Responses to Referees

1 Response to Referee #1

We are grateful to the referee for the careful review of our paper. Please see each response below and changes in the manuscript addressing all comments of referee #1. For the general comments, each number refers to each comment orderly. Meanwhile, for the supplementary comments, the responses are structured based on the order of the lines in the manuscript.

1.1 General Comments

1. **Comment:** Since limiting the meteorological and atmospheric conditions of a specific day (in which the Taisho eruption occurred) to define the worst-case scenario, does not seem to have been given very reliable results. Nonetheless, the input parameters used for the modelling of the worst-case scenario (analysed within this paper), are too much specific, considering atmospheric conditions that are not common in Japan. Therefore, the scenario modelled, could happen, but with a very low certainty.

   Response: Actually, we did not limit the meteorological conditions in contrast to what the referee pointed out. Instead, **we use 6-hourly wind data for 64 years (96 hours for each simulation) to obtain both ash deposits in the ground and airborne ash concentration**. Limitation on a specific day's meteorological and atmospheric conditions is solely for the validation procedure. This mechanism does not constrain the dataset only to contain explicit dates or specific atmospheric conditions. The dataset contains meteorologically-diverse ash deposits in the ground and airborne ash concentrations. When a large-scale eruption of the Sakurajima volcano (like the Taisho eruption) occurs in contemporary settings, the extensive size of the dataset, for example, can provide its users with an evaluation of conditional ashfall risk in Japan, analyses of both the dispersal and deposition pattern volcanic ashfall over a long period, hazard maps for the disaster risk management process, and the tendency of ashfall distribution over a large region.

   Changes in manuscript: Lines 59-61, 86-88, and 282-288.

2. **Comment:** In fact, the validation presented was not satisfactory, and the authors knows it...which was probably due to the fact that the authors pushed the model to a very narrow scenario, forcing the inputs, trying to recreate an historic eruption with sparse data.

   Response: Our intentions in presenting the validation section are to illustrate the dataset's quality and to check the model's performance for replicating the past large-scale eruption. For smaller-scale eruption cases, the validation of ash dispersal simulation using the PUFF model for Sakurajima eruptions has been done successfully in previous studies (e.g. Tanaka and Iguchi, 2019; Tanaka et al., 2020).

Therefore, we think it is also necessary to provide a validation framework for a large-scale eruption of the Sakurajima volcano. For our case, we assumed that the model would produce a relevant ash distribution in wider space (all of Japan) if given the precise wind data on a specific eruption scenario (the Taisho eruption). Because of the lack of complete wind data during eruption time, we searched the date(s) with similar weather conditions to the eruption day, expecting to bear an equivalent wind pattern. Then, we matched the chosen date(s) simulation result with the available ground observation data and obtained a comparable result. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B. Besides the intention, we understand that the mechanism we utilised is complicated and has limitations, so it may not yield perfect results, both in the wind patterns found through the searching process and the ash distribution from the simulation.

Changes in manuscript: Lines 378-444 and 518-741 (Moved to Appendix B).

3. **Comment:** The paper is well written, however, the objective of the paper should be reconsidered, along with the scope of the modelling.

   Response: We clarified the objective of the study in the Introduction section.

   Changes in manuscript: Lines 82-97.

1.2 Supplementary Comments

1. **Line 2 (clause 'Ashfall Disaster Countermeasure' in Title):** This was not assessed at all, not even as suggestions in the discussion section.

   Response: To describe the dataset's usage and significance, we added one more subsection (Sect. 4.2) to explain the usage examples of the dataset. In addition, we added a brief description of the dataset's purpose in the Introduction section.

   Changes in manuscript: Lines 94-97 and 319-376.

2. **Line 40:** amplified?

   Response: Revised following the suggestion.

   Changes in manuscript: Line 43.

3. **Line 111:** The high possibility of a large-scale explosive eruption in the following decades that probably would resemble the past event.

