

Interactive comment on “Long-range transported bioaerosols captured in snow cover on Mount Tateyama, Japan: Impacts of Asian-dust events on airborne bacterial dynamics relating to ice-nucleation activities” by Teruya Maki et al.

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Dear Anonymous Referee 2,

I appreciate your useful comments and valuable suggestions for our manuscript. Moreover, we feel very glad that our study has been valued. I would have revised our manuscript referring to your comments, and wish your review again. Your comments are indicated at sections (Q) and my responses are indicated at sections (A). In sections (A), the revised parts in our manuscript were indicated using line.

C1

Q1. Section 2: To make the readers more easily understand the method of your study, a flowchart that briefly summaries snow sampling and analysis processes is needed in the manuscript. Probably, ‘Sampling and Methods’ is better for the title of Section 2. Moreover, current title of section 2.2 is not appropriate because several analysis methods by use of ion chromatography, epifluorescence microscope as well as lidar are introduced.

A1: As your suggestions, I have revised the titles in Section 2 (P3 L20, P4 L3) and inserted the flowchart figure (Figure 2).

Q2. Section 3 and 4: The authors are encouraged to combine these two sections together. The current version is quite hard to get intact information of each subsection. Therefore, please rewrite and combine to a section.

A2: I agree with your comment. Section 3 and 4 have been combined in the revised manuscript (Section of Results and Discussion).

Q3. Figure 3: lidar measurements at Toyama AD-net are used to show the periods of Asian dust events and air pollutions during February to April 2013. However, this figure cannot show sufficient information so that should be improved. The authors should use attenuated backscatter coefficient and depolarization ratio that could clearly show dust events and non-dust events, rather than retrieved extinction coefficient of spherical and non-spherical particles (soil dust).

A3: The data of attenuated backscatter coefficient and depolarization ratio are used in the lidar figure in the revised manuscript (Figures 4 and S1).

Q4. Moreover, what is the altitude of lidar site at Toyama? According to position of red boxes in figure 3, it seems that the altitude of lidar site is very close to sea level. Now all dust events should be clearly seen based on lidar measurements, but it is not clear to distinguish local air pollution days from others. Please enlarge size of panels and rescale the axis of figure 3.

C2

A4: The lidar site of Toyama is located at the altitude of 25 m at sea level. This altitude can be neglected in the lidar figure (Figure 4).

Q5. Figures 4: there is a peak at 698-695cm of snow cover height for concentration of bacteria. Is it also a dust event? According to results from 16S rDNA sequencing analysis in figure 6, dust aerosols probably affected the sample. Please explain in the paper.

A5: This layer indicated high concentrations of total particles as well as bacterial cells. I think this layers would include some particles transported by very short term of dust events, which had not detected using lidar measurements. This suggestion has been added in the revised manuscript (P7 L27-L29).

Q6. Line 3 in page 3: please change 'Taklamakan' to 'Taklimakan'.

A6: I have integrated to 'Taklimakan' (Entire section of the revised manuscript).

Q7. Line 6 in page 3: please change 'Huang et al., 2015ab' to 'Huang J. et al., 2015; Huang Z. et al., 2015'.

A7: Thank you for your advice. I have changed to this citation style (P2 L5, P7 L1).

Q8. Line 16 in page 5: change '36.57N, 137.60E' to '36.57N, 137.60E'.

A8: As your comment, I have revised the description of longitude and latitude (P3 L22).

Q9. Line 1 in page 6: I think 'coloured layers' is not suitable, 'polluted layers' and 'dirty layers' is much better. Please replace it throughout the manuscript.

A9: As your suggestion, I have integrated to use the term 'dirty layers' at entire sections (Entire section of the revised manuscript).

Q10. Line 4 and 5 in page 7: depolarization ratio is more popular for lidar community than depolarization rates. Please change 'depolarization rates' to 'depolarization ratio' throughout the manuscript. Actually spherical-particle rates is included within lidar data

C3

in the paper, please rewrite it.

A10: Thank you for your suggestion. I have integrated to use the term 'depolarization ratio' (Entire section of the revised manuscript).

