1 Response to Anonymous Reviewer #1

This manuscript provides an incredible contribution to the literature through the compilation of annual concentrations and annual deposition fluxes of Be-7 and Pb-210 around the world. Overall, the manuscript is well-written (although there are multiple typos throughout the text) and the data treatment/interpretation is of interest to a large audience (including vast research communities dealing with processes occurring in the atmosphere, the ocean, soils and rivers and for which the use of Be-7 and Pb-210 as a tracer is particularly useful).

9 We would like to thank the anonymous referee #1 for taking the time to provide a 10 thorough review of our submitted manuscript. The comments are very valuable and the 11 suggestions are very helpful. These comments and suggestions help us in greatly 12 improving the quality of our MS. In addition, language has been carefully further edited

- 13 by one of the coauthors Mark Baskaran.
- 14 Below, the original comments are in black, our responses are in blue.
- 15 General remarks
- 16 In my opinion, there is a research topic missing from the list, i.e. use of Be-7 and Pb-

210 as tracers of the sources and dynamics of riverine sediment (and not only soils and
ocean particles, there are transfers in-between both compartments). This should be

19 acknowledged in the text, with some supporting references.

Response: We fully agree this comment. We have incorporated the use of <sup>7</sup>Be and <sup>210</sup>Pb
as tracers for the sources and dynamics of sediments in freshwater systems (not only
rivers but also lakes). This is incorporated in the text throughout this paper. Specific
revisions are as follows:

 Abstract: 'for tracing soil redistribution processes on land and particle dynamics and...' will be changed as 'for tracing soil redistribution processes on land, particle dynamics in aquatic systems and mixing processes in open ocean...'

2) Introduction: 'Meanwhile, <sup>7</sup>Be and <sup>210</sup>Pb are also widely used for indicating particle 27 transport, deposition, and resuspension in estuarine and coastal regions' will be 28 rephrased as 'Meanwhile, <sup>7</sup>Be and <sup>210</sup>Pb are also widely used as tracers of sediment 29 source identification and particle dynamics in rivers (e.g., Bonniwell et al., 1999; 30 Matisoff et al., 2005; Jweda et al., 2008; Mudbidre et al., 2014; Baskaran et al., 31 2020;), lakes (e.g., Dominik et al., 1987; Schuler et al., 1991; Vogler et al., 1996), 32 estuaries and coasts (e.g., Baskaran et al., 1997; Huang et al., 2013; Wang et al., 33 2016)' 34

3) Section 3.6, 'In the estuarine and coastal areas, the mass balance calculations of <sup>7</sup>Be and...' will be rephrased as 'In aquatic systems (including river, lake, estuary and coast), the mass balance models of <sup>7</sup>Be and <sup>210</sup>Pb<sub>ex</sub> have become powerful tools to understand the sediment source, transportation and resuspension processes (e.g., Wieland et al., 1991; Feng et al., 1999; Jweda et al., 2008; Huang et al., 2013; Mudbidre et al., 2014), in such models, the atmospheric depositional input of <sup>7</sup>Be

and <sup>210</sup>Pb is a required source term. In addition, <sup>7</sup>Be/<sup>210</sup>Pb<sub>ex</sub> activity ratio can be
used to identify the source area of sediments (Whiting et al., 2005; Jweda et al.,
2008; Wang et al., 2021), to quantify the age of sediments (Matisoff et al., 2005;
Saari et al., 2010), and to determine the transport distance of suspended particles
(Bonniwell et al., 1999, Matisoff et al., 2002). Thus, <sup>7</sup>Be and <sup>210</sup>Pb atmospheric
depositional flux data are important for tracing particle dynamics in aquatic
systems';

- 48 4) Conclusion, 'a basic parameter for tracing soil erosion, particle dynamics, and...'
  49 will be changed as 'a basic parameter for tracing soil erosion on land, particle
  50 dynamics in aquatic systems, and...'
- 51 Reference
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   turbid estuary of south-east Texas, Estuar. Coast. Shelf S., 45, 165-176, 1997.
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  sediment resuspension rate in a shallow riverine system: case study from Southeast Michigan, USA,
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  in a mountain stream using fallout radionuclides, Geomorphology, 27, 75-92, 1999.
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  of suspended particles in a partially mixed estuary, Geochim. Cosmochim. Ac., 63, 2487-2505,
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   coastal region determined by natural particle-reactive radionuclides (<sup>7</sup>Be, <sup>210</sup>Pb, and <sup>234</sup>Th), J.
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   Agricultural Watersheds that Drain to Lake Erie, J. Environ. Qual., 31, 62-72, 2002.
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  of Po-210 and Pb-210 in a riverine system in Southeast Michigan USA. J. Environ. Radioact., 138,
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  Hofmann, H. J., Suter, M., and Wolfli, W.: A multitracer study of radionuclides in Lake Zurich,

- 83 Switzerland: 1. Comparison of atmospheric and sedimentary fluxes of <sup>7</sup>Be, <sup>10</sup>Be, <sup>210</sup>Pb, <sup>210</sup>Po, and
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   Under Different Tidal Conditions as Determined Using Multiple Radionuclide Tracers, J. Geophys.
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  Switzerland: 2. Residence times, removal processes, and sediment focusing, J. Geophys. ResOceans, 96, 17067-17080, 1991.