   Response: Revised following the suggestion.

   Changes in manuscript: Lines 110-111.

4. **Line 119:** An enormous volume of volcanic material.
   Response: Revised following the suggestion.
   Changes in manuscript: Line 117.

5. **Line 121:** Delete gigantic.
   Response: Revised following the suggestion.
   Changes in manuscript: Line 120.

6. **Line 136:** Delete considerable, were.
   Response: Revised following the suggestion.
   Changes in manuscript: Line 121.

7. **Line 136:** Better in numbers.
   Response: Revised following the suggestion.
   Changes in manuscript: Line 139.

8. **Line 137:** Redundant.
   Response: Revised following the suggestion.
   Changes in manuscript: Line 140.

9. **Line 145:** It depends entirely on the wind speed and its direction, as well as the granulometry of the volcanic material...if you take as an example the Eyjafjallajökul eruption, the features of the volcanic ash plumes were smaller than the Sakurajima eruption, and caused a major impact, because even a “small eruption” as the Icelandic one, can have a big impact with the precise wind-factors...
   Response: We acknowledge that the dispersed ashes flown by the strong wind, even from a small eruption, can affect the broader population living in the distal locations of the volcano.
   Changes in manuscript: No changes.

10. **Line 157-159:** From this sentence, it’s not clear how it would help.
    Response: We mean here that this dataset can present significant inputs for the government when preparing to respond to ashfall disasters, using the Taisho eruption case as a reference. We revised this sentence and moved it to the Abstract, Introduction section, and Sect. 4.2.
    Changes in manuscript: Moved the revised sentence to lines 26-28, 94-97, and 319-376.

11. **Line 167:** And works better within the first 48 hours of the eruption.

    Response: Revised following the suggestion.

    Changes in manuscript: Line 171.

12. **Line 193:** This value is concerning...not sure it the PUFF model works well after the first 48 hr simulation.

    Response: We use the 96 hours to track the ash dispersal further to all of Japan. The eruption itself only lasted 48 hours in the simulation.

    Changes in manuscript: No changes.

13. **Line 256-258:** This sentence is not clear.

    Response: Revised to clarify the sentence further.

    Changes in manuscript: Lines 271-273.

14. **Line 353-354:** What is the reason behind this scenario? If those atmospheric conditions during the Taisho eruption were so unusual, why did you decide to use this eruption to forecast the extreme future scenario?

    Response: We did not emphasise the unusual atmospheric conditions as the reference to forecast the extreme scenario. We highlighted the unusual weather during the Taisho eruption for validation purposes only. Since the actual wind data is unavailable, understanding the weather when the eruption occurred is crucial as we assume that similar weather would produce a similar wind pattern. Furthermore, the ash dispersal simulation using similar wind patterns should resemble the ash distribution from the reports. If the Taisho eruption occurred in general weather conditions, we would validate the simulation results using the general wind data. We do not mean only publishing the dataset with the same weather conditions as the Taisho eruption. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Lines 549-550 (Moved to Appendix B).

15. **Line 354-356:** I suppose that at some point, you will consider to present a risk map that takes into account the most common weather conditions in Japan.

    Response: We added a conditional ashfall risk map considering Japan’s general weather conditions as the dataset’s usage examples in Sect. 4.2.

    Changes in manuscript: Added lines 319-376.

16. **Line 364-365:** Yes, and probably with another set of rare conditions too. So, it seems that you’re trying to use this “rare condition” of one of the biggest eruptions in Japan, and propose them as if they were the common thing.

Response: We are not proposing the rare conditions of one of the biggest eruptions in Japan as the common. We already explained that the description of unusual weather conditions during the Taisho eruptions is solely for validation purposes. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

Changes in manuscript: Lines 559-560 (Moved to Appendix B).

17. **Line 370:** I'm not sure if it's ideal trying to reproduce the specific conditions of the Taisho eruption, just to calibrate the model, if at the end, the usual conditions should be modelled, in order to produce outcomes for the commonly weather conditions, and actually, trying to obtain the information about the true weather conditions of that date seems to be a real challenge.