Q11. Line 5 in page 9: please change 'workers' to 'Researchers'.

A11: I have changed 'workers' to 'Researchers' (P5 L30).

Q12. To increase reader better understanding of impact of Asian dust and bioaerosols on climate over East Asia, please reference papers as follow. Sugimoto, N., Z. Huang, T. Nishizawa, I. Matsui, and B. Tatarov, 2012: Fluorescence from atmospheric aerosols observed with a multi-channel lidar spectrometer, *Optics Express*, 20(19), 20800-20807. Huang J., Y. Li, C. Fu, F. Chen, Q. Fu, A. Dai, M. Shinoda, Z. Ma, W. Guo, Z. Li, L. Zhang, Y. Liu, H. Yu, Y. He, Y. Xie, X. Guan, M. Ji, L. Lin, S. Wang, H. Yan and G. Wang, 2017: Dryland climate change recent progress and Huang J., H. Yu, A. Dai, Y. Wei, and L. Kang, 2017: Drylands face potential threat under 2C global warming target. *Nature Climate Change*, doi: 10.1038/NCLIMATE3275. Tang, K., Huang, Z., Huang, J., Maki, T., Zhang, S., Ma, X., Shi, J., Bi, J., Zhou, T., Wang, G., and Zhang, L.: Characterization of atmospheric bioaerosols along the transport pathway of Asian dust during the Dust-Bioaerosol 2016 Campaign, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2017-1172>, in review, 2017.

A12: Thank you for telling us important reference papers. I referred these references in the revised manuscript (Entire section of the revised manuscript).

Q13. The results in the paper give us further information about bioaerosols in snow, especially affected by Asian dust events. The authors are encouraged to evaluate the impact of bioaerosols on surface albedo and melting rate of snow in future.

A12: I appreciate your valuable comments for the perspectives to our research. This comments were also described in the conclusion section of the revised manuscript (P11 L21-22).

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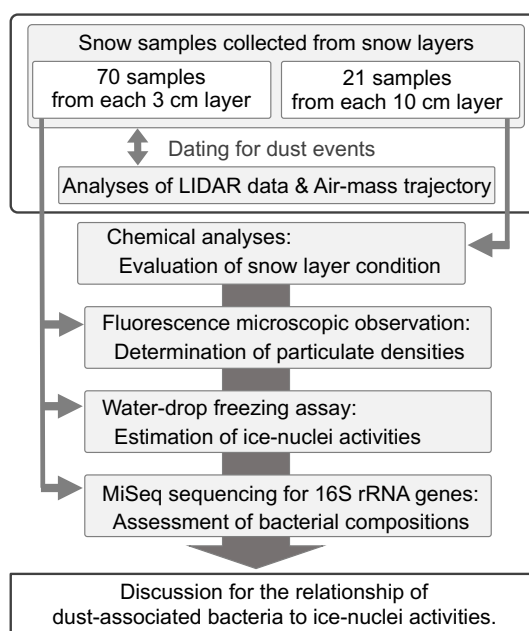


Fig. 2 T. Maki et al.

Fig. 1. Figure2: Sampling and experimental scheme.

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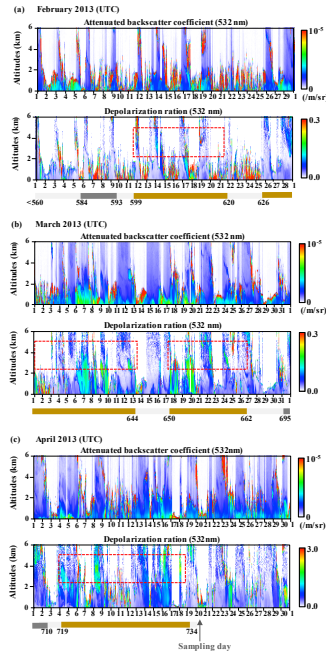


Fig. 4 T. Maki et al.

Fig. 2. Figure 4: LIDAR observation of attenuated backscatter coefficient and depolarization ratio in Toyama in February (a), March (b) and April (c) of 2013. Red dotted lines indicate the occurrences of Asia