

# ***Interactive comment on “Development of the very long range muographic imaging technique to explore the internal structure of an erupting volcano, Shinmoe-dake, Japan” by T. Kusagaya and H. K. M. Tanaka***

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We thank the referee for the helpful comment. Please see the following answers.

1) Regarding elimination of the in-flight decay positrons/electrons background, 6-hold PSD with 5-hold 10-cm Pb and 2x6-cm Fe in intermediate radiation shielding were employed. The explanation is needed why the 6-hold PSP are required instead of smaller number of PSP such as removing #2, #3, #4 and #5 and using #1 and #6 only

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with keeping same shieldings.

→To reduce the accidental coincidence from vertical electromagnetic particles by selecting linear trajectory.

2) As for the multiple scattering effect of the incoming cosmic-ray muons, the background contribution from BWD (toward the sky) muon to FWD (toward the mountain) data in VLRM measurement was pointed out for the first time. However, the discrimination between the FWD and BWD was not made experimentally. It should not be difficult to event identification by comparing the absolute timing of #1 counter to that of #6 counter. Total length (3 m) between #1 and #6 counter and expected time resolution of the event-time recording device such as FPGA (less than 10 ns) make such discrimination marginally possible. Please explain why such analysis was not done.

→Because we used the same detection system as the other observation (Tanaka et al., 2014) whose FPGA was not designed to have a function to discriminate between the FWD and BWD muons.

In addition, the following rather minor revisions are suggested. 1. Page 1 line 1, the word of “muographic” should be “cosmic-ray muon radiographic”.

→Fixed.

2. Page 3 line 43, Fig. 1 should be simplified by removing presently used volcano plane-map as a background.

→Fixed. Please see Fig. 1.

3. Page 5 line 71, the word of “Level 2” should be explained.

→The explanation “People are forbidden to enter the volcano within approximate 1 km from the crater when the JMA volcano eruption level is Level 2.” was added after “... remained high and were Level 2 in 2014.” at Page 5 line 71.

4. Page 5 line 74, the word of “predicting” should be “investigating”.

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→Fixed.

5. Page 17 line 263, (1400 m) should be (750 m).

→Fixed.

6. Page 20 line 311 and others, “opposite the mountains” should be “opposite to the mountains”.

→Fixed.

7. Page 47 Fig. 13 (b), Elevation angle (mrad) of horizontal axis should be negative values like -50, -100, etc.

→Fixed. Please see Fig.2.

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 5, 207, 2015.

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1. Tanaka et al.(2007) Asama
2. Tanaka et al.(2007) Showa-Shinzan
3. Lesparre et al.(2012) La Soufrière Guadeloupe
4. Carbone et al.(2013) Etna
5. Tanaka et al.(2009,2014) SatsumaIwojima
6. Cărlöganu et al.(2013) Puy de Dôme
7. Tanaka et al.(2010) Asama
8. Miyamoto et al.(2012 JpGU) Utsun
9. Perez et al.(2012,AGU) Taicöe
10. Lesparre et al.(2012) La Soufrière Guadeloupe
11. Tanaka and Yokoyama(2013) Meiji-Shinzan
12. Lellis et al.(2014, MNOGPAHERS) Stromboli
13. Kusagaya et al.(2013, JpGU) Usu
14. Present study Shimoe-dake

