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## Comment on acp-2022-282

Anonymous Referee #1

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Referee comment on "Detection of Stratospheric Air Intrusion Events From Ground-based High-resolution  $^{10}\text{Be}/^{7}\text{Be}$  by Accelerator Mass Spectrometry" by Xu-Ke Liu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-282-RC1>, 2022

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Review of "Detection of stratospheric air intrusion events from ground-based high-resolution  $^{10}\text{Be}/^{7}\text{Be}$  by accelerator mass spectrometry" by X K Liu et al.

In this paper, the authors derive  $^{10}\text{Be}$  and  $^{7}\text{Be}$  measurements from collected aerosol and rainwater samples from 7 locations in central China. A large amount of data is presented. I will return to the question of the data coverage in my comments. The results are interesting and should be eventually published in final form, however, some details seems to be glossed over and need to be addressed.

In my view, the paper needs major revision.

- abstract, line 30-32. Here, it says that 24% of  $^{10}\text{Be}$  in Xi'an (XA) air was dust-borne, yet the various figures 2 and 3 show considerable variability.
- line 48 delete "hard-to-capture". I am not sure what is meant here, but I assume you mean that it is difficult to quantify the intrusion events. Perhaps rewrite the sentence.
- line 57 "intrusions"
- line 64 replace "it is generally believed.." with "it has been suggested.."
- line 74 delete "the" before "very different"
- Line 82-87. Here, it is stated that  $^{7}\text{Be}$  was done by AMS. This is not correct. **Some of the measurements were done by AMS.** In the supplementary data and lines 166-169, it is stated that "some .. membranes were selected and  $\frac{1}{4}$  of them were measured by AMS. The  $^{7}\text{Be}$  in the remaining  $\frac{3}{4}$  filter membranes...were analyzed by high-purity germanium (HpGe) detector(s)..and analyzed a 477.6KeV..". Maybe this was only a fraction of the samples, but please rewrite and explain what was actually done.
- Line 105-106. It is stated here that "an annual record with daily resolution" was obtained. This is most true for site XA (Xi'an) and QL (Qinling) but even there, it's not actually daily, there are missing values.
- Section 2.1 Samples from the other sites were only measured at a few times in October

2020, Jan 2021 and April 2021.

- Section 2.3 lines 148-151 and supplement. 1-2. Here, it is stated that the “transmission after the second stripping foil” was improved to ~24%. If this is into  $^{10}\text{Be}^{4+}$ , this is a remarkable improvement. Most labs get lower yields even into 3+. Also, what is the location of the second stripping foil? I assume it is after the analyzing magnet and before an ESA, but no details of the AMS setup are given. The discussion in the reference Zhang and Fu (2017) is not completely helpful. First, in that paper, the yield from  $\text{Be}^{2+}$  to  $\text{Be}^{3+}$  is given as 31% **and from  $\text{Be}^{3+}$  to  $\text{Be}^{4+}$  is 3%. If some other improvement was done, it is not clear from this paper.** Also, much of the paper of Zhang and Fu (2017) discusses other methods, such as using  $\text{BeF}_3^-$  as an injection beam. Hence, we still don’t know from the paper presented here by Liu et al. which method was used.
  - Line 182-188. Here, the values from previous work on  $^{10}\text{Be}$  have errors, it would be good to quote them here.
  - Line 234. “material”
  - Line 236. I think “atmospheric movement information” isn’t a good term, please use something like “atmospheric circulation”
  - Line 247. I think the accepted value of the half-life is 1.38Myr.
  - Line 250. “cannot”
  - Line 265 “aridity” not “dryness”
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- Figures 2,3 and 4 have small font sizes and they can be hard to read. I suggest scaling up the figures in the revised version.
  - Line 333-334. What are the “V” events and don’t you have meteorological data about what happened on those days at XA and QL?
  - Line 402-406 restates what has already been said and can be deleted.
  - Line 369. This seems to be a new subject here. It appears the authors try to argue that the ozone in the ground-based measurements at XA are not due to photochemical effects (e.g. due to pollution) and the ozone is due to stratospheric injection. This seems like a long shot, especially in a city like XA with considerable anthropogenic air quality problems, although I agree others (e.g. Langford) have assert similar effects elsewhere.
  - Figure 4b. How are the data in figure 4b compared to fig. 4a? Are all the data used? 4b refers only to XA, but 4a also includes QL data.
  - Line 455. “STE is an important channel...”. This sentence needs rewriting and makes little sense at present. Perhaps STE are important processes that can quickly transmit chemical material from the stratosphere into the lower atmospheric environment..”