    Response: Yes, finding similar weather conditions to the weather during the Taisho eruption is challenging. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Lines 516-738 (Moved to Appendix B).

18. **Line 474-457:** This process, together with the objective of using the exact meteorological conditions of the day of the Taisho eruption for the simulation of the extreme scenario, seems to me to be an eccentricity. I mean, this process surely is very useful for other type of research, not specifically for the objective of this paper.

    Response: As we explained our validation framework in the paper, all the processes we performed are to find similar weather conditions to the eruption day for selecting the appropriate simulation result(s) with the ground truth. Therefore, using the method here with limited information, we can carefully find wind data considerably similar to the wind data on the eruption day to reproduce the Taisho eruption. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Lines 650-738 (Moved to Appendix B).

19. **Line 512-513:** Exactly. Why keep pushing into these context then?

    Response: As we described in Sect B.2.1, the unusual weather conditions at the Taisho eruption could be observed again in the meteorological data we used here (1958-2021). We acknowledge that the process of finding weather similarities may have shortcomings. Still, most of the crucial features of the selected dates matched the weather description during the eruption, resulting in similar ash distribution to the reports. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Lines 719-720 (Moved to Appendix B).

20. **Line 513-514:** 170 / 5.000. So why bother applying all these procedures and techniques that surely consumed time and effort, for something that could finally be generalised?

    Response: The aim of applying all those procedures and techniques is to confirm that validating a simulation result with ground reports is also replicable to large-scale eruption cases. As described in Sect. 5.1, the ground reports of the Taisho eruptions are not entirely available. However, the small number of simulation results resembling the ash distribution of the Taisho eruption further confirms the unusual weather during such an event. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Line 720 (Moved to Appendix B).

21. **Line 515-516:** This should be concerning, isn't? I mean, pressure is one of the spotlight parameters of the weather conditions during the Taisho eruption.

    Response: Generally, the selected date was enclosed by a high-pressure centre over Japan. Although the locations of the centre were slightly different, the weather report on the chosen date is similar to the eruption day. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B. In the revised version, we only highlighted the date with the most similar weather conditions to the weather during the eruption (5 March 1997).

    Changes in manuscript: Lines 722-724 (Moved to Appendix B).

22. **Line 555-556:** May be this result is due to the fact that you're forcing these input conditions.

    Response: The wind data used in the ash dispersal simulation would influence the ash distribution on the ground. Some biases would still exist as we only found similar wind patterns and no exact data observed during the eruption. We revised this sentence. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Lines 431-439.

23. **Line 560:** I would say that "similar" is better.

    Response: Revised following the suggestion. We revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Line 433.

24. **Line 563:** Because they're similar not completely exact.

    Response: We revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

Changes in manuscript: Removed the sentence in the revised version.

25. **Line 570:** So, none of the two conditions simulated were satisfying?

    Response: We revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

    Changes in manuscript: Removed the sentence in the revised version.

26. **Line 573-574:** I'm not sure that this sentence is correct. I think I would be better to run simulations with the most common weather/atmospheric conditions in Japan, instead of clinging to the specific context of the weather conditions of the Taisho eruption. First, calibrating the model with other known eruption, developed during regular atmospheric conditions, and then running the simulations to future common atmospheric conditions.

    Response: One of the purposes we conduct our validation this way is to confirm that validating a simulation result with ground reports is also replicable for large-scale eruption cases. The large-scale eruptions are infrequent and do not necessarily occur in general weather conditions. We also need to consider that a volcanic eruption and its impacts are heavily localised, so we could not just take any eruption outside the Sakurajima volcano that may occur during typical weather. We already described that the model we use worked well for smaller-scale eruptions of the Sakurajima volcano (e.g. Tanaka and Iguchi, 2019; Tanaka et al., 2020). However, this is the first attempt to validate the result of the ash dispersal simulation of the Taisho eruption. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B. The sentence was removed in the revised version.

