A ~~comprehensive~~ global dataset of atmospheric [7]Be and ^{210}Pb measurements: annual air concentration and depositional flux

Fule Zhang[1], Jinlong Wang[1], Mark Baskaran[2], Qiangqiang Zhong[3], Yali Wang[1], Jussi Paatero[4], Jinzhou Du[1].

[1]State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai, 200241, China

[2]Department of Environmental Science and Geology, Wayne State University, Detroit, Michigan 48202, USA

[3]Laboratory of Marine Isotopic Technology and Environmental Risk Assessment, Third Institute of Oceanography, Ministry of Natural Resource, Xiamen, 361005, China

[4]Observation Services, Finnish Meteorological Institute, Helsinki, FI-00560, Finland

Correspondence to: Jinlong Wang (jlwang@sklec.ecnu.edu.cn)

Abstract. [7]Be and ^{210}Pb air concentration and depositional flux data provide key information on the origins and movements of air masses, as well as atmospheric deposition processes and residence time of aerosols. After their deposition onto the Earth's surface, they are utilized for tracing soil redistribution processes on land, ~~and~~ particle dynamics in aquatic systems and mixing processes in ~~the~~ open ocean. Here we present a global dataset of air concentration and depositional flux measurements of atmospheric [7]Be and ^{210}Pb made by a large number of global research~~ers and laboratories~~community. Data were collected from published papers between 1955 and early 2020. It includes the annual surface air concentration~~s~~ data of [7]Be from 367 sites and of ^{210}Pb from 270 sites, the annual depositional flux data of [7]Be from 279 sites, and of ^{210}Pb from 602 sites. When available, appropriate metadata have also been summarized, including geographic location, sampling date, methodology, annual precipitation, and references. The dataset is ~~available~~ archived at https://doi.org/10.5281/zenodo.4785136 (Zhang et al., 2021) and is freely available for the scientific community. The purpose of this paper is to ~~have the published data available in one place for future researchers' public consumption in their research and~~ provide an overview of the scope and nature of this dataset ~~holdings~~ and its potential utility as baseline data for future research.

1 Introduction

30   Naturally occurring beryllium-7 (^{7}Be, $T_{1/2}$: 53.3 days) and lead-210 (^{210}Pb, $T_{1/2}$: 22.3 y) have been widely

utilized as tracers to investigate Earth's~~s~~ surface and atmospheric processes (Huh et al., 2006; Du et al.,

2012). ^{7}Be, a cosmogenic radionuclide, is produced by the spallation of oxygen and nitrogen nuclei by

cosmic rays in the stratosphere and upper troposphere (Lal et al., 1958). The production rate of ^{7}Be has

negligible dependence on longitude or season, but depends on the altitude, latitude and the ~11 years

35   solar cycle (Koch et al., 1996; Liu et al., 2001; Su and Huh, 2003). ~~Although A~~a major fraction of ^{7}Be

(67%) production takes place in the stratosphere, ~~but they do~~it does not readily reach the troposphere

except during spring when seasonal thinning of the tropopause folds near the jet stream ~~seasonal~~

~~thinning~~occurs at mid-latitudes ~~and changing the seasonal structure of the stratosphere facilitating the~~

~~exchange of air masses~~ (Lal and Peters, 1967; Danielsen, 1968). ~~Depositional flux of ^{7}Be is independent~~

40   ~~of longitude but depends on the altitude and the ~11 years solar cycle. Besides, owing to the~~

~~tropospheric/stratospheric exchange occurring in the mid-latitudes during spring~~Thus, ^{7}Be flux to the

Earth's~~s~~ surface varies with latitude and season (Lal and P~~p~~eters, 1967; Koch and Mann, 1996). ^{210}Pb, a

progeny of ^{222}Rn in the ^{238}U-series, is derived mostly (>99%) from the radioactive decay of ^{222}Rn. Most

of the atmospheric ^{210}Pb is derived from atmospheric radon. The global ^{222}Rn flux from continent ranges~~d~~

45   from 1300 to 1800 Bq m^{-2} d^{-1},~~.~~ while ~~~1~~72-21 Bq m^{-2} d^{-1} ~~is~~ were reported for the oceanic areas

(~~Samuelsson et al., 1986~~Wilkening and Clements, 1975; Nazaroff, 1992). ~~Radon is not removed by~~

~~precipitation scavenging while its decay products are.~~ Vertical profiles of ^{222}Rn in the atmosphere indicate

the highest concentrations occur in the continental boundary layer (CBL, 3-8 Bq m^{-3}) ~~and~~while an order

of magnitude lower activity (~40 mBq m^{-3}) occurs near the tropopause, with decreasing activity with

50   increasing altitude from CBL (Moore et al., 1977; Liu et al., 1984; Kritz et al., 1993). Consequently, the

atmospheric concentration of ^{210}Pb decreases with increasing altitude and is strongly controlled by the

land-sea distribution pattern. After formation, both ^{7}Be and ^{210}Pb ~~or its predecessors,~~and short-lived ^{222}Rn

progeny, are rapidly and irreversibly attached to aerosol particles (Winkler et al., 1998; Elsässer et al.,

2011). Subsequently, the fate of ^{7}Be and ^{210}Pb is closely linked to that of aerosols. Most of ^{7}Be and ^{210}Pb

55   are in accumulation mode aerosol particles with an aerodynamic diameter of a few hundred nanometers

(Ioannidou and Paatero, 2014; Paatero et al., 2017). Therefore, they are deposited onto the Earth's~~s~~ surface

primarily by precipitation because accumulation mode aerosol particles are too small for gravitational

settling and removal and too large to be deposited by Brownian motion.

Owing to their distinctly different source terms but well-known source distributions, and similar

60   tropospheric physicochemical behavior, [7]Be and ^{210}Pb have been widely utilized as powerful atmospheric

tracers for studying the origin of ~~the~~ air masses (e.g., Graustein and Turekian, 1996; Zheng et al., 2005;

Likuku et al., 2006; Dueñas et al., 2011; Lozano et al., 2012), vertical exchange and horizontal transport

processes (e.g., Arimoto et al., 1999; Lee et al., 2007; Rastogi and Sarin, 2008; Tositti et al., 2014),

deposition velocities and washout ratios of aerosols (e.g., Todd et al., 1989; McNeary and Baskaran, 2003,

65   Dueñas et al., 2005; Lozano et al., 2011; Mohan et al., 2019) and behavior and fate of analog species

(e.g., Crecelius, 1981; Mattson, 1988; Prospero et al., 1995; Lamborg et al., 2013). Following their

deposition on the Earth'~~s~~ surface, both [7]Be and ^{210}Pb are strongly attached to soils, which make them

useful for assessing soil erosion rates from episodic to multi-decadal timescales (e.g., Wallbrink and

Murry, 1993; Walling and He, 1999; Blake et al., 1999; Walling et al., 1999; Wilson et al., 2003; Mabit

70   et al., 2008, 2014). In aquatic~~eous~~ environments, ^{210}Pb is most widely used for dating recent sediments

(e.g., Appleby, 2008). Meanwhile, [7]Be and ^{210}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., Baskaran et al., 1997; Huang et al., 2013; Wang

75   et al., 2016)~~for indicating particle transport, deposition, and resuspension in estuarine and coastal regions~~

~~(e.g. Du et al., 2010; Huang et al., 2013; Wang et al., 2016)~~. [7]Be deposited on ~~the~~ open ocean ~~are~~ is further

used as a tracer for diagnosing ocean ventilation and subduction (Kadko, 2000; Kadko and Olson, 1996),

inferring upwelling rates (Kadko and Johns, 2011) and estimating the deposition of trace metals (Kadko

et al 2015; Shelley et al., 2017; Buck et al., 2019).

