SUPPLEMENT COMMENTS

Comment #1: "*This was not assessed at all, not even as suggestions in the discussion section*" on "*Ashfall Disaster Countermeasure*" part in the title.
Response: We found that we did not comprehensively describe the dataset's usage and significance, as pointed out by the referee. If it is allowed by the editor, we would like to add one more subsection within Sect. 4 to explain the usage example of the dataset. The dataset is intended to provide information for the local government to prepare the response plans for the ashfall impacts during a large-scale volcanic disaster. The information available in the dataset (ground deposits and airborne concentrations) will be useful for preparing responses such as the creation of conditional ashfall risk maps, early warning system enhancement, planning for ash clean-up operations, closure management on both air and land transportation, and long-term / long-distance evacuation. In addition, other types of users, such as researchers and private sectors, can use the dataset to further research the mitigation strategies against ashfall hazards.

Comment #2: "*amplified*" on "*amplifies*" word in section 1 on page 2.
Response: We will change it following the correction.

Comment #3: "*The high possibility of a large-scale explosive eruption in the following decades* ***that*** *probably* ***would*** *resemble the past even*" on "*The high possibility of a large-scale explosive eruption in the following decades probably resembles the past even*" sentence in section 2 on page 4.
Response: We will change it following the correction.

Comment #4: "*an enormous volume of volcanic material*" on "*enormous eruptive materials*" sentence in section 2 on page 4.
Response: We will change it following the correction.

Comment #5: "*are*" on "*were*" word in section 2 on page 5.
Response: We will change it following the correction.

Comment #6: "*better in number*" on "*nine*" word in section 2 on page 5.
Response: We will change it following the recommendation.

Comment #7: "*redundant*" on "*give clear and definitive clarification*" clause in section 2 on page 5.
Response: We will remove it following the recommendation.

Comment #8: "*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.."* on"*fast-travelling as*" clause in section 2 on page 5.
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.

Comment #9: "*From this sentence, it's not clear how it would help"* on "*One of the main aims we produce the dataset here is to provide the necessary information, which is vital in modern times. By having an extended period dataset on ash dispersal in wider areas for a worst-case scenario, hopefully, comprehensive countermeasure strategies can be derived to reduce the ashfall risk further*" sentences in section 2 on page 5.
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 would like to revise the sentences and explain this part better.

Comment #10: "*and works better within the first 48 hours of the eruption..*" on "*The PUFF mode*" clause in section 3 on page 6.
Response: We will add additional sentences following the recommendation.

Comment #11: "*this value is concerning...not sure it the PUFF model works well after the first 48 hr simulation..*" on "*96 hour*" clause in section 3 on page 7.
Response: We use the 96 hours to track the ash dispersal further to entire Japan. The eruption itself only lasted 48 hours in the simulation.

Comment #12: "*This sentence is not clear"* on "*We assume that one ash particle contained 450 tons of ash mass when plume height reached its peak, and by giving the virtual mass to each particle, we can alleviate the uncertainty that appeared when assigning the small number of particles in the simulation (see Scollo et al., 2011)*" sentences in section 3 on page 9.
Response: We mean that each particle will have 450 tons of virtual mass when the eruption reaches its peak, i.e, the maximum plume height. Scollo et al. (2011) clarify that there will be uncertainty when simulating ash dispersal using the small number of particles, as it would not represent the actual mass ejected from the volcano. We will revise the sentences and explain this part better.

Comment #13: "*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*" on "*When the eruption occurred, the vicinity of Kagoshima city and Sakurajima volcano were experiencing a maximum atmospheric pressure in four days, providing a unique characteristic of the Taisho eruption*" sentence in section 5.1 on page 12.
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 complete checking with the ground truth. 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 the general weather conditions, we would validate the simulation results using general wind data. We do not mean only publishing the dataset with the same weather conditions as the Taisho eruption. We realised that we did not describe our validation structure clearly, and we would like to revise and add more details in Sect. 5.

Comment #14: "*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*" on "*From 9 January 1914 to the morning of 13 January 1914, atmospheric pressure in Japan consistently recorded an unusual high, resulting in stable sea waves and low-velocity winds indicating calm and clear weather at most of the places (Omori, 1914)*" sentence in section 5.1 on page 12.
Response: In the upcoming publications, we will present a risk map considering Japan's general weather conditions. We will describe that as one of the dataset's usage examples in the additional subsection, as mentioned in our reply to the referee's comment on the paper title.

Comment #15: "*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..*" on "*Following such reports, we concluded that the clear, sunny weather with weak winds played a big part in transporting ashfall to entire Japan, and also such conditions, although rare, can be repeated*" sentence in section 5.1 on page 12.
Response: We are not proposing the rare conditions of one of the biggest eruptions in Japan as the common. In the previous comment, we explained that the description of unusual weather conditions during the Taisho eruptions is for validation purposes.

Comment #16: "*I'm not sure if its 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...*" on "*Finding the Identical Weather Characteristics*" title of section 5.2 on page 12.
Response: Yes, finding the specific weather conditions of the Taisho eruption is challenging, as we explained further in Sect. 5.2.