Overall, I thought that there might be a confusion regarding Pb-210 measurements
between the supported Pb-210 and the unsupported Pb-210 (that referred to as 'excess
Pb-210'); could this be clarified in the text?

- 100 Response: This is clarified in section 2.2.3 as given below:
- 101  $^{210}$ Pb<sub>ex</sub> is the difference between total (measured)  $^{210}$ Pb and the supported  $^{210}$ Pb in the
- soils. Supported <sup>210</sup>Pb is assumed to be the same as <sup>226</sup>Ra activity, under the assumption
- 103 of secular equilibrium between <sup>226</sup>Ra and supported <sup>210</sup>Pb. It can also be obtained by
- assuming that the supported <sup>210</sup>Pb activity is equal to the total <sup>210</sup>Pb at depth greater
- than 30 cm in the soil profile where atmospherically-delivered <sup>210</sup>Pb has not reached
- 106 (Matisoff et al., 2014).
- 107 Reference
- Matisoff, G.: <sup>210</sup>Pb as a tracer of soil erosion, sediment source area identification and particle transport
   in the terrestrial environment, J. Environ. Radioactiv., 138, 343-354, 2014.
- 110 Database
- 111 Regarding the dataset in itself, I am not sure that modifications can still be made, but I
- 112 wondered whether the monitoring period (from year x to year y, typically) could be
- added? Currently, to the best of my understanding, only the publication year is referred.

114 Response: The modifications of dataset can still be made. However, there may be some

115 misunderstanding here. The monitoring period (if available) has already been

**included in the dataset**. To alleviate the referee's concerns, we have attached a partial

screenshot (as below) of the dataset, **please note the part enclosed by the red frame.** 

1	A	В	С	D	E	F	G	Н	1	J	
1	Site	Sampling time	Latitude (°N)	Longitude (	Altitude (n	Annual pro	Sampling device	Filter	Frequency	Data nun	<sup>7</sup> Be annu
148	Jungfraujoch, Switzerla	Jul 1996-Dec 1998	46.53	7.98	3580	NA	air flow rate of 32-68 m3/h	glass fiber (or cellulose nitrate) filters	2 days	568	7.00
149	Jungfraujoch, Switzerla	Apr 1996-Jan 1997	46.53	7.98	3580	NA	high volume air samplers	glass fiber (or cellulose nitrate) filters	2 days	~120	6.80
150	Jungfraujoch, Switzerla	Mar 2000-Feb 2001	46.53	7.98	3580	NA	HIVOL air sampler with flow rat	glass fibre filters	2 days	NA	5.60
151	Richland, USA	Jan 1967-Dec 1967	46.30	-119.28	NA	NA	NA	NA	NA	NA	2.67
152	GERN, Switzerland	Jul 1998-Oct 2011	46.20	6.10	421	NA	ASS-500 sampler station with flo	Petryanov filtering cloth	weekly	NA	3.74
153	Wisconsin, USA	May 1994 and Aug 19	46.17	-89.83	NA	NA	Anderson high volume air sample	quartz fiber filters	daily	43	4.00
154	Sondrio, Itlay	May 1991-April 1992	46.17	9.87	360	NA	electric blowing-fan (characterise	glass micro-fibre filters (diameter = 50	daily	NA	3.10
155	Monte Ceneri, Switzer	Jan 1994-Jun 1998 an	46.10	8.90	586	NA	ASS-500 sampler station with flo	Petryanov filtering cloth	weekly	NA	3.94
156	5 Ljubljana, Slovenia	Feb 2003-Dec 2011	46.09	14.59	281	NA	NA	NA	monthly	118	3.70
157	7 Macugnaga, Milan, Itla	Feb 2011-Dec 2011	45.95	7.96	1300	NA	flow rate of 28.3 L/min	Acetate Cellulose filters (0.8 µm pore	quarterly	4	3.60
158	3 Ispra, Milan, Itlay	Feb 2011-Dec 2011	45.82	8.61	NA	NA	flow rate of 28.3 L/min	Acetate Cellulose filters (0.8 µm pore	quarterly	4	4.21
159	Brunate, Itlay	Oct 1992-May 1993	45.82	9.10	800	NA	blowing-fan (characterised by an	glass micro-fibre filters (diameter 50 cr	2-3 days	NA	2.10
160	Puy de Dome, France	Oct 2005-Jul 2008	45.77	2.97	1465	NA	high-volume sampler having a flo	polypropylene fibres (Filters Jonell JP)	biweekly	~80	4.23
161	Opme France	Oct 2004-Jul 2008	45.72	3.07	660	NA	high-volume sampler having a flo	polypropylene fibres (Filters Jonell JPM	10 days	~45	4.30
162	Beaverton, Oregon, US	Jan 1977-Dec 1985	45.53	-122.88	64	NA	flow rate of about 1400 m3/day	Microsorban air filter medium 99/97-4	weekly	89	2.66
163	Beaverton, Oregon, U	Jan 1986-Dec 1993	45.53	-122.88	64	NA	NA	Dynaweb DW7301L filter material	weekly	178	2.20
164	1 Segrate, Milan, Itlay	Feb 2011-Dec 2011	45.49	9.29	NA	NA	flow rate of 28.3 L/min	Acetate Cellulose filters (0.8 µm pore	quarterly	15	3.64
165	5 Milano, Italy	Feb 1988-Jan 2011	45.47	9.18	125	NA	NA	NA	two weeks	473	3.00
166	5 Milan, Itlay	Sept 1993-Jun 1995	45.47	9.17	120	NA	blowing-fan (characterised by an	glass micro-fibre filters (diameter = 50	daily	NA	2.70
167	7 University Degli Studi o	Feb 2011-Dec 2011	45.46	9.20	NA	NA	flow rate of 28.3 L/min	Acetate Cellulose filters (0.8 µm pore	quarterly	3	3.59
168	B Hokkaido, Japan	Feb 2001-Aug 2001	45.32	142.17	NA	NA	high volume air sampler (SIBAT.	glass fiber filters (TOYO, GB-100R)	weekly	19	2.60
169	Vinca, Serbia	May 2011-Sep 2012	44.89	20.60	95	NA	constant flow rate samplers (air f	Whatman 41, 15 cm×25 cm in diameter	daily	15	5.06
170	Insitute, Belgrade, Serl	Apr 1994-Dec 2013	44.89	20.60	95	687.00	Air samples were collected by co	Whatman 41, 15 cm×25 cm in diameter	daily	260	3.76
171	City, Belgrade, Serbia	Jan 2004-Apr 2009	44.78	20.53	205	700.00	Constant flow rate samplers (ave	FILTRAK/Whatman 41/DDR, 15 cm	daily	52	2.73
172	Institute, Belgrade, Ser	Jan 2004-Apr 2009	44.89	20.60	95	700.00	Constant flow rate samplers (ave	FILTRAK/Whatman 41/DDR, 15 cm	daily	52	2.54
173	Monaco	Jan 1998-Dec 2010	44.83	7.50	15	622.00	Sierra-Anderson (type 305-200	Quartz microfiber filters of 0.8 µm por	monthly	112	6.69
174	1 Belgrade, Serbia	Jan 1996-Dec 2001	44.78	20.53	205	820.00	flow rate of 25 m3/h	FILTRAK/Whatman 41/DDR, 15 cm	daily	NA	2.10
175	Belgrade, Serbia	Jan 1991-Apr 1996	44.78	20.53	205	700.00	flow rate of 20 m3/h	FILTRAK/Whatman 41/DDR, 15 cm	daily	64	4.04
176	Kumodraz, Belgrade,	Mar 2009-Dec 2011	44.74	20.51	NA	NA	digital samplers DH 604EV.2 (F	Cellulose filter paper FJ213340 1.770	weekly	~140	1.76
177	7 Bordeaux, France	NA (3 y)	44.70	-0.70	30	NA	NA	NA	NA	NA	3.49
178	Mt.Cimone, Italy	Jul 1996-Dec 1999	44.20	10.70	2165	NA	air flow rate of 32-68 m3/h	glass fiber (or cellulose nitrate) filters	irregular interva	264	5.30
179	Mt.Cimone, Italy	Jan 1998-Aug 2011	44.20	10.70	2165	NA	Thermo-Environmental PM10 hi	rectangular glass fiber filters (Whatman	weekly	1609	4.30
180	) Ussuriysk, Russia	May 2009-Dec 2015	44.15	132.00	112	NA	NA	NA	daily	NA	4.47
	7Pa annual concentration 210Dh ensuel concentration 7Pa consul descrition flux 210Dh ensuel descrition flux										