80   There have been numerous published datasets with concentrations and depositional fluxes of ^{210}Pb and

[7]Be (directly and indirectly) over the past few decades, particularly under the national or international

monitoring programs such as Environmental Measurements Laboratory (EML) Surface Air Sampling

Program (Feely et al., 1989), Sea-Air Exchange (SEAREX) program (Uematsu et al., 1994), Finnish

Meteorological Institute monitoring program (Paatero et al., 2015), Radioactivity Environmental

85   Monitoring (REM) network (Hernandez-Ceballos et al., 2015), and International Monitoring System

(IMS) operated by Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) (Terzi and

Kalinowski, 2017). It is valuable to compile all these existing data, including those measured in case

studies, along with appropriate metadata, in one place for facilitating further data analysis and geological,

geochemical and geophysical applications.

90   Although several datasets of air concentrations and depositional fluxes of [7]Be (Bleichrodt, 1978; Brost

et al., 1991) and [210]Pb (Rangarajan et al., 1986; Preiss et al., 1996) have been published, unfortunately,

many of the published data are not readily available in hard data format (e.g., data table) and often it is

challenging and retrieval of data from published figures often is not precisednot precise to retrieve data

from published figures. To date, only one dataset was published that compiled [7]Be and ^{210}Pb together

95   (Persson, 20162015), but it contained limited data. Therefore, the focus of the present work is to build a

new and comprehensive dataset. This dataset is the result of many scientists' efforts in generating the

data.

2 Methods

2.1 [7]Be and ^{210}Pb air concentrations measurement methodology

100   Aerosol samples are usually collected by pumping filtering a high volume of air, typically 1.4-1.5 m^3/min,

collected typically for a day, through paper filters. at a relatively constant flow rate. Common aerosol

collecting equipment includes ASS 500 (CLRP Warsaw, Germany), Anderson PM10 (Anderson Ltd.,

USA), Snow White (Senya Ltd., Finland), and HV-1000F (Shibata Co. Ltd., Japan). The preferred filter

membrane material includes glass fiber, cellulose nitrate or acetate, polypropylene fiber, and quartz fiber.

105   The collection efficiency, the percentage of the particles in the air stream that are collected by the air

filter, depends on the aerodynamic diameter of aerosol particles and the filter face velocity (average flow

velocity of air into the filter) of the airflow. Although the collection efficiency depends on the distribution

of particle sizes, generally the collection efficiency varies between 80% and 100% for different filter

materials. This was shown by overlapping two filters in tandem and comparing the concentrations

110   separately in the top and bottom filters. The sampling frequency is usually set from daily to monthly,

with a typical collection time of ~ 24 h, corresponding to ~ 2,000 m^3 air. The [7]Be and ^{210}Pb trapped on

filters can both be analyzed simultaneously by gamma spectrometry spectroscopy (e.g., McNeary and

Baskaran, 2003; Bourcier et al., 2011; Lozano et al., 2012; Mohan et al., 2018), while ^{210}Pb also can also

be analyzed by beta counting of its daughter [210]Bi (e.g., Joshi et al., 1969; Poet et al., 1972; Daish et al.,

115   2005) or via alpha counting of in-grown [210]Po from the decay of [210]Pb (e.g., Turekian and Cochran, 1981;

Mattsson et al., 1996; Marx et al., 2005).

2.2 [7]Be and ^{210}Pb depositional fluxes measurement methodology

The atmospheric depositional fluxes of ^{7}Be and ^{210}Pb are commonly measured directly by using rain collectors such as polyethylene drum/buckets, stainless steel container, and indirectly by natural archives (e.g., soils, lichens, mosses, snow/ice cores, salt marsh sediments). The direct collecting method is the most reliable technique for the measurement of annual ^{7}Be and ^{210}Pb depositional fluxes, and this technique is useful in collecting short-time scale (daily, weekly and monthly) depositional fluxes. In contrast, using natural archives avoids the labor and time-intensive measurement of the ^{7}Be and ^{210}Pb concentration in precipitation the tedious procedures and can serve as a complementary to fill regional gaps especially in deserted remote areas. However, these archives are susceptible to be affected by natural processes and anthropogenic activities, thus, the sampling location of these archives should be restricted to an undisturbed areas.

2.2.1 Direct ^{7}Be and ^{210}Pb flux measurements

Rain collectors are usually placed on the roof of a building so as to prevent contamination from resuspended dust from the ground. Care should be taken to ensure direct overhead atmospheric deposition is collected and there is no shadowing effect from adjacent structure/building or funneling effect in sample collection. Atmospheric aerosols can be removed not only by precipitation-scavenging but also by settling under the influence of gravitational or electrostatic forces. In most cases, the collectors are continuously exposed over a long enough period and the bulk (wet + dry) depositional samples are collected periodically (e.g., Baskaran et al., 1993; Hirose et al., 2004; Baskaran and Swarzenski, 2007; Lozano et al., 2011; Du et al., 2015). Fluxes obtained by this method yields the best estimate of the depositional flux. Sometimes, fallout ^{7}Be and ^{210}Pb samples are collected only during rainfall, and concentration is measured in the individual rainwater sample (e.g., Cho et al., 2011; Chae and Kim, 2019; Du et al., 2020). In this case, only the bulk depositional flux is obtained for the duration of collection. In rare cases, only a mean concentration of ^{210}Pb and/or ^{7}Be in rainwater is available, the wet flux can be estimated by multiplying by the annual precipitation (Peirson et al., 1966).

Most of the time, the volume of rainwater sample is large enough which cannot be directly counted in a gamma-ray spectrometer for the simultaneous measurements of ^{7}Be and ^{210}Pb, and in which case a preconcentration of the sample is required. Since both ^{7}Be and ^{210}Pb have a strong affinity for solid surfaces, it is strongly recommended to add stable Be (commonly 1-5 mg) and stable Pb (typically 5-20 mg) in about 1 L of 1 M HCl to the rain collector prior to deployment. AlternatAlternatively,ely, the

spikes can also be immediately added after sample collection, followed by rinsing of rain collector with 1 L of 1 M HCl rinsing twice and combining the rinses with the collected rainwater. An earlier critical review of earlier atmospheric depositional flux studies by Lal et al. (1979) showed that loss of ^{7}Be and ^{210}Pb by sorption onto rain collector walls was observed when pre-acidification of the collector was not done resulting in the underestimateion of depositional flux. In the case of preconcentration by ferric chloride precipitation method, due to variable scavenging efficiency of ^{7}Be and ^{210}Pb during the preconcentration method, it is required to add stable Pb and Be as yield tracer (e.g., Baskaran et al., 1993). The best chemical procedure to obtain high-quality data is to add acid and stable Be and Pb careers with 1 L of 1 M HCl to the rain collector prior to the start of the sample collection. The final calculation for depositional fluxes would involve chemical yield for ^{7}Be and ^{210}Pb, and appropriate decay corrections, as outlined in Baskaran et al. (1993) and Du et al. (2015).

