



Have great earthquakes induced large volcanic eruptions in Japan?

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After the 2011 Tohoku-oki megathrust earthquake of Mw9.0, a great concern is whether there would be large volcanic eruptions and disastrous aftershocks in Japan or not. There exist 110 active volcanoes in Japan and they have been investigated and their volcanic activity has been compiled every detail by Japan Meteorological Agency. Especially, most of large volcanic eruptions have been classified according to Volcanic Explosivity Index (VEI; Newhall and Self, 1982) from 0(Non-explosive) to 8(Mega-colossal).

According to "Volcanoes of the World" by Siebert et al. (2010), we could find 50 eruptions classified VEI4 (Large) and Larger (5~) in Japan since 600 A.D. Speaking about great earthquakes, of which earthquake (moment) magnitude (M) is equal to or larger than 8.0, there occurred 34 times since 684 A.D. in Japan.

I have compared the date of large eruptions of each volcano and of large earthquakes at first ($M > 7.5$), taking examples of Mt. Fuji, Tokachidake, Hokkaido Komagatake and Sakurajima volcanoes. I also studied inland earthquakes ($M > 7.2$) near volcanoes. Since I could not find any systematic correlation between them, I decided to compare all the Large (and Very Large) volcanic eruptions and the great earthquakes ($M > 8.0$) in Japan. This is to remove the limitation of historical/future period of time for eruption records of each volcano, by considering the volcanic activity in the wide area of Japan. In order to develop the quantitative discussion, we need to introduce cross correlogram analysis (Perkel et al., 1967; Grun, 2009) for these two discrete point-processes.

All that I could find was very poor correlation between great earthquakes and large eruptions of the volcanoes in Japan. It is true that many SCIENTIFIC papers tell us the correlation between earthquakes and volcanic eruptions. But it is not true for the correlation between large volcanic eruptions and great earthquakes. The reason is that some small volcanic activity out of many volcanoes in the vicinity has been induced by great earthquakes almost all the time. Even after the Tohoku-oki megathrust earthquake M9.0 of March 11, 2011, it has been reported that the volcanic activity of about 20 of the volcanoes in Japan has been enhanced, including volcanic fumes/tremors and volcanic earthquakes.

The evidences should be added of the eruptions of Mt. Fuji in 1707 (VEI5) which was 49 days after the 1707 Hoi earthquake of M8.6 which is the largest earthquake ever recorded in Japan and Bezymianny in 1955 (VEI5) 3 years after the 1952 Kamchatka earthquake of M8.8 which is the largest eruption of the volcano in the history. Both of them have spent about 900~1000 years of rather quite (not large) volcanic activity. This would strongly suggest that great earthquakes might induce large volcanic eruptions nearby, however it is totally dependent on its own potential and preparedness to erupt of each volcano and the earthquakes are just a trigger, the last one push to activate the eruption.