In relation with this remark, how to explain the following statement: 'The dataset includes 494 annual surface air concentration data of <sup>7</sup>Be covering 367 different sites, 366 annual surface air concentration data of <sup>210</sup>Pb from 270 different sites, 304 annual depositional flux data of <sup>7</sup>Be from 279 different sites, and 645 annual depositional flux data of <sup>210</sup>Pb from 602 different sites.' >> these values at each site correspond to different years/periods then? I feel that this remains somewhat unclear...

Response: Yes, these values at each site correspond to different monitoring years/periods and were published in different articles. For example, at Malaga (Spain), the <sup>7</sup>Be air concentration data during 1992-1995, 1996-2001, 2000-2006 and 2009-2012 were published in Dueñas et al. (1999), Dueñas et al. (2004), Dueñas et al. (2009) and Gordo et al. (2015), respectively.

- 129 Reference
- Dueñas, C., Fernández, M. C., Liger, E., and Carretero, J.: Gross alpha, gross beta activities and <sup>7</sup>Be
   concentrations in surface air: analysis of their variations and prediction model, Atmos. Environ., 33,
   3705-3715, 1999.
- Dueñas, C., Fernández, M. C., Carretero, J., Liger, E., and Cañete, S.: Long-term variation of the
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   aerosols, Atmos. Environ., 38, 1291-1301, 2004.
- Dueñas, C., Fernández, M. C., Cañete, S., and Pérez, M.: <sup>7</sup>Be to <sup>210</sup>Pb concentration ratio in ground level
   air in Málaga (36.7°N, 4.5°W), Atmos. Res., 92, 49-57, 2009.
- Gordo, E., Liger, E., Dueñas, C., Fernandez, M. C., Canete, S., and Perez, M.: Study of <sup>7</sup>Be and <sup>210</sup>Pb as
   radiotracers of African intrusions in Malaga (Spain), J. Environ. Radioactiv., 148, 141-153, 2015.