    Changes in manuscript: Removed the sentence in the revised version.

27. **Line 584:** This is why, probabilistic methods are being used more often for this type of assessments.

    Response: We acknowledge the dataset's limitations and drawbacks, as explained in the Limitation section.

    Changes in manuscript: No changes.

28. **Line 587-588:** This is one of the main reasons why you should use a probabilistic approach.

    Response: We acknowledge the dataset's limitations and drawbacks, as explained in the Limitation section.

    Changes in manuscript: No changes.

29. **Line 590-591:** That's right, and is one of the drawbacks of using deterministic approaches, like the one you use in this work.

    Response: We acknowledge the dataset's limitations and drawbacks, as explained in the Limitation section.

    Changes in manuscript: No changes.

30. Line 599: If so...why bother in processing all the meteorological data from 1958 to 2021, just to find the exact atmospheric conditions as the ones of the Taisho eruption?

Response: We emphasised here is the "meteorological databases", not the "meteorological data". We meant that meteorological databases are the data source for the wind data, e.g., JRA-55, ERA-Interim, etc., not the difference between past and future weather data. We added examples of meteorological databases to clarify the sentence further.

Changes in manuscript: Line 478.

31. Line 621: Which was not fully successful.

Response: We revised the sentence in Conclusion section and moved the detailed validation procedure to Appendix B and revised the sentence.

Changes in manuscript: Lines 491-493.

32. Line 861: Lowercase.

Response: Revised following the suggestion.

Changes in manuscript: Line 131.

33. Line 927: Perhaps, instead of putting an example image caption of the database configuration, it would be better to put it in an Appendix at the end of the paper.

Response: Revised following the suggestion.

Changes in manuscript: Line 500 (Moved to Appendix A).

34. Line 929: Same suggestion as figure 5.

Response: Revised following the suggestion.

Changes in manuscript: Line 502 (Moved to Appendix A).

35. Line 935: Same suggestion as figure 5-6.

Response: Revised following the suggestion.

Changes in manuscript: Line 506 (Moved to Appendix B).

36. Line 944: Better in appendix.

Response: Revised following the suggestion.

Changes in manuscript: Line 679 (Moved to Appendix B).

1.3 References

Referee comment on "Long-Term Ash Dispersal Dataset of the Sakurajima Taisho Eruption for Ashfall Disaster Countermeasure" by Haris Rahadianto et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-42-RC1, 2022.

Tanaka, H. L., Nakamichi, H., and Iguchi, M.: PUFF Model Prediction of Volcanic Ash Plume Dispersal for Sakurajima Using MP Radar Observation, Atmosphere, 11, 1240, https://doi.org/10.3390/atmos11111240, 2020.

Tanaka, H. L. and Iguchi, M.: Numerical Simulations of Volcanic Ash Plume Dispersal for Sakura-Jima Using Real-Time Emission Rate Estimation, JDR, 14, 160–172, https://doi.org/10.20965/jdr.2019.p0160, 2019.

2 Response to Referee #2

We are grateful to the referee for the careful review of our paper. Please see each response below and changes in the manuscript addressing all comments of referee #2. Each number refers to each comment orderly.

1.1 General Comments

1. **Comment:** Reproduction of ash dispersal from past eruption is an exercise already published elsewhere and for a number of past eruptions. I have to say with better results than for the Taisho eruption. This is probably due to the poor constraints on actual deposits and the broad assumption on meteorological model used for running the simulations.