2.2.2 Indirect ^{7}Be flux measurements

Measurements of ^{7}Be inventory in the upper oceanic water column, from air-sea interface until the layer where ^{7}Be activity is below the detection limit (in >400 L water sample), can indirectly yield the bulk depositional flux of ^{7}Be (Brost et al., 1991). This requires precise determination of the penetration depth of ^{7}Be in the water column. The only uncertainty is the loss of ^{7}Be-laden sinking particles from the upper water column where ^{7}Be is present. After being deposited on the ocean surface, ^{7}Be is generally mixed uniformly within the surface mixed layer (Young and Silker, 1980; Kadko and Olson, 1996). In oOpen oOcean, the particle concentration is generally low, and a major fraction of ^{7}Be is expected to be in the dissolved phase, thus allowing particle scavenging losses to be ignored (Silker, 1972; Andrews et al., 2008). Therefore, in the absence of physical removal processes other than radioactive decay, the input flux of ^{7}Be should be balanced by the ^{7}Be inventory integrated over the water column. In other words, ^{7}Be flux of atmospheric fallout (Bq m^{-2} d^{-1}) can be obtained from the ^{7}Be water column inventory (Bq m^{-2}) multiplied by the decay constant (0.013 d^{-1}) of ^{7}Be. This method has been proven to be reliable in open ocean due to the relatively short half-life of ^{7}Be and the constancy of ^{7}Be deposition over broad latitudinal bands (Young and Silker, 1980; Aaboe et al., 1981). ~~Although in areas where there are large variations in seasonal variations of precipitation, the inventory is expected to be season-dependent.~~It is expected that the ^{7}Be inventory is season-dependent in areas with large seasonal variations in precipitation (e.g., monsoon-dominated continental and oceanic areas). Time-series study in Bermuda

带格式的: 字体: 10 磅, 字体颜色: 文字 1

has shown that the inventory of ^{7}Be was relatively constant throughout the year, such that ^{7}Be inventory measured at any one time is likely representative (to within 20%) of the instantaneous ^{7}Be flux~~, the time-series study in Bermuda showed that , the inventory of ^{7}Be inventory was relatively constant throughout the year, such that ^{7}Be inventory measured at any one time is representative (to within 20%) of the instantaneous ^{7}Be flux~~ (Kadko and Prospeo, 2011; Kodko et al., 2015). This method is not suitable for coastal and estuarine areas where ^{7}Be is scavenged substantially by particulate matters (Olsen et al., 1986; Baskaran and Santschi, 1993), and upwelling-dominated areas where ^{7}Be inventory is diluted by ^{7}Be "dead" water (Kadko and Johns, 2011; Haskell et al., 2015).

Another potential candidate is undisturbed soil profiles. However, ^{7}Be inventories in undisturbed soils were reported to vary by more than an order of magnitude within one year (Walling et al., 2009; Kaste et al., 2011; Zhang et al., 2013). Such large variations in depositional fluxes of ^{7}Be are attributed to the seasonal fluxes of ^{7}Be. Earlier studies have shown that the atmospheric fluxes are highly dependent upon the amount of precipitation (Baskaran, 1995; Du et al., 2015). Since seasonal variations will significantly affect the ^{7}Be inventory in soils, the data of ^{7}Be soil inventory are not included in our dataset.~~and hence those are data are not included.~~

2.2.3 Indirect ^{210}Pb flux measurements

Several archives (soils, snow/ice cores, sediment cores, etc) have been used to assay the ^{210}Pb fluxes. Here we only present ^{210}Pb fluxes estimated from soil profiles and snow/ice cores. The former is the most frequently used, and the latter perfectly fills the regional gap in polar regions and montane permanent snowfields. There are many ^{210}Pb measurements in sediment cores, however, due to the sediment focusing and erosion, most sediment cores do not provide a reliable estimate of the atmospheric ^{210}Pb flux (Turekian et al., 1977; Preiss et al., 1996), thus this type of ^{210}Pb depositional flux data are not included in our dataset.

^{210}Pb in surface (upper ~30 cm) soil has two sources: one is generated from the decay of ^{222}Rn in the soil minerals, known as supported ^{210}Pb which is produced from the decay of ^{238}U and the other comes from atmospheric deposition as unsupported ^{210}Pb. The fallout of ^{210}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)~~organic matter as well as in lithogenic mineral grain~~. When soil CO_2 combines with percolating water, carbonic acid is produced which can leach some of the sorbed ^{210}Pb ultimately

resulting in slow migration down to a ~~maximum~~ depth of up to 20-30 cm (Matisoff and Whiting, 2012). As a result, the surface soil layer contains an excess ^{210}Pb ~~concentration than~~ compared to that ~~expected~~ from its equilibrium with ^{226}Ra (Mabit et al., 2014). The part of the ^{210}Pb excessing is termed "unsupported" or "excess" ^{210}Pb (^{210}Pb$_{ex}$). ^{210}Pb$_{ex}$ is the difference between total (measured) ^{210}Pb and the supported ^{210}Pb in the soils. Supported ^{210}Pb is assumed to be the same as ^{226}Ra activity, under the assumption of secular equilibrium between ^{226}Ra and supported ^{210}Pb. It can also be obtained by assuming that the supported ^{210}Pb activity is equal to the total ^{210}Pb at depth greater than 30 cm in the soil profile where atmospherically-delivered ^{210}Pb has not reached (Matisoff et al., 2014). The mean residence time of ^{210}Pb over a large drainage basin is on the order of 2000-3000 years in surface soils (Benninger et al., 1975; Dominik et al., 1987), so the inventory of ^{210}Pb$_{ex}$ in a soil profile that has not been disturbed by erosion, accumulation or human activities for about a century can be used to calculate the depositional flux (Graustein and Turekian, 1986). At ~~a~~ steady state, the ^{210}Pb depositional flux can be deduced using the ^{210}Pb$_{ex}$ inventory multiplied by the decay constant (0.0311 y^{-1}) of ^{210}Pb. This method has been widely used worldwide (e.g., Nozaki et al., 1978; Graustein and Turekian, 1986, 1989; Dörr and Munich, 1991; García-Orellana et al., 2006). At undisturbed soil sites, flux values derived from soil profile measurements were consistent with direct atmospheric flux observations (Olsen et al., 1985; Appleby et al., 2002, 2003), and ^{210}Pb$_{ex}$ soil inventory showed little discrepancy at different sampling times (Porto et al., 2006, 2016).