Some of the results obtained in this meta-analysis are of very large interest for the 140 community. They could avoid colleagues to start monitoring Be-7 or Pb-210 fluxes and 141 rely on previous data monitoring. For instance, on Figure 7, providing the empirical 142 equations describing the relationships between annual precipitation and Be-7 143 depositional fluxes for different latitudinal bands would be extremely useful (at least 144 for those latitudinal bands where the relationship is satisfactory) >> could they be added 145 in a table and made accessible to the community? The same suggestion could be made 146 for Pb-210 in Figure 8. 147

Response: Thank you for the suggestion. The empirical equations describing the
 relationships between annual precipitation and depositional fluxes of <sup>7</sup>Be and <sup>210</sup>Pb for
 different latitudinal bands have been added in a table as given below. The Pearson's r,

- 151 p-value and number of data points have also been added in Table 2.
- 152 Table 2. A summary of empirical equations and fitting parameters describing the
- relationships between annual precipitation (x) and <sup>7</sup>Be and <sup>210</sup>Pb depositional fluxes (y) for different latitudinal bands

Nuclides	Latitudinal band	Empirical equation	Pearson's r	p-value	Number of points
	60°N-70°N	y=2.97x-1000.3	0.89	1.1E-1	4
	50°N-60°N	y=2.16x-540.0	0.95	7.2E-7	13
	40°N-50°N	y=1.71x+183.4	0.76	3.8E-9	43
	30°N-40°N	y=1.40x+97.5	0.64	1.3E-8	64
<sup>7</sup> Be	20°N-30°N	y=0.29x+653.9	0.38	9.1E-2	21
	10°N-20°N	y=0.54x+297.9	0.95	5.3E-2	4
	10°S-20°S	y=0.76x+293.8	0.67	2.1E-1	5
	20°S-30°S	y=1.50x+302.5	0.80	2.0E-1	4
	30°S-40°S	y=2.52x-297.4	0.99	1.9E-2	3
	70°N-80°N	y=0.04x+0.07	0.84	6.8E-4	12
	60°N-70°N	y=0.10x-16.1	0.76	4.2E-5	22
	50°N-60°N	y=0.03x+74.9	0.25	2.5E-2	31
	40°N-50°N	y=0.06x+117.5	0.25	2.7E-4	206
	30°N-40°N	y=0.13x+71.8	0.39	2.1E-5	113
	20°N-30°N	y=0.25x-124.6	0.59	1.8E-7	67
	10°N-20°N	y=0.09x-6.4	0.94	1.5E-3	7
<sup>210</sup> Pb	0°N-10°N	y=-0.03x+239.9	0.29	5.3E-1	7
	10°S-20°S	y=0.06x-2.2	0.66	5.3E-2	9
	20°S-30°S	y=0.01x+56.5	0.15	6.5E-1	11
	30°S-40°S	y=0.11x-31.3	0.65	3.7E-3	18
	40°S-50°S	y=0.06x-3.5	0.80	1.8E-3	12
	60°S-70°S	y=0.01x+1.7	0.77	9.4E-3	10
	70°S-80°S	y=0.02x+0.2	0.86	6.1E-3	8
	80°S-90°S	y=0.02x+0.5	0.92	2.1E-4	10

A similar remark can be made regarding Fig. 9: how could this very useful data compilation on Be-7/210Pb activity ratios be of further use for the community in the future? Could the range in ratios found in different latitudinal bands be provided somewhere (e.g. in a table)?

- Response: Thank you for the suggestion. We have uploaded the <sup>7</sup>Be/<sup>210</sup>Pb concentration
  ratio and flux ratio data (regarding Fig. 9) in the dataset. Furthermore, we have also
  uploaded the deposition velocities (V<sub>d</sub>) data for aerosols calculated from <sup>7</sup>Be and <sup>210</sup>Pb
  (Fig. 10) in the dataset. A new DOI (https://doi.org/10.5281/zenodo.4785136) of new
  version dataset is provided in the revised manuscript.
- A final general question (that could be addressed in section 3.7 for instance) is to think about the potential inclusion of nuclear safety continuous monitoring data (e.g. those monitored by state agencies in charge of nuclear safety) in future global databases, what would be the opinion of the authors on that?
- Response: This is an interesting proposition. The inclusion of nuclear safety continuous 168 monitoring data in future global databases will undoubtedly fill some gaps and expand 169 the scope of this dataset. However, this involves an important issue: data sharing. Data 170 sharing is a valuable part of the scientific method allowing for verification of results 171 and extending research from prior results. Scientific data are not only the outputs of 172 research but provide inputs to new hypotheses, enabling new scientific insights and 173 driving innovation. However, barriers to effective data sharing and preservation are 174 deeply rooted in the practices and culture of the research process as well as the 175 176 researchers themselves (Tenopir et al., 2011). During our compilation of this dataset, we encountered some obstacles. Some data is difficult to obtain directly from the 177 literature (whether from text or figures), so we contacted the authors, but sometimes 178 did not receive a reply. For some old data, the author cannot even be contacted. Of 179 course, we also received some generous and friendly helps. Thus, there is still some 180 181 data not included in our dataset, although we have tried our best. Finally, back to the question itself, we believe that the inclusion of nuclear safety continuous monitoring 182 data in future global databases requires more extensive collaboration and data sharing. 183 Hope our dataset can be a starting point. 184
- 185 Reference
- Tenopir, C., Allard, S., Douglass, K., Aydinoglu, A.U., Wu, L., Read, E., Manoff, M., and Frame, M.:
  Data sharing by scientists: practices and perceptions, PLoS ONE, 6, e21101, http://doi.org/10.1371/journal.pone.0021101, 2011.
- 189 Detailed remarks throughout the text
- 190 Abstract