   Response: We recognised that various publications already discuss the reproduction of ash dispersal from past eruptions. However, previous studies on the ash dispersal from a large-scale eruption of the Sakurajima volcano did not consider the impact on wider areas and distal locations in Japan. As we explained in Sect 2, the Taisho eruption is regarded as the typical eruption that a large-scale eruption in the Sakurajima volcano would resemble. Based on such a finding, reproducing the Taisho eruption in contemporary weather will provide a framework to prepare responses for the upcoming ashfall disasters for all of Japan. As stated in the paper, we only used one eruption scenario (a deterministic eruption scenario with various winds distribution), but we did not limit the simulations to a particular atmospheric condition only. This approach is useful for determining the upper limit value on the ash dispersal as we set the parameter for the latest large-scale eruption of the Sakurajima volcano in any given weather scenario (Bonadonna, 2006). We understand that our deterministic approach limits the extent of presenting all possible outcomes of a large-scale eruption. We intend to improve our results with better methodology in future publications.

   Changes in manuscript: Lines 77-81 and 89-91.

2. **Comment:** Modern studies on hazard from ash dispersal use a thousand of simulations to produce probabilistic maps of ash deposition, able to capture the meteorological variability. Why to consider only the conditions of a given day? What are the meaning of this map in the light of ash fall hazard? Indeed, the probability to have the chosen condition for a future eruption at Sakurajima are very low. So in which way these simulations may help in drawing hazard maps?

   Response: Actually, we did not consider only the conditions of a given day in contrast to what the reviewer pointed out. **Instead, we did the simulation for 64 years (in total, 23,736 simulations) to obtain meteorologically-diverse ash deposits in the ground and airborne ash concentration**. In addition, we added examples of probabilistic ash deposition maps to show the dataset's usage in Sect. 4.2. The consideration of a specific day is solely for the validation procedure. For our case, we assumed that the model would produce a relevant ash distribution in wider space (all of Japan) if given the precise wind data on a specific eruption scenario (the Taisho eruption). Because of the lack of complete wind data during eruption time, we searched the date(s) with similar weather conditions to the eruption day, expecting to bear an equivalent wind pattern. Then, we matched the chosen date(s) simulation result with the available ground observation data and obtained a comparable result. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B. **The figures of the ash distribution map shown in the latter part of the paper (Fig. 10) are the results from the chosen date for the matching illustrations with the ground observation data** and are not representing the entire dataset.

   Changes in manuscript: Lines 59-61, 86-88, 282-288, and 434-435.

3. **Comment:** Honestly, I think the manuscript, in its present form, is of poor usefulness for ashfall hazard mitigation over Japan.

   Response: We acknowledged that we only used one eruption scenario (deterministic eruption scenario with various winds distribution) that may limit the extent of presenting all possible outcomes of a large-scale eruption, but **this approach is still useful for determining the upper limit value on the ash dispersal as we set the parameter for the latest large-scale eruption of Sakurajima volcano in any given weather conditions**. In addition, we added examples of probabilistic maps of ash deposition to show the usage of the dataset in Sect. 4.2. The dataset contains meteorologically-diverse ash deposits in the ground and airborne ash concentrations. When a large-scale eruption of the Sakurajima volcano (like the Taisho eruption) occurs in contemporary settings, the extensive size of the dataset, for example, can provide its users with an evaluation of conditional ashfall risk in Japan, analyses of both the dispersal and deposition pattern volcanic ashfall over a long period, hazard maps for the disaster risk management process, and the tendency of ashfall distribution over a large region.

   Changes in manuscript: Lines 59-61, 86-88, and 319-376.

1.2 References

Referee comment on “Long-Term Ash Dispersal Dataset of the Sakurajima Taisho Eruption for Ashfall Disaster Countermeasure” by Haris Rahadianto et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-42-RC2, 2022.

Tanaka, H. L., Nakamichi, H., and Iguchi, M.: PUFF Model Prediction of Volcanic Ash Plume Dispersal for Sakurajima Using MP Radar Observation, Atmosphere, 11, 1240, https://doi.org/10.3390/atmos11111240, 2020.