Goldberg (1963) was the first to show that the total ^{210}Pb activity in a glacier from Greenland decreased with depth, with a possibility of ~~the~~ dating ice cores. Subsequently, snow chronology in the Antarctic was determined (Crozaz et al. 1964; Picciotto et al., 1964). Since then, this technique has been used in both the large ice caps of Antarctica (e.g., Picciotto et al., 1968; Koide et al., 1979; Nijampurkar et al., 2002) and the Arctic (e.g., Crozaz and Langway, 1966; Koide et al., 1977; Dibb et al., 1990a, 1992; Peters et al., 1997) and the small montane permanent snowfield ~~filed~~ (e.g., Windom, 1969; Gäggeler~~Gaggeler~~ et al., 1983; Monaghan and Holdsworth, 1990). The ^{210}Pb flux in snow/ice core is calculated in the same way as for the soil, except ~~the difference is~~ that supported ^{210}Pb in snow/ice core is very low due to low concentration of ^{226}Ra in snow/ice core and may be negligible, as the lithogenic dust is the primary source of ^{226}Ra and its concentration in polar regions ~~are~~is very low (Preiss et al., 1996). When the snow accumulation rate is known, the depositional flux can also be ~~also~~ obtained by using ^{210}Pb concentration in surface snow multiplied by the accumulation rate (Pourchet et al., 1997; Suzuki et al., 2004). The

235 uncertainty in the depositional flux of ^{210}Pb from snow/ice core record is the potential post-depositional movement of the snow/ice due to heavy wind and the possibility of snow melting and percolation.

2.3 Data collection

~~Regarding compiling~~In order to compile the global dataset for annual ^{7}Be and ^{210}Pb air concentrations and depositional fluxes comprehensively, we attempted to collect published papers between 1955 and

240 early 2020 in which hard data for their concentrations and depositional fluxes are available or their calculated values reported. Using a series of keywords or with a combination of words search (e.g., ^{7}Be, ^{210}Pb, air concentration, depositional flux, fallout radionuclide, atmospheric tracer, or soil erosion), data were retrieved from online literature databases (Web of Science, Science Direct, and China Knowledge Resource Integrated Database). During the literature survey, no a priori criteria (e.g., study area, sampling

245 period, and measurement method) were applied. However, a critical review of the collected literature was conducted to obtain long-term data, using the following criteria. For concentrations in air and directly measured fluxes of ^{7}Be and ^{210}Pb, only those sites ~~where~~ with more than one year of data were included. When averaged over a longer period, data are more representative because of the inherent seasonal variations (at least one full year data) and inter-annual fluctuations (multi-year data). For indirectly

250 measured fluxes of ^{7}Be and ^{210}Pb, only those undisturbed sites clearly stated in the original literature ~~was~~ were included.

Here we did not include unpublished data, as data quality control could be a potential issue. In the peer-reviewed published data, it is assumed that the ~~originating~~ authors, reviewers and/or ~~and~~ editors of the original articles have undertaken the necessary steps to verify data quality. All concentrations in air were

255 converted into mBq m^{-3} and all depositional fluxes were converted into Bq m^{-2} y^{-1}, if not already reported in these units. When available, the metadata of latitude, longitude, altitude, sampling date, annual precipitation, methodology, and references are also given. A brief description of different variables that could affect the data is summarized in Table 1. In ~~the event that~~cases where the air concentration and depositional flux data were only available graphically, a computer program (GetData Graph Digitizer)

260 was used to digitize the data from graphics, the same was done for geographical location and annual precipitation. In rare cases, only the locality name of the study site was available, the geographical ~~location~~ coordinates were extracted from~~was digitized by~~ Google Earth.

Table 1. Fields in the main data table.

Field name	Field description	Field type	Unit
Site	Locality name (city, country) or station name of study site	Short text	Unitless
Sampling time	~~Sampling~~ Monitoring period or sampling /date in month/year format	Short text	Unitless
Latitude	North latitude in decimal degrees (from -90 to +90) either directly from original studies or extracted from Google Earth	Number	°
Longitude	East longitude in decimal degrees (from -180 to +180) either directly from original studies or extracted from Google Earth	Number	°
Altitude	Altitudes of study sites either directly from original studies	Number	m
Annual precipitation	Mean annual precipitation of study sites directly from original studies	Number	mm
Sampling device[a]	Model of aerosol sampling device and air flow rate during sampling	Short text	Unitless
Filter[a]	Model, material and dimension of filter membranes	Short text	Unitless
Frequency[a]	Sampling frequency set during observation	Short text	Unitless
Data number[a]	Total number of measurements performed	Integer	Unitless
Concentration[a]	^{7}Be or ^{210}Pb annual concentration in surface air	Number	mBq m^{-3}
Con-error[a]	Uncertainty in ^{7}Be or ^{210}Pb annual concentration in surface air	Number	mBq m^{-3}
Con-range[a]	Minimum to maximum values of ^{7}Be or ^{210}Pb concentration	Number	mBq m^{-3}
Method[b]	Short ~~descriptor~~ description of ^{7}Be or ^{210}Pb depositional flux obtained from different methods	Short text	Unitless
Rain collector[b]	Material, shape and collection area of rain collectors	Short text	Unitless
Clean procedure[b]	Rainwater collector cleaning process and reagents used	Short text	Unitless
Preconcentration[b]	Preconcentration method for rainwater samples	Short text	Unitless
Recovery[b]	Recovery of ^{7}Be or ^{210}Pb and the determination method	Short text	Unitless
Decay-correction[b]	Calculation of decay-correction for ^{7}Be or ^{210}Pb	Short text	Unitless
Flux[b]	^{7}Be or ^{210}Pb annual depositional flux derived from different methods	Number	Bq m^{-2} y^{-1}
Flux-error[b]	Uncertainty in ^{7}Be or ^{210}Pb annual depositional flux	Number	Bq m^{-2} y^{-1}
Contribution of dry deposition[b]	Fraction of dry depositional flux to total depositional flux of ^{7}Be or ^{210}Pb	Number	Unitless
Reference	Investigator and published year of references	Short text	Unitless
Reference's DOI	Digital Object Identifier of references	Short text	Unitless

[a]The field only appears in ^{7}Be or ^{210}Pb annual concentration worksheet;

265 [b]The field only appears in ^{7}Be or ^{210}Pb annual ~~depsositional~~depositional flux worksheet.