Comment #17: "*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.*" on "*it is beyond the scope of this paper.*" clause in section 5.2.2 on page 15.
Response: As we explained the validation mechanism in the text and earlier replies, the process we did in this section is to find a similar weather to the eruption day, as a means to present the checking mechanism with the ground truth. Using the method here with limited information at hand, we can carefully find a wind data that considerable similar to the wind data at the eruption day to reproduce the Taisho eruption.

Comment #18: "*Exactly...Why keep pushing into these context then?*" on "*proving that we may not observe the exact similar weather completely*" clause in section 5.2.3 on page 17.
Response: As we described in Sect. 5.1 that the unusual weather conditions at the Taisho eruption could be observed again in the meteorological data we used here (1958 to 2021). We recognise that the process of finding weather similarities may have its 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.

Comment #19: "*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?*" on "*This slight difference can slightly affect the ashfall distribution produced by the simulation.*" sentence in section 5.2.3 on page 17.
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. The small number of simulation results resembling the ash distribution of the Taisho eruption further confirms the unusual weather during such an event.

Comment #20: "*this should be concerning isn't? I mean, pressure is one of the spotlight parameters of the weather conditions during the Taisho eruption*" on "*Both dates contradict each other regarding high-pressure centres but exhibit the same weather characteristics.*" sentence in section 5.2.3 on page 17.
Response: Generally, both selected dates were enclosed by a high-pressure centre over Japan. Although the locations of the centre were slightly different, the weather report on those dates is similar to the eruption day. We understand that the description in this part is ambiguous, and we would like to revise the sentence more clearly.

Comment #21: "*May be this result is due to the fact that you're forcing these input conditions...*" on "*It should be noted that the simulation result may, in reality, depicts worse impacts on the map.*" sentence in section 5.3 on page 18.
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 it is not exact data observed during the eruption. The sentence here is to recognise such biases.

Comment #22: "*I would say that "similar" is better*" on "*have a matching ash dispersal pattern.*" clause in section 5.3 on page 18.
Response: We will change it following the recommendation.

Comment #23: "*Because they're similar not completely exact*" on "*similarities*" word in section 5.3 on page 18.
Response: Yes, we acknowledge the meaning of the word 'similar'.

Comment #24: "*so...none of the two conditions simulated were satisfying?*" on "*somewhat agreeable*" words in section 5.3 on page 18.
Response: We will revise the sentences and explain this part better.

Comment #25: "*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 clingling 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...*" on "*In summary, we successfully demonstrate the quality of the dataset under limited validation data with a novel method incorporating a machine learning technique.*" sentence in section 5.3 on page 18.
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 to 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 impact are heavily localised, so we could not just take any eruption outside Sakurajima volcano that may occur during normal weather. We already described that the model we use worked well smaller-scale eruptions of Sakurajima volcano (e.g. Tanaka and Iguchi, 2019; Tanaka et al., 2021). However, this is the first attempt to validate the result of the ash dispersal simulation of the Taisho eruption.

Comment #26: "*This is why, probabilistic methods are being used more often for this type of assessments.*" on "*However, a researcher must be careful when using this method as it introduces a significant bias in the mean height value.*" sentence in section 5.4 on page 19.
Response: We acknowledge the dataset's limitations and drawbacks, as explained in the limitation section.

Comment #27: "*This is one of the main reasons why you should use a probabilistic approach.*" on "*though we recognise wide variability that could change the significance of the implied hazard.*" clause in section 5.4 on page 19.
Response: We acknowledge the dataset's limitations and drawbacks, as explained in the limitation section.

Comment #28: "*That's right, and is one of the drawbacks of using deterministic approaches, like the one you use in this work.*" on "*However, variations on those parameters could result in different eruption rates and total mass, resulting in different ashfall footprints.*" sentence in section 5.4 on page 19.
Response: We acknowledge the dataset's limitations and drawbacks, as explained in the limitation section.

Comment #29: "*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?*" on "*It should be noted that the variability in the different meteorological databases seems relatively insignificant*" sentence in section 5.4 on page 20.
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 understand that the description in this part is ambiguous, and we would like to revise the sentence more clearly.

Comment #30: "*which was not fully successful*" on "*we conduct the validation procedure*" clause in section 6 on page 20.
Response: We will revise the sentences and explain this part better.

Comment #31: "*lowercase*" on "*Blue*" word in Figure 1 caption on page 27.
Response: We will change it following the correction.

Comment #32: "*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.*" on "*Figure 5*" title in Figure 5 on page 35.
Response: We will move it the appendix following the recommendation.

Comment #33: "*Same suggestion as figure 5*" on "*Figure 6*" title in Figure 6 on page 35.
Response: We will move it the appendix following the recommendation.

Comment #34: "*same suggestion as figure 5-6*" on "*Figure 9*" title in Figure 9 on page 37.
Response: We will move it the appendix following the recommendation.

Comment #35: "*better in appendix*" on "*Figure 12*" title in Figure 12 on page 38.
Response: We will move it the appendix following the recommendation.