Tanaka, H. L. and Iguchi, M.: Numerical Simulations of Volcanic Ash Plume Dispersal for Sakura-Jima Using Real-Time Emission Rate Estimation, JDR, 14, 160–172, https://doi.org/10.20965/jdr.2019.p0160, 2019.

Bonadonna, C.: Probabilistic modelling of tephra dispersion, in: Statistics in Volcanology, edited by: Mader, H. M., Coles, S. G., Connor, C. B., and Connor, L. J., The Geological Society of London on behalf of The International Association of Volcanology and Chemistry of the Earth’s Interior, 243–259, https://doi.org/10.1144/IAVCEI001.19, 2006.

3 Response to Referee #3

We are grateful to the referee for the careful review of our paper. Please see each response below and changes in the manuscript addressing all comments of referee #3. For the general comments, each number refers to each comment orderly. Meanwhile, for the specific comments and technical corrections, the responses are structured based on the order of the lines in the manuscript.

1.1 General Comments

1. **Comment:** In my opinion, the authors should have used this data set to then develop a probabilistic map of ashfall deposits (and perhaps airborne concentrations at certain times post-eruption) and provided that as a useful hazard map for emergency planners.

   Response: We added one more subsection (Sect. 4.2) containing probabilistic maps of ashfall ground deposits tas suggested. We intended to present more detailed analyses in another publication since the paper here focuses more on dataset generation.

   Changes in manuscript: Added lines 319-376.

2. **Comment:** I am perplexed by this effort to apply novel techniques to query the meteorological records to find two days with weather that generally match the unusual weather conditions believed to have existed during the Taisho eruption. The Taisho eruption is then modelled with the meteorological conditions of those two days to derive ashfall maps that are compared with the map of ashfall from the Taisho eruption. I find this exercise to be unnecessary and of limited utility, as the PUFF model does not require such validation. Moreover, the map comparisons provided in Figure 15 do not show very good agreement.

Response: We acknowledged the referee's comment that the PUFF model performance for ash dispersal simulation from a volcanic eruption is well-established. Our intentions in presenting the validation section are to illustrate the dataset's quality and to check the model's performance for replicating the past large-scale eruption. For smaller-scale eruption cases, the validation of ash dispersal simulation using the PUFF model for Sakurajima eruptions has been done successfully before (e.g. Tanaka and Iguchi, 2019; Tanaka et al., 2020). Therefore, we think it is also necessary to provide a validation framework for a large-scale eruption of the Sakurajima volcano. For our case, we assumed that the model would produce a relevant ash distribution in wider space (all of Japan) if given the precise wind data on a specific eruption scenario (the Taisho eruption). Because of the lack of complete wind data during eruption time, we searched the date(s) with similar weather conditions to the eruption day, expecting to bear an equivalent wind pattern. Then, we matched the chosen date's simulation result with the available ground observation data and obtained a comparable result. Besides the intention, we understand that the mechanism we utilised is complicated and has limitations, so it may not yield perfect results, both in the wind patterns found through the searching process and the ash distribution from the simulation. Therefore, we can follow the reviewer's recommendation to, perhaps, remove the validation section, but it is also fair for us to show some level of validity for the ash dispersal simulation on a large-scale eruption case like the Taisho eruption. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

Changes in manuscript: Lines 378-444 and 518-741 (Moved to Appendix B).

3. **Comment:** Sections 5.2 through 5.3 of the paper are an interesting description of applying AI to sort through a complex data set, but anything novel in these sections should probably be published in a separate paper. They have little bearing on calculating the ashfall hazard across Japan.

   Response: We moved the sections mentioned to Appendix B.

   Changes in manuscript: Lines 518-741 (Moved to Appendix B).

4. **Comment:** Another general comment is that the entire manuscript should be edited by a native English speaker prior to publication. Portions of the manuscript require extensive editing for proper English.

   Response: We used the professional proofreading service to check and enhance the final revision of the manuscript before resubmitting again to the editor.

   Changes in manuscript: All changes from the native English speaker have been implemented in the manuscript.