3 Results and discussions

3.1 Scope of the dataset

From 456 references (Appendix A), we have compiled a comprehensive dataset of atmospheric ^{7}Be and

^{210}Pb measurements made by numerous laboratories. The dataset includes 494 annual surface air concentration data of ^{7}Be covering 367 different sites, 366 annual surface air concentration data of ^{210}Pb from 270 different sites, 304 annual depositional flux data of ^{7}Be from 279 different sites, and 645 annual depositional flux data of ^{210}Pb from 602 different sites. In some cases, data collected from different periods were published in different ~~literature~~articles. In these cases, all data from the same site are listed as separate~~ly in the~~ dataset, but in ~~the~~ data analysis and plotting ~~of this article~~, the data from the same site are merged. The sampling locations of this global dataset show broad geographical coverage (Fig. 1). The sampling maps are mainly composed of continental sites, while the oceanic monitoring sites are ~~relatively few~~limited.
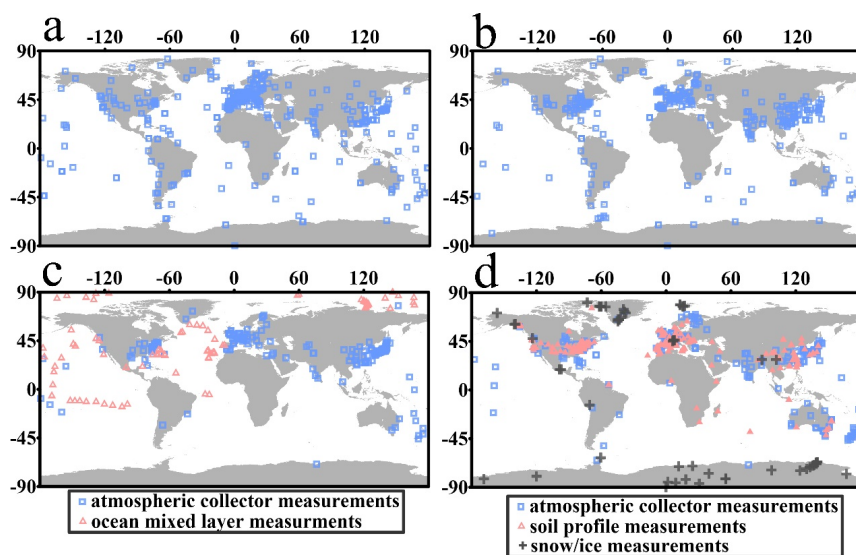
Figure 1: Maps showing ~~the distribution of~~ sampling locations of (a) ^{7}Be concentration in surface air, (b) ^{210}Pb concentration in surface air, (c) ^{7}Be atmospheric depositional flux, and (d) ^{210}Pb atmospheric depositional flux.

~~A~~The number of peer-reviewed journal articles published annually, containing ^{7}Be and ^{210}Pb data from 1955 to 2020 which are included in this article is plotted in Fig. 2. ~~The ^{7}Be M~~measurements of ^{7}Be began in the mid-1950s (Arnold and Al-Salih, 1955; Cruikshank et al., 1956; Rama and Zutshi, 1958), earlier than ~~that~~those of ^{210}Pb, which began in ~~the~~ early 1960s (Burton and Stewart, 1960; Crozaz et al., 1964; Peirson et al., 1966). The long-term monitoring work ~~was~~ started in the 1980s with the ^{7}Be and ^{210}Pb concentration data generated by the EML Surface Air Sampling Program (Feely et al., 1989; Larsen et

al., 1995). This was followed by more ambitious international programs such as the REM network (Hernandez-Ceballos et al., 2015) and IMS-CTBTO (Terzi and Kalinowski, 2017). However, in these two programs, ^{210}Pb concentration measurements were conducted only in a few stations measured ^{210}Pb concentration (Heinrich et al., 2007; Sangiorgi et al., 2019). In contrast, direct ^{7}Be and ^{210}Pb flux measurements were rarely supported by the international program, but there were several national monitoring programs initiated by developed countries like Australia (Bonnyman and Molina-Ramos, 1976), Japan (Narazaki et al., 2003; Yamamoto et al., 2006), United States (Lamborg et al., 2013) and Finland (Paatero et al., 2015; Leppanen, 2019). The measurement of ^{7}Be inventory in ocean mixed layer began in the 1970s (Silker, 1972; Young and Silker, 1974, 1980), and the idea proposed by Young and Silker was subsequently developed in the upper 100-200 m to assess surface water subduction, oxygen utilization and rate of upwelling (Kadko, 2009; Kadko and Olson, 1996; Kadko and Johns, 2011). The measurement of ^{210}Pb$_{ex}$ in the an undisturbed soil profile was first conducted by Fisenne (1968). Subsequently, Benninger et al. (1975) and Moore and Poet (1976) showed that excess ^{210}Pb activities in undisturbed soil profiles can be utilized to estimate the atmospheric ^{210}Pb depositional flux, which motivated resulted in an increase in the measurements of ^{210}Pb$_{ex}$ in soil profiles in the late 1980s (Graustein and Turekian, 1986, 1989; Monaghan et al., 1989; Dörr and Munnich, 1991). Subsequently, ^{210}Pb$_{ex}$ was shown to be useful for soil erosion studies on agricultural land A second boost to soil ^{210}Pb measurements occurred after the development of ^{210}Pb$_{ex}$ tracing soil erosion studies on agricultural land (Walling and He, 1999; Walling et al, 2003).
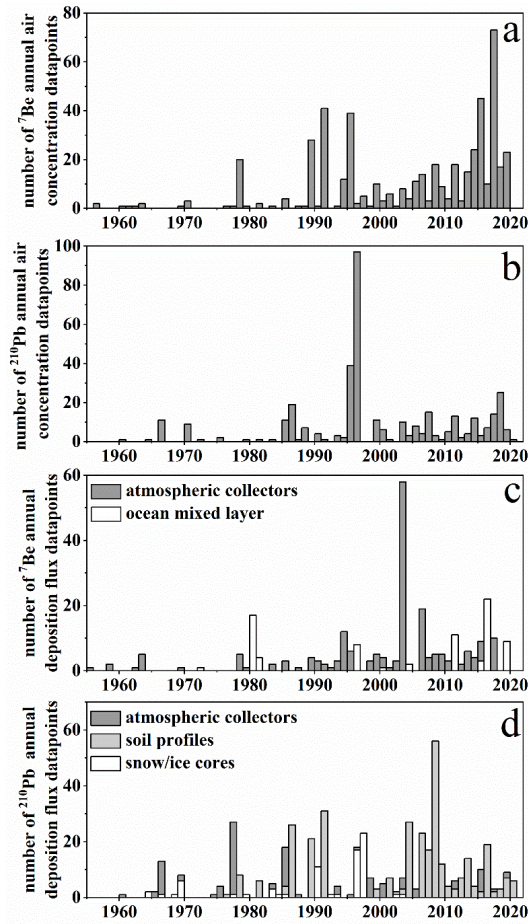
Figure 2: ~~Time d~~Distributions of data published between 1955 and early 2020: (a) [7]Be concentration, (b)[210]Pb concentration, (c) [7]Be depositional flux, and (d) ^{210}Pb depositional flux.