L.17 "for tracing soil redistribution processes on land and particle dynamics and mixing
processes in the ocean" >> Be-7 and Pb-210 are also widely used for quantifying the
sources and the dynamics of riverine sediment (not only soils or ocean particles as
mentioned in the current version of the text)

195 Response: As given above, this missing research topic is now included in the text 196 throughout this paper; the words 'in aquatic systems' is be added after 'particle 197 dynamics'

- 198 L.21 I would remove the second 'of'
- 199 Response: The second 'of' is removed in the revised version.

L.25 'future researchers' public consumption in their research' >> unclear what is
 meant here

202 Response: Here we mean that the dataset is freely available for the scientific community. sentence will be rephrased as 'The dataset is archived This 203 https://doi.org/10.5281/zenodo.4785136 (Zhang et al., 2021) and is freely available for 204 the scientific community. The purpose of this paper is to provide an overview of the 205 scope and nature of this dataset and its potential utility as baseline data for future 206 research. 207

- 208 Introduction
- 209 L.29 Earth's surface > Earth' surface
- 210 Response: Thank you for noting this mistake it is corrected it in the revised manuscript.
- 211 Similar mistakes throughout the text are also corrected.
- 212 L.32 they do not >> it does not?
- 213 Response: Thank you for noting this mistake –it is corrected in the revised manuscript.
- 214 L.33 and changing >> which changes?
- 215 Response: This sentence is rewritten as A major fraction of  $^{7}\text{Be}$  (67%) production takes

216 place in the stratosphere, but it does not readily reach the troposphere except during

- 217 spring when seasonal thinning of tropopause folds near the jet stream take occurs at 218 mid-latitudes'.
- L.40 while not providing a range of Rn-222 fluxes for the oceanic areas as for the continental fluxes?
- 221 Response: We have added this in the revised version: "Rn-222 fluxes for the oceanic
- areas ranged from 2 to 21 Bq m<sup>-2</sup> d<sup>-1</sup> (Wilkening and Clements, 1975)."
- 223 Reference
- Wilkening, M. H., and Clements, W. E.: Radon 222 from the ocean surface, J. Geophys. Res., 80, 38283830, 1975.
- L.41 a part of the sentence is missing here (at the end of L.41?)
- Response: Thank you for noting this mistake This sentence is deleted in the revised
  manuscript.
- 229 L.49 'in accumulation mode'? >> unclear what is meant here
- 230 Response: Atmospheric aerosols are typically described as consisting of three modes
- based on their sizes: the nucleation mode (0.01-0.1 µm), accumulation mode (0.1-1.0
- 232  $\mu$ m), and coarse mode (> 1  $\mu$ m) (Whitby, 1978; Meng and Seinfeld, 1994). The size of
- 233 aerosol particles determines to a large extent how they are transported and transformed

234 in the atmosphere and how they are removed. Accumulation mode aerosol particles are

- removed from atmosphere primarily by precipitation because they are too small for
- 236 gravitational settling and removal and too large to be deposited by Brownian motion.
- 237 Reference
- 238 Whitby, K. T.: The physical characteristics of sulfur aerosols, Atmos. Environ., 12, 135-159, 1978.
- Meng, Z. Y., and Seinfeld, J. H.: On the source of the submicrometer droplet mode of urban and regional
   aerosols, Aerosol Sci. Tech., 20, 253-265, 1994.

241 L.54 and similar tropospheric...?

242 Response: The suggestion is taken into consideration in the revised manuscript.

L.66 (and elsewhere); of note, this type of research is also widely conducted in
freshwater/ river environments and could be acknowledged in the text, e.g.

Response: Thank you for the suggestion. As mentioned in the response above,
'Meanwhile, <sup>7</sup>Be and <sup>210</sup>Pb are also widely used for indicating particle transport,
deposition, and resuspension in estuarine and coastal regions' is rewritten as
'Meanwhile, <sup>7</sup>Be and <sup>210</sup>Pb are also widely used as tracers of sediment source
identification and particle dynamics in rivers (e.g. Bonniwell et al., 1999; Matisoff et
al., 2005; Jweda et al., 2008; Mudbidre et al., 2014; Baskaran et al., 2020), lakes (e.g.
Dominik et al., 1987; Schuler et al., 1991; Vogler et al., 1996), estuaries and coasts (e.g.