1.2 Specific Comments

1. **Line 133-134:** What is the phenomenon referred to? This is not clear.

Response: The phenomenon here refers to the massive ash deposits found in Bonin Islands (Ogasawara), located 1222 km from the volcano. Revised to clarify the sentence further.

Changes in manuscript: Lines 134-136.

2. **Line 135-136:** First, how do we know the average wind velocity from this period in 1914? And what elevation does this refer to? Surface winds?

   Response: The winds here refer to the calculation done by both Omori (1914) and Todde et al. (2012) based on the arrival of ashes in cities reported by the meteorological office at that time and sightings in the tobacco plantations. Both publications explained the calculation in detail. Added explanation to clarify the sentence further.

   Changes in manuscript: Lines 137-140.

3. **Line 427-429:** This sentence is not clear. The span of 1996-2021 contains > 9000 days. Are the authors trying to convey that certain days have very similar weather conditions, and therefore the number of days considered can be reduced? If so, what exactly allows two days' weather to be considered similar enough that one can be eliminated from consideration?

   Response: Due to seasonal differences and the data availability, we only used the weather charts on winter days (Dec, Jan, Feb, and Mar) from 1996-2021 to find similar weather to the eruption weather. As we explained in Sect. 5.1, we assume that the meteorological features of the eruption day (calm and clear sunny days with high pressure and weak winds) over Japan during winter is rare but can exist in the future. Therefore, the uncommon atmospheric features during winter are crucial factors; hence we only used winter days and not all seasons. Based on this assumption, the similarity in weather is determined by matching the features found in the weather charts with the feature described in multiple reports on the eruption.

   Changes in manuscript: Lines 564-569 and 624-626 (Moved to Appendix B).

4. **Line 135-136:** This sentence highlights much that I see problematic in this paper. Validating the results provided by the PUFF model is not necessary. Identifying days with unusual weather conditions similar to those present during the Taisho eruption is unimportant, because there is no need to validate that PUFF produces a similar ashfall distribution under those conditions present during the 1914 eruption. Finally, the PUFF simulations do not agree well with the observed 1914 distributions, so the attempted validation was not successful.

   Response: We acknowledged the referee's comment that the PUFF model performance for ash dispersal simulation from a volcanic eruption is well-established. Our intentions in presenting the validation section are to illustrate the dataset's quality and to check the model's performance for replicating the past large-scale eruption. For smaller-scale eruption cases, the validation of ash dispersal simulation using the PUFF model for Sakurajima eruptions has been done successfully in the previous studies. Therefore, we think it is also necessary to provide a validation framework for a large-scale eruption of the Sakurajima volcano. For our case, we assumed that the model would produce a relevant ash distribution in wider space (all of Japan) if given the precise wind data on a specific eruption scenario (the Taisho eruption). Because of the lack of complete wind data during eruption time, we searched the date(s) with similar weather conditions to the eruption day, expecting to bear an equivalent wind pattern. Then, we matched the chosen date's simulation result with the available ground observation data and obtained a comparable result. Besides the intention, we understand that the mechanism we utilised is complicated and has limitations, so it may not yield perfect results, both in the wind patterns found through the searching process and the ash distribution from the simulation. Therefore, we can follow the reviewer's recommendation to, perhaps, remove the validation section, but it is also fair for us to show some level of validity for the ash dispersal simulation on a large-scale eruption case like the Taisho eruption. To clarify further, we revised a large part of the validation section in the main text (Sect 5.1) and moved the details of the validation procedure to Appendix B.

Changes in manuscript: Lines 378-444 and 518-741 (Moved to Appendix B).

1.3 Technical Corrections

1. **Line 142:** I do not see this map in the paper. If it is in the paper, specify which figure it is.

   Response: The ash dispersal map mentioned in the sentence is referred to as the map in Figure 2.2, page 8 in Mita et al. (2018) and supplementary materials in Todde et al. (2012). These maps were referred in the earlier sentence.