310   The histogram of sampling durations of [7]Be and ^{210}Pb measurements is given in Fig. 3. In general, the duration of sampling for [7]Be measurements, especially for air concentration, is longer than that of [210]Pb. Globally, there are 140 sites that monitored [7]Be air concentration for more than 10 years. The long-term (decades) measurements of [7]Be were mainly dedicated to investigate the ~~negative~~ effect of changes in sunspot number on [7]Be (Megumi et al., 2000; Cannizzaro et al., 2004; Kulan et al., 2006; Pham et al.,

315   2013; Steinmann et al., 2013). Due to the simpler measurement procedure for air concentration, the duration of air concentration measurements, whether for [7]Be or ^{210}Pb, is generally longer than that of ^{210}Pb and/or [7]Be depositional flux measurements.
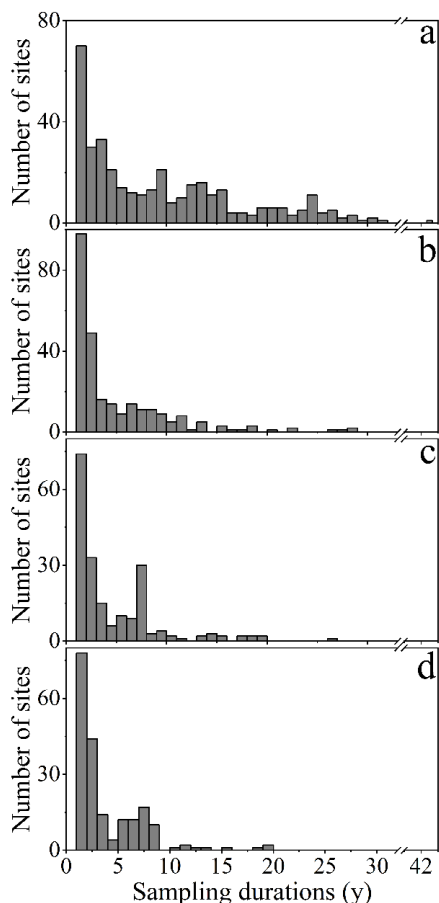
Figure 3: Histogram of sampling durations of (a) ^{7}Be concentration, (b) ^{210}Pb concentration, (c) ^{7}Be depositional flux, and (d) ^{210}Pb depositional flux. For those sites with multiple data~~set~~, we added the sampling duration together, after deducting the overlapping period, if any. Note that the ~~data of~~ ^{7}Be and ^{210}Pb depositional flux data plotted here ~~only~~ refer to ~~that~~ those obtained ~~by~~ using rain collectors.

3.2 Global variability

The global data of ^{7}Be and ^{210}Pb air concentrations and depositional fluxes are presented in Fig. 4. The range of concentrations of ^{7}Be and ^{210}Pb are 0.33-17.77 mBq m^{-3} and 0.003-4.65 mBq m^{-3}, respectively. The range of depositional fluxes of ^{7}Be and ^{210}Pb are 59-6350 Bq m^{-2} y^{-1} and 1-2539 Bq m^{-2} y^{-1}, respectively. ~~The concentration and depositional flux ranges of ^{7}Be and ^{210}Pb are 0.33-17.77 mBq m^{-3} and 0.003-4.65 mBq m^{-3}, 59-6350 Bq m^{-2} y^{-1} and 1-2539 Bq m^{-2} y^{-1}, respectively.~~ The concentrations and depositional fluxes of ^{7}Be show ~~clear~~ discernable latitudinal variability (Fig. 5a and 5c). In general, ^{7}Be

concentration and flux peak at the mid-latitudes and decrease toward the equator and poles, as was theoretically predicted by Lal and Peters (1967). A symmetric pattern is observed between the Northern and Southern hemispheres,.; however, a sharp increment increase in [7]Be air concentration (lack of flux data) occurred on the Antarctic, continentwhich reflects the subsidence of stratospheric air masses over the Antarctica continent (Wagenbach et al., 1988; Elsässer et al., 2011). Although the ^{210}Pb concentration and depositional flux are expected to heavily depend on the source(s) of air mass(es), and not to depend on the latitude, the 10° latitudinal variability of ^{210}Pb concentration and depositional flux in the Northern and Southern hemisphere is observed (Fig. 5b and 5d). The latitudinal variability of ^{210}Pb flux is similar to the global fallout curve based on 167 global sites (Baskaran, 2011). Since most of the ^{210}Pb data are derived from continental sites, the latitudinal variation is mostly due to differences in the radon emanation rates with latitude. As the area of the landmass in the Southern hemisphere is smaller compared to the Northern hemisphere, the ^{210}Pb concentration and depositional flux are much lower there. An asymmetry is observed in the ^{210}Pb concentration and depositional flux between the Northern and Southern hemispheres, with the highest values appearing in the mid-latitudes of the Nnorthern hemisphere.
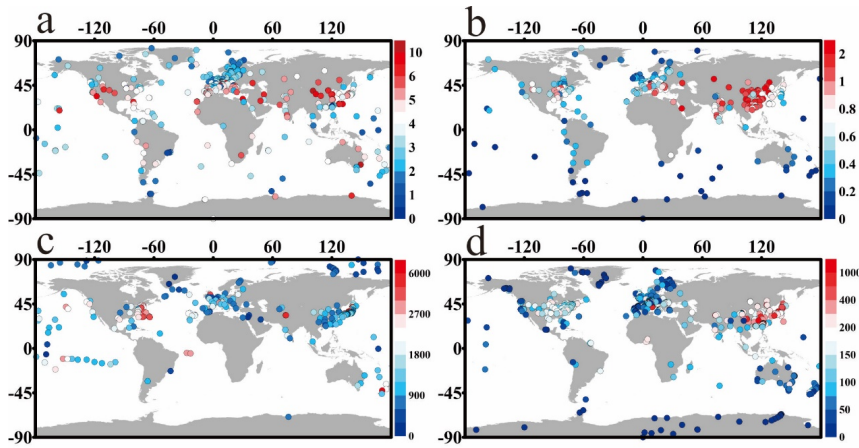
Figure 4: Global distribution of (a) [7]Be annual air concentration (in mBq m⁻³), (b) ^{210}Pb annual air concentration (in mBq m⁻³), (c) [7]Be annual depositional flux (in Bq m⁻² y⁻¹) and (d) ^{210}Pb annual depositional flux (in Bq m⁻² y⁻¹). For those sites with multiple datasetpublished, a weighted average was performed calculated based on the sampling durations.
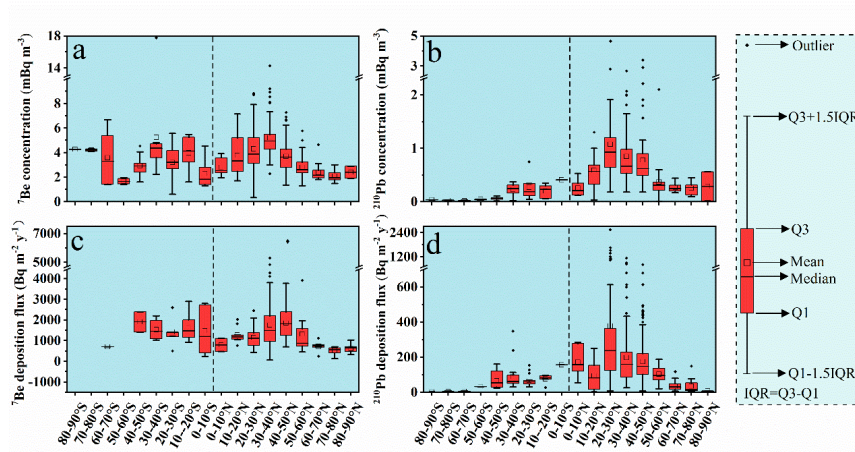
Figure 5: Latitudinal variability (box whisker plots) of (a) ^{7}Be concentration, (b) ^{210}Pb concentration, (c) ^{7}Be depositional flux, and (d) ^{210}Pb depositional flux ~~sorted~~ plotted ~~by the~~ 10° latitudinal band~~s~~.