- 252 Baskaran et al., 1997; Huang et al., 2013; Wang et al., 2016).' in the revised manuscript.
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  times of Po-210 and Pb-210 in a riverine system in Southeast Michigan USA. J. Environ.
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  Switzerland: 1. Comparison of atmospheric and sedimentary fluxes of <sup>7</sup>Be, <sup>10</sup>Be, <sup>210</sup>Pb, <sup>210</sup>Po,
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  2016.
- 284 L.77 IMS operated by CTBTO?
- 285 Response: The suggestion is incorporated in the revised manuscript.
- 286 Methods
- 287 L.89 'high volume air' >> a high volume of air?
- 288 Response: The suggestion is incorporated in the revised manuscript
- 289 L.101 spectrometry instead of spectroscopy?
- Response: Thank you for noting this mistake we have corrected it in the revisedmanuscript.
- 292 L.111 'tedious procedures' >> unclear what is meant here

Response: The 'tedious procedures' refers to the continuous and tedious measurement
(preclean of rain collectors, preconcentration of rain samples, determination of
chemical yield, etc.) of the <sup>7</sup>Be and <sup>210</sup>Pb concentration in precipitation. We also note a
mistake in this sentence – the word 'avoids' is missing here. The sentence is rephrased
as: 'use of natural archives avoids the labor and time-intensive measurements of <sup>7</sup>Be
and <sup>210</sup>Pb concentration in precipitation and can serve as a complement...' in the revised
manuscript.

- 300 L.112 'deserted areas' >> unclear what is meant here
- 301 Response: 'deserted areas' here refer to areas where continuous monitoring is difficult
- 302 (such as open ocean, alpine region and polar region). To avoid misunderstanding, we 303 changed it to: 'remote areas' in the revised manuscript.
- 304 L.114 'to an undisturbed area' > to undisturbed areas?
- 305 Response: The suggestion is incorporated in the revised manuscript.
- 306 L.123 yields > yield?
- 307 Response: Thank you for noting this mistake corrected it in the revised manuscript.
- 308 L.133 'immediately after' >> immediately added after?
- 309 Response: The suggestion is incorporated in the revised manuscript.

- 310 L.137 'was not done resulting in underestimate of depositional' >>resulting in the
- 311 underestimation of...?
- 312 Response: The suggestion is incorporated in the revised manuscript.
- 313 L.149 After deposited >> after being deposited?
- 314 Response: Suggested revision is made.
- 315 LL.150-51: 'Open Ocean' >> why using capital letters here (instead of open ocean)?
- Response: Thank you for noting this mistake we have corrected in the revisedmanuscript.
- 318 L.169 have shown that the atmospheric fluxes
- 319 Response: The suggestion is incorporated in the revised manuscript.
- 320 L.171 "and hence those are data are not included" >> unclear, please rephrase
- 321 Response: This sentence is rephrased as: "the data of <sup>7</sup>Be soil inventory are not included
- 322 in our data set" in the revised manuscript.
- L.177 'sediment focusing and erosion" >> unclear what is referred to with 'sedimentfocusing'
- Response: In lake basin, surficial finer sediment may be resuspended due to bottom currents and and/or tidal currents in shallow water and subsequently transported to areas to specific areas which are conducive to deposition, in particular, especially during overturn (Davis, 1968). This phenomenon, which results in redistribution of bottom sediments resulting in higher accumulation in certain areas of the lake/estuaries/coastal areas which results in areas of sediment focusing (Likens and Davis, 1975).
- 331 References
- Davis, M. B.: Pollen grains in lake sediment, redeposition caused by seasonal water circulation, Science,
   162, 796-799, 1968.
- Likens, G. E. and Davis, M. B.: Post-glacial history of Mirror Lake and its watershed in New Hampshire,
   USA: An initial report, Int. Ver. Theor. Angew. Limnol. Vcrh, 19, 982-993, 1975.
- LL.182-184 'one is generated from the decay of 222Rn in the soil minerals, known as supported 210Pb which is produced from the decay of 238U and the other comes from atmospheric deposition as unsupported 210Pb. The fallout of 210Pb is retained generally in the organic rich surface soils presumably because of the sequestering properties of the organic matter as well as in lithogenic mineral grain.' >> this seems to reflect the old vision that there are a mineral and an organic component in soils, instead of the occurrence of 'organo-mineral complexes'
- Response: Thank you for suggestion. The sentence is rephrased in the revised manuscript as 'The fallout of <sup>210</sup>Pb is retained generally in the organic rich surface soils presumably because of the sequestering properties of the organo-mineral complexes (Covelo et al., 2008)'.

## 347 Reference

- 348 Covelo, E. F., Vega, F. A., and Andrade, M. L.: Sorption and desorption of Cd, Cr, Cu, Ni, Pb and Zn
  349 by a Fibric Histosol and its organo-mineral fraction, J. Hazard. Mater., 159, 342-347, 2008.
- L.187 'concentration than that expected' >> higher than that/compared to that...?
- 351 Response: The suggestion is taken into consideration in the revised manuscript.
- 352 L.197 'at different sampling time' >> sampling times
- 353 Response: Revision is made.
- L.200 'possibility of the dating ice core' >> 'possibility of dating ice cores'?
- 355 Response: The suggestion is incorporated in the revised manuscript.
- 356 L.203 and the Arctic?
- 357 Response: The suggestion incorporated in the revised manuscript.
- 358 L.204 'small montane permanent snow filed' >> unclear what is meant here (maybe 359 snowfield...)?
- Response: Thank you for noting this mistake 'snow filed' here is corrected to 'snowfield' in the revised manuscript.
- 362 L.205 'in the same way as the soil' >> in the same way as for the soil, except that...?
- 363 Response: The suggestion is incorporated in the revised manuscript.
- 364 L.208 'are very low' > is very low?
- 365 Response: Thank you for noting this mistake it is corrected it in the revised manuscript.
- 366 L.214 'Regarding compiling' >> please rephrase
- Response: We have replaced: 'Regarding compiling the global dataset for annual <sup>7</sup>Be and <sup>210</sup>Pb air concentrations and depositional fluxes' with: 'In order to compile the global dataset for annual <sup>7</sup>Be and <sup>210</sup>Pb air concentrations and depositional fluxes comprehensively' in the revised manuscript.
- 371 L.226 was included > were included?
- 372 Response: Thank you for noting this mistake it is corrected in the revised manuscript
- 373 L.228 'originating authors' > unclear, I would rephrase this
- 374 Response: 'the originating authors and editors have taken...' is rephrased as 'the
- authors and editors of the original articles have taken...' in the revised manuscript.
- 376 LL.229-230 convert in >> convert into?
- 377 Response: The suggestion is incorporated in the revised manuscript.
- 378 L.234 'program' >> which program is referred to here?

