

## Comment on **essd-2021-35**

Anonymous Referee #2

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Referee comment on "A global dataset of atmospheric  $^7\text{Be}$  and  $^{210}\text{Pb}$  measurements: annual air concentration and depositional flux" by Fule Zhang et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-35-RC2>, 2021

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This paper presents a global data set of surface air concentrations and depositional fluxes of  $^7\text{Be}$  and  $^{210}\text{Pb}$  that the authors compiled from literatures published during 1955-2020. This effort is timely as it has been a long time since last time such a data set was compiled. The two radionuclides are very useful tracers for studying Earth's surface (land/ocean) processes as well as transport and deposition processes in the atmosphere. The new data set is expected to be widely used and cited in the years to come. The content of this paper is generally well presented, but I do have some concerns that should be addressed before its publication on ESSD.

Major comments:

(1). There are many typos and grammatical errors in the text. Some are listed below. Editing assistance is needed (perhaps from coauthor MB) and would significantly improve the presentation.

(2). "Finally, we acknowledge that the seasonal information is indeed not much discussed for this dataset. (P22, L456-457)"; "Further compilation of monthly data is also warranted to assess seasonal variability of  $^7\text{Be}$  and  $^{210}\text{Pb}$  and understand the relationship between these changes and influencing factors such as atmospheric dynamics, meteorological condition, and geographic location on a global scale. (P23, L465-468)"

---- As authors mentioned in the paper, seasonal air concentrations and depositional fluxes of  $^7\text{Be}$  and  $^{210}\text{Pb}$  are not reported. Such data would otherwise significantly increase the value of this new compilation. For example, the seasonal data can be used to evaluate seasonality of transport in global atmospheric models. The authors are strongly encouraged to add the seasonal data into their data set, if at all possible. If not, a discussion of why the seasonal data are not included would be helpful. In that case, compiling the seasonal data in a future effort is also encouraged.

(3). Is the unit of air concentration "mBq m<sup>-3</sup>" or "mBq / SCM" where "SCM" stands for standard cubic meter?

(4). P2, L34-35: "Depositional flux of <sup>7</sup>Be is independent of longitude but depends on the altitude and the ~11 years solar cycle"

---- As Figure 4c shows, the <sup>7</sup>Be depositional flux does depend on longitude, and the error bars show the longitudinal variability of <sup>7</sup>Be deposition fluxes is quite large at northern mid-latitudes. Do you mean the production rate of <sup>7</sup>Be is independent of longitude? Do you mean "latitude" by "altitude" here?

P22, L441-444: "As mentioned above, <sup>7</sup>Be depositional flux is independent of longitude and is constant over broad latitudinal bands. Thus, the <sup>7</sup>Be depositional flux data in our dataset can be used to estimate <sup>7</sup>Be ocean inventory in the same latitude, which can avoid the collection of the large volume of seawater samples and extend the application of <sup>7</sup>Be in the Open Ocean."

Again, see the comment above. In that case, the <sup>7</sup>Be depositional flux data in the dataset would not be able to be used to estimate <sup>7</sup>Be ocean inventory in the same latitude.

Minor comments:

P1, L29: Earth's surface AND ATMOSPHERIC processes

P2, L32-34: correct grammar.

P2, L56: studyING

P2, L56: add comma after all "e.g." throughout the text

P3, L80: fluxes OF <sup>7</sup>Be

P3, L84: "To date, only one dataset was published that compiled <sup>7</sup>Be and <sup>210</sup>Pb together (Persson, 2016)" --- is it actually a 2015 publication?

Persson, B. R. R. (2015) Global distribution of <sup>7</sup>Be, <sup>210</sup>Pb and, <sup>210</sup>Po in the surface air.

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P4, L111: This is confusing. Correct grammar. Complementary is an adjective.

P5, L133: Alternately - do you actually mean "Alternatively, "

P6, L158-162: This sentence is way too long and hard to understand. Please revise.

P6, L171: "and hence those are data are not included" – please rewrite.

P7, L175: , AND the latter

P7, L200: remove "the" before "dating ice core"

P7, L204: typo "filed" (field)

P8, L209: can ALSO be obtained

P8, L223: only those sites WITH more than one year of data

P10, L255: THE number of

P13, L301: "a sharp increment in  $^7\text{Be}$  air concentration occurred on the Antarctic continent" – this reflects the subsiding motion of air over the Antarctic continent

P15, Fig.5: the convention is to plot from South to North (x-axis). Also indicate what the whiskers / dots / bars stand for.

P21, L406: "CTM" is the abbreviation for chemical transport model; it's not a model name.

How about "a CTM based on GISS GCM"?

P21, L431-432: Not sure what " $\text{Bq m}^{-2} \text{ y}^{-1}$  / mean-life of the isotope,  $\gamma$ " means.

P22, L450: change "in areas" to "areas"

P22, L454: "which ARE almost"

P23, L470: correct " $\text{SO}_4$ ".

P23, L471-472: what is the connection between the 1<sup>st</sup> and 2<sup>nd</sup> sentences?

P23, L473-474: how about zonal transport?

P23, L474-477: Do these lines mean the following? "In the middle and upper troposphere where precipitation is much less frequent, the removal rate of aerosols is also slow. Collection of air samples in that part of the atmosphere will provide useful information on the total deposition velocity of aerosols (Lal and Baskaran, 2012)."