km high based on column model and decay rate of tephra mass loading as a function of distance from the eruption centre. This study assumed all particles on the ground originated from umbrella region; however, Mannen (2014) showed that most of the particles on the ground originated from the eruption column lower than 8 km high.
Woodhouse et al. (2013) established a new model of eruption columns that bend with wind. Based on the model and the aerological observation of Hachijyojima island near Izu-Oshima, mass flux rates are calculated as 1×10^7 kg/s for 8 km high and 1×10^8 kg/s for 12 km high. Since the total erupted mass of the eruption is calculated to be 1.4×10^{10}kg (Mannen and Ito, 2007), duration of the eruption column is calculated to be 20 minutes for an 8 km high column and 2 minutes for a 12 km high column.
The 1986B eruption started 16:15 then reached to the climax at around 17:00 then waned until 22:00 and thus the duration is about 6 hours. Therefore, column height of 12 km is unlikely. Even if the column height marked 8 km, duration of such climax is assumed to be less than 20 minutes, and phases, column heights of which are lower than 5 km (1×10^6 kg/s) or 4 km (1×10^5 kg/s) could fill a large part of the duration of the 1986B eruption.

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