Response: The program refers to GetData Graph Digitizer. We has added thisinformation in the revised manuscript.

381 LL.235-236 'In rare cases, only the locality name of the study site was available, the 382 geographical location was digitized by Google Earth.' >> unclear here, do you mean 383 that the approximate coordinates were extracted from Google Earth?

Response: Yes, the approximate coordinates were extracted from Google Earth. To alleviate the referee's concern, 'the geographical location was digitized by Google Earth' will be rephrased as 'the geographical coordinates were extracted from Google

- 387 Earth' in the revised manuscript.
- 388 Results and discussion
- 389 L.247 in different literature >> unclear what is meant here
- 390 Response: To avoid misunderstanding, the 'literature' here is changed to 'articles' in
- 391 the revised manuscript.
- 392 Figure 1: the a/b/c/d letters referring to the different figure panels are not easy to see,
- 393 could there be a way to make them visible?

Response: The figure 1 has been replotted (as below) to make the a/b/c/d letters more visible.



- 1255 'A number' > the number?
- 397 Response: The suggestion is incorporated in the revised manuscript.
- 398 L.257 'earlier than that' > those?
- Response: Thank you for noting this mistake we have corrected it in the manuscript.
- 400 L.259 work was started >> I would remove 'was'?

- Response: The suggestion is incorporated in the revised manuscript. 401
- L.271 'in the undisturbed site' >> in an undisturbed site? 402
- Response: The suggestion is incorporated in the revised manuscript. 403
- 404 L.284 mainly dedicated to investigate...
- Response: The suggestion is incorporated in the revised manuscript. 405
- L.285 Be-7 >> are you referring to the Be-7 fluxes here? 406
- Response: No, we are referring to the <sup>7</sup>Be air concentrations and depositional fluxes. 407
- L.295 I would refer to the concentrations and depositional fluxes separately in the 408 sentence to facilitate its reading 409
- Response: The suggestion is incorporated in the revised manuscript. The sentence will 410
- be rephrased as "The range of concentrations of <sup>7</sup>Be and <sup>210</sup>Pb are 0.33-17.77 mBq m<sup>-3</sup> 411
- and 0.003-4.65 mBq m<sup>-3</sup>, respectively. The range of depositional fluxes of <sup>7</sup>Be and <sup>210</sup>Pb 412
- are 59-6350 Bq m<sup>-2</sup> y<sup>-1</sup> and 1-2539 Bq m<sup>-2</sup> y<sup>-1</sup>, respectively." in the revised manuscript. 413
- L.331 for Pb-210 than for Be-7 414
- Response: Thank you for noting this mistake we have incorporated this in the revised 415
- manuscript 416
- L.332 'However' >> why starting the sentence with 'however'? 417
- Response: Thank you for noting this mistake 'however' is deleted in the revised 418 manuscript 419
- 420 Figure 6 – caption – L. 338: 'against with' >> versus?
- Response: The suggestion is incorporated in the revised manuscript. 421
- LL.342-43 'less than 5% of that in the same latitude' >> unclear what is meant here? 422
- Response: 'less than 5% of that in the same latitude' will be rephrased as 'less than 5% 423 of the global average <sup>7</sup>Be flux' in the revised manuscript. 424
- L.345 'Hokitika' >> I don't know this location, where is it located? 425
- Response: 'Hokitika' is located in New Zealand, we have added this information in the 426 revised manuscript. 427
- Figure 8 caption L. 358: latitudinal bands (in plural)? (same remark in Fig. 7) 428
- Response: Thank you for noting this mistake we have corrected this in the revised 429 manuscript 430
- L.368 in 19 sites for which (...) ratios were available,...? 431
- Response: The suggestion is incorporated in the revised manuscript. 432

- 433 L.368 the paired t-test > a paired t-test?
- 434 Response: The suggestion is incorporated in the revised manuscript.
- L.375 'their measurements are easy' >> this is all relative, depending on the point ofview...
- 437 Response: We have deleted this sentence in the revised manuscript.
- 438 L.389 'is an artifact of the manner in the calculation' >> in the calculation mode?
- 439 Response: The suggestion is incorporated in the revised manuscript.
- 440 L.405 were used > was used?
- Response: Thank you for noting this mistake, we have corrected it in the revisedmanuscript
- 443 L.418 particle dynamics > riverine particle dynamics?
- 444 Response: Thank you for the suggestion. Considering that <sup>7</sup>Be and <sup>210</sup>Pb are also widely
- 445 used as tracers of sediment source identification and particle dynamics not only in rivers,
- 446 but also in lakes, estuaries and coasts, we believe that it is more appropriate to use