   Changes in manuscript: Lines 144-147.

2. **Line 232:** Refers to Figure 4 for the first time. This figure requires improvement. The resolution is too small and the figure text is not readable. The figure has two columns and five rows.

   Response: We added the full-resolution image that can be downloaded separately accompanying the manuscript and revised the figure's description in the text as suggested.

   Changes in manuscript: Line 241.

3. **Line 235:** This is opposite what the figure caption states.

   Response: Revised following the suggestion.

   Changes in manuscript: Lines 242-253.

4. **Line 236:** The figure has only two columns. The figure caption alone does not convey complete information to understand the differences between the five rows.

   Response: Revised following the suggestion.

   Changes in manuscript: Lines 242-253.

5. **Line 318:** Contains the acronym "ESP." This needs to be defined.
   Response: Acronym was removed in the revised version.
   Changes in manuscript: Removed the acronym in the revised version.

6. **Line 386-387:** I believe this should read "particular day."
   Response: Revised following the suggestion.
   Changes in manuscript: Line 577 (Moved to Appendix B).

7. **Line 386-387:** Mentions the date 5 March 1997. This date/year is mentioned several more times on this page. However, Figure 14 and its caption use the date 5 March 1995. Clarify whether the date of interest is in 1995 or 1997.
   Response: The selected date is supposed to be 5 March 1997. Revised following the suggestion.
   Changes in manuscript: Line 717 (Moved to Appendix B).

8. **Line 539:** The heading for Section 5.3. It is mislabelled as 5.2.
   Response: Removed the section and moved the contents in the Sect 5.1.
   Changes in manuscript: Lines 377-443

9. **Line 542 & 555:** Both refer to Figure 6. I believe they should refer to Figure 7.
   Response: Sentences were removed in the revised version.
   Changes in manuscript: Removed the sentence in the revised version.

10. **Line 539:** Part of the caption for Figure 11, has a reference to Japan Meteorological Agency, 2022. This reference is not in the reference list.
    Response: Added new reference following the suggestion.
    Changes in manuscript: Added lines 868-869.

11. **Line 894 & 895:** After examining figure 15, I believe grey-stripped should be red-stripped, and dark grey should be light brown.
    Response: Revised following the suggestion.
    Changes in manuscript: Lines 436-437.

12. **Line 897-899:** This caption is incorrect, as it is the same caption as Figure 15.
    Response: The figure was removed in the revised version.

Changes in manuscript: Removed the figure in the revised version.

13. **Line 932:** Figure 8 contains a thick black line with an arrow. The caption does not explain this line. I believe it may be the latitude of maximum wind velocity each month, but the caption should explain the thick black line.
    Response: Revised following the suggestion.
    Changes in manuscript: Lines 537-538 (Moved to Appendix B).

14. **Line 947:** Figure 14 differs from the caption explanation. The caption explanation of 14b appears to be the wind rose labelled as 14c. Likewise, the caption explanation of 14c appears to be the wind rose labelled as 14b.
    Response: Revised following the suggestion.
    Changes in manuscript: Lines 733-734 (Moved to Appendix B).

1.4 References

Referee comment on "Long-Term Ash Dispersal Dataset of the Sakurajima Taisho Eruption for Ashfall Disaster Countermeasure" by Haris Rahadianto et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-42-RC3, 2022.

Tanaka, H. L., Nakamichi, H., and Iguchi, M.: PUFF Model Prediction of Volcanic Ash Plume Dispersal for Sakurajima Using MP Radar Observation, Atmosphere, 11, 1240, https://doi.org/10.3390/atmos11111240, 2020.

Tanaka, H. L. and Iguchi, M.: Numerical Simulations of Volcanic Ash Plume Dispersal for Sakura-Jima Using Real-Time Emission Rate Estimation, JDR, 14, 160–172, https://doi.org/10.20965/jdr.2019.p0160, 2019.