## Distance from crater

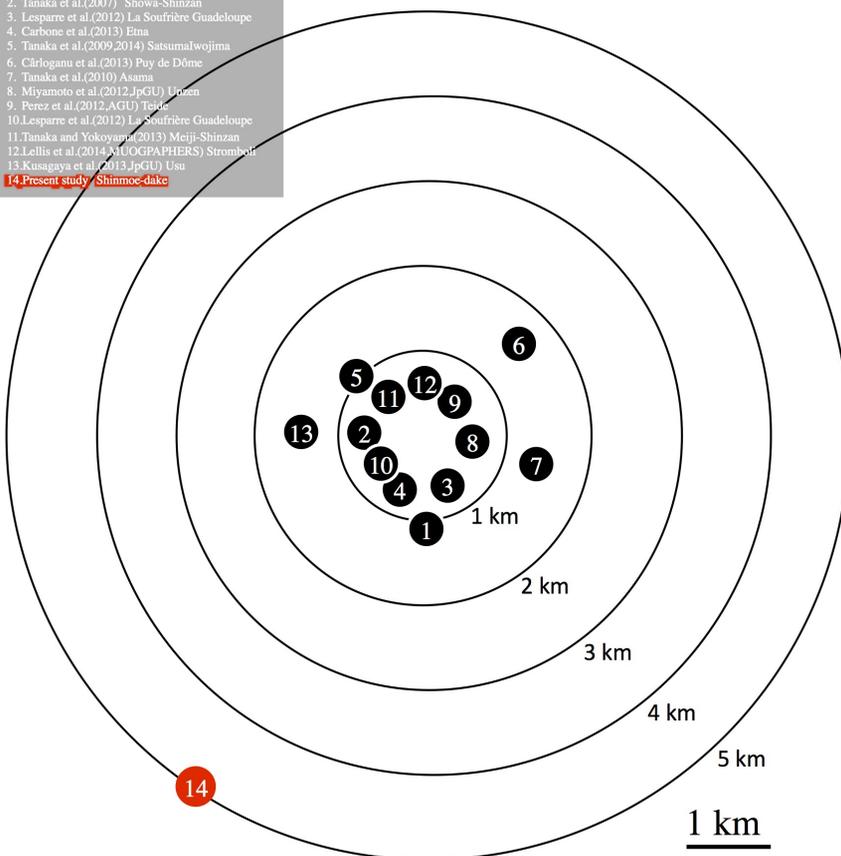


Fig. 1.

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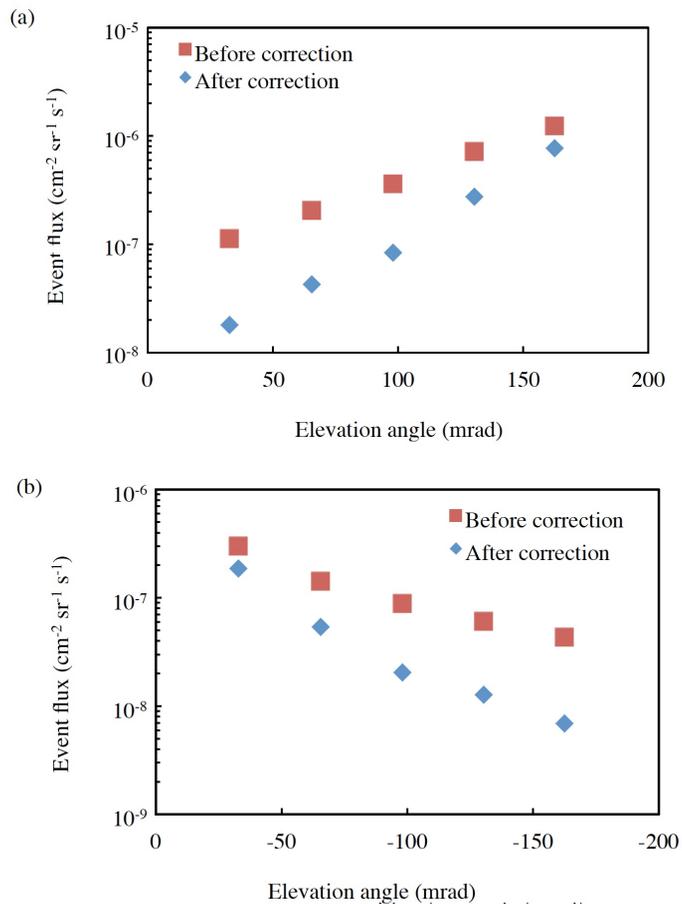


Fig. 2.