447 'aquatic particle dynamics' here. Thus, 'particle dynamics' is changed to 'aquatic

- 448 particle dynamics' in the revised manuscript.
- 449 Section 3.6: As mentioned above, I think that riverine particle dynamics using Be-7 and450 Pb-210 measurements should be addressed in this section.
- Response: Thank you for suggestion. As in the response to general remarks above, the
  riverine particle dynamics using <sup>7</sup>Be and <sup>210</sup>Pb measurements is addressed in this
  section:
- 'In the estuarine and coastal areas, the mass balance calculations of <sup>7</sup>Be and...' is 454 rephrased as 'In aquatic systems (including river, lake, estuary and coast), the mass 455 balance models of <sup>7</sup>Be and <sup>210</sup>Pbex have become powerful tools to understand the 456 sediment source, transportation and resuspension processes (e.g. Wieland et al., 1991; 457 Feng et al., 1999; Jweda et al., 2008; Huang et al., 2013; Mudbidre et al., 2014), in such 458 models, the atmospheric depositional input of <sup>7</sup>Be and <sup>210</sup>Pb is a required source term. 459 In addition, <sup>7</sup>Be/<sup>210</sup>Pb<sub>ex</sub> activity ratio can be used to identify the source area of sediments 460 (Whiting et al., 2005; Jweda et al., 2008; Wang et al., 2021), to quantify the age of 461 sediments (Matisoff et al., 2005; Saari et al., 2010), and to determine the transport 462 distance of suspended particles (Bonniwell et al., 1999, Matisoff et al., 2002). Thus, the 463 atmospheric depositional flux data of <sup>7</sup>Be and <sup>210</sup>Pb are also important for tracing 464 particle dynamics in aquatic systems' 465
- 466 L.423 of an undisturbed > at an undisturbed?
- 467 Response: The suggestion is incorporated in the revised manuscript.
- 468 L.425 'exceeding' > enrichment?
- 469 Response: The suggestion is incorporated in the revised manuscript.

- 470 L.425 'accumulation and/or redistribution' >> unclear which difference you make
- 471 between both processes here?
- 472 Response: We deleted 'and/or redistribution' in the revised manuscript.
- 473 L.432 'indicates notable sediment focusing or additional particle input other than
  474 atmospheric fallout' >> unclear what is meant here, please rephrase
- 475 Response: Due to the extensive modification of the section 3.6, this sentence is deleted
- 476 in the revised manuscript.
- LL.443-444: '7Be depositional flux is independent of longitude and is constant over
  broad latitudinal bands. Thus, the 7Be depositional flux data in our dataset can be used
  to estimate 7Be ocean inventory in the same latitude, which can avoid the collection of
  the large volume of seawater samples and extend the application of 7Be in the Open
  Ocean' >> I fully agree with the authors here and I think that this could be further
  outlined in the text (including for continental locations)
- 483 Response: Thank you for the suggestion. We will add a new paragraph (as below) in484 section 3.6 to for clarification:
- 485 Scientific data are not only the outputs of research but also provide inputs to new hypotheses, extending research and enabling new scientific insights (Tenopir et al., 486 2011). Our dataset provides a forum in which a large amount of <sup>7</sup>Be and <sup>210</sup>Pb 487 atmospheric depositional flux data for the above-mentioned research communities. 488 Researchers can rely on previously collected data in planning their research, without 489 additional monitoring of <sup>7</sup>Be and/or <sup>210</sup>Pb depositional fluxes. Even for those areas with 490 data gaps, the empirical equations between <sup>7</sup>Be and <sup>210</sup>Pb depositional fluxes and annual 491 precipitation (Table 2) provide an empirical method for estimating fluxes, especially 492 for <sup>7</sup>Be, as <sup>7</sup>Be depositional flux is independent of longitude and is constant over broad 493 latitudinal bands. In summary, the atmospheric depositional flux data presented in our 494 dataset as well as the meta-analysis of the data will be useful in the investigations of 495 soil erosion studies in terrestrial environments, particle dynamics studies in aquatic 496 systems, and surface mixing process studies in open ocean. 497
- 498 Reference
- Tenopir, C., Allard, S., Douglass, K., Aydinoglu, A.U., Wu, L., Read, E., Manoff, M., and Frame, M.:
  Data sharing by scientists: practices and perceptions, PLoS ONE, 6, e21101, http://doi.org/10.1371/journal.pone.0021101, 2011.
- 502 L.454 are almost non-existent
- Response: Thank you for noting this mistake we have corrected it in the revisedmanuscript.
- 505 L.468 meteorological conditions?
- 506 Response: The suggestion is incorporated in the revised manuscript.
- 507 L.481 'from the same literature' >> article?

- 508 Response: This suggestion is incorporated in the revised manuscript.
- 509 Conclusions
- 510 L.486 'spanning the time from 1955 to early 2020' >> spanning the period...?
- 511 Response: The suggestion is incorporated in the revised manuscript.
- 512 L.493 may be add 'in river systems' after dynamics here?
- 513 Response: 'in aquatic systems' is added here in the revised manuscript.