3.3 ~~Contribution~~ Fraction of dry deposition and effect of precipitation on ^{7}Be and ^{210}Pb depositional flux

It was reported that dry deposition of ^{7}Be and ^{210}Pb generally accounts for less than 10% of the total deposition (Talbot and Andren, 1983; Brown et al., 1989; Todd et al., 1989), however, the fraction of dry deposition of ^{7}Be and ^{210}Pb is highly variable (McNeary and Baskaran, 2003; Pham et al., 2013). It is likely that the contribution of dry fallout could increase when annual precipitation decreases (McNeary and Baskaran, 2003). The fraction of dry to total depositional flux of ^{7}Be and ^{210}Pb are presented in Fig. 6a and 6b. Globally, the fraction of dry to total depositional flux of ^{7}Be and ^{210}Pb ranged from 1% to 44% (mean:12±9%, n=29, excluding one extreme site without precipitation) and from 5% to 51% (mean: 21±12%, n=26), respectively (Fig. 6c). The low fraction of dry to total depositional fluxes of ^{7}Be and ^{210}Pb suggest that these nuclides are removed from the atmosphere primarily by precipitation (both rain and snowfall). Our results also support previous studies (Baskaran et al., 1993; Benitez-Nelson and Buessler, 1999) that the fraction of dry deposition is higher for ^{210}Pb than for ^{7}Be. The fraction of dry fallout of ^{7}Be and ^{210}Pb is plotted against annual precipitation in Fig. 6d and 6e, ~~however,~~ a weak negative correlation is observed especially for ^{210}Pb.
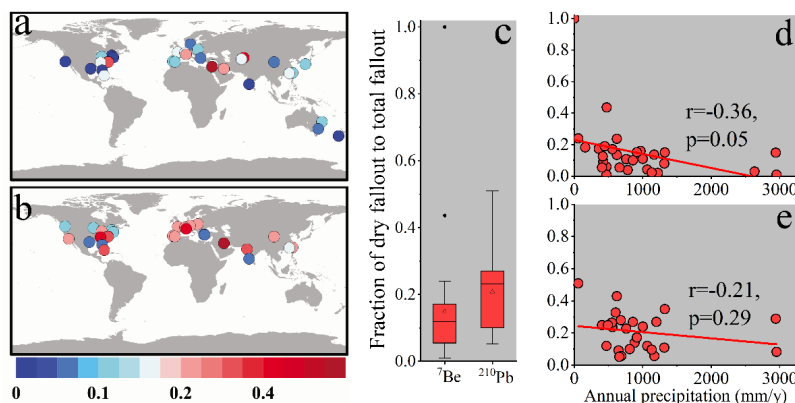
Figure 6: Global distribution of the fraction of dry to total depositional fluxes of (a) [7]Be and (b) [210]Pb. (c) Box whisker plots showing the comparison between the fraction of dry to total depositional fluxes of [7]Be and the fraction of dry to total depositional fluxes of [210]Pb. (d) The fraction of dry to total depositional fluxes of [7]Be versus annual precipitation. (e) The fraction of dry to total depositional fluxes of [210]Pb ~~against with~~versus annual precipitation.

As precipitation is the primary mechanism of removal of these nuclides from the atmosphere, the annual depositional fluxes ~~of these nuclides~~ generally depend on the amount and frequency of precipitation. In our dataset, the world's lowest [7]Be depositional flux (only 59 Bq m^{-2} y^{-1}, less than 5% of the global average [7]Be flux) occurred in Judean Desert, a precipitation free area in the horse latitude~~that in the same latitude) was observed in a precipitation area, the Judean Desert~~ (Belmaker et al., 2011). The highest [7]Be (6350 Bq m^{-2} y^{-1}) and [210]Pb (2539 Bq m^{-2} y^{-1}) depositional flux were observed in heavy rainfall areas, Hokitika, New Zealand (Harvey and Matthews, 1989) and Taiwan (Huh and Su, 2004), respectively. Positive correlations between annual depositional flux and precipitation have been observed on a local scale (e.g., Narazaki et al., 2003; Garcia-Orellana et al., 2006; Sanchez-Cabeza et al, 2007; Leppanen et al., 2019). Here we illustrate the effect of precipitation on annual depositional flux on a global scale (Figs. 7 and 8). As both [7]Be and ^{210}Pb depositional flux show ~~clear~~ latitudinal variability, the ~~fitting~~ linear best-fit curve of annual depositional flux to annual precipitation is plotted within the 10° latitudinal bands (if data are available). The empirical equations and fitting parameters describing the relationships between annual precipitation and [7]Be and ^{210}Pb depositional fluxes are summarized in Table 2. [7]Be and ^{210}Pb annual depositional fluxes generally show a good positive correlation with annual precipitation, although the data are limited in some latitudinal bands. Note that the frequency of precipitation is also an important factor which is not considered in earlier studies.
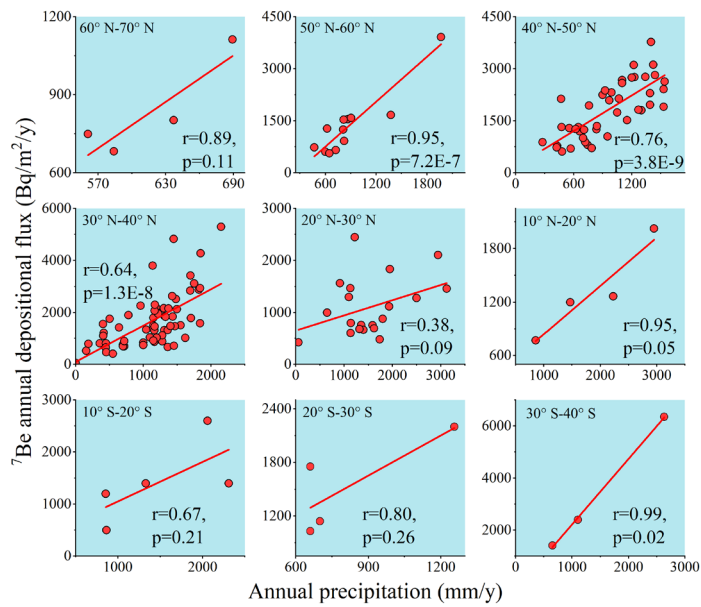
Figure 7: Annual depositional fluxes of ⁷Be are plotted against annual precipitation ~~within the~~for 10° latitudinal band~~s~~.
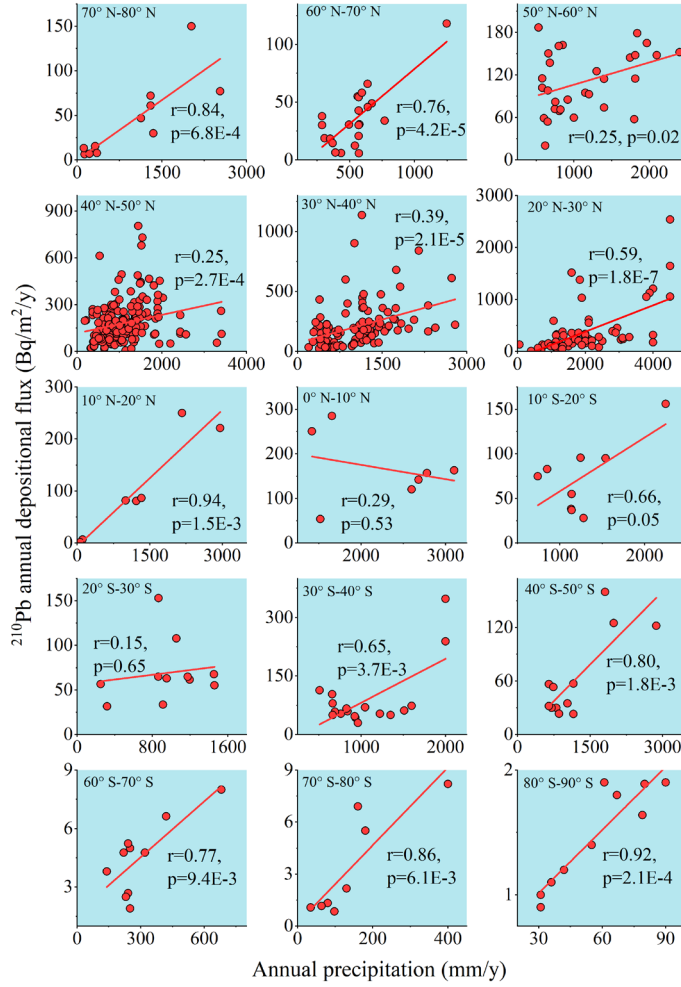
Figure 8: Annual depositional fluxes of ²¹⁰Pb are plotted against annual precipitation ~~within the~~for 10° latitudinal band~~s~~.

3.4 ⁷Be/²¹⁰Pb ratios and deposition velocities

Considering that some data come from the same station, we further calculated the ratios of ⁷Be to ²¹⁰Pb and deposition velocities of aerosols using ⁷Be and ²¹⁰Pb data, as shown in Figs. 9 and 10.

The variations in the ⁷Be/²¹⁰Pb ratios reflect both vertical and horizontal transport in the atmosphere (Baskaran, 1995; Koch et al., 1996; Arimoto et al., 1999; Lee et al., 2007; Tositti et al., 2014). Our dataset exhibits similar global patterns of ⁷Be/²¹⁰Pb ratio as simulated with a three-dimensional chemical tracer

model (Koch et al., 1996), with a positive south poleward gradient and a little variation in the Nnorthern hemisphere. Globally, the ^{7}Be/^{210}Pb air concentration ratio ranged from 2 to 222, and the ^{7}Be/^{210}Pb depositional flux ratio ranged from 2 to 229. In 19 sites for which, ^{7}Be/^{210}Pb air concentration ratio and depositional flux ratio are were available simultaneously, the a paired t-test indicates that at 0.05 level the ^{7}Be/^{210}Pb air concentration ratio and depositional flux ratio are not significantly different.
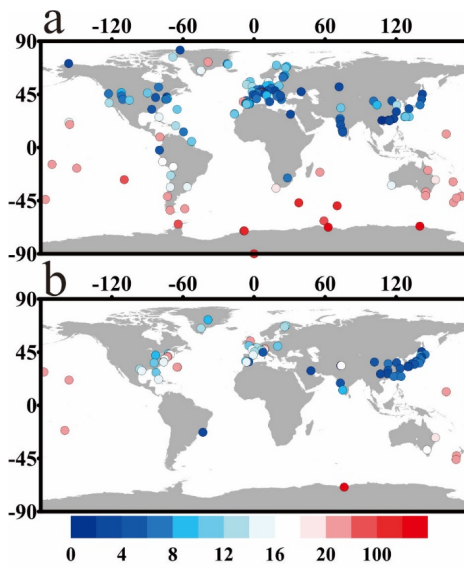
Figure 9: Global distribution of (a) ^{7}Be/^{210}Pb activity ratio and (b) ^{7}Be/^{210}Pb depositional flux ratio. Note that the color bar below applies to both figures.

^{7}Be and ^{210}Pb are excellent tracers for the determination of the deposition velocities of aerosols for several two reasons: (1) their measurements are easy; (12) their production rates depositional fluxes and air concentrations at any given site remain fairly constant over a long period; and (32) their size distributions in aerosols are similar to that of many particulate contaminants of interest (McNeary and Baskaran, 2003; Dueñas et al., 2005). When both air concentration (C) and depositional flux (F) at the same site are available, the average total deposition velocities of aerosols that carry these nuclides (V_d) can be calculated by the following Eq. (1):

$$V_d = F/C, \tag{1}$$

Thus, the V_d obtained from ^{7}Be and ^{210}Pb can be used to determine the depositional flux of analog species (Turekian et al., 1983) with a knowledge of their air concentration (Turekian et al., 1983) of these analog species, assuming that the scavenging behavior of analog species is similar to ^{7}Be and ^{210}Pb. The V_d for

[7]Be ranged from 0.~~1~~82-8.~~39~~4 (mean: 1.2~~5~~3±1.~~1~~62, n=70) cm s^{-1}, and for ^{210}Pb ranged from 0.1~~3~~-12.7~~0~~ (mean: 1.~~1~~62±1.6~~8~~7, n=72) cm s^{-1}. The deposition velocity of aerosols collected over a period of 17 months in Detroit, MI, USA varied over two orders of magnitude, from 0.2 to 3.6 (mean: 1.6, n=30) cm s^{-1} for [7]Be and 0.04 to 3.6 cm s^{-1} (mean: 1.1, n=30) cm s^{-1} (McNeary and Baskaran, 2003). A summary of deposition~~al~~ velocity from 10 different stations are also given in McNeary and Baskaran (2003). Earlier studies suggested that, at continental sites, V_d of [7]Be will be higher than V_d of ^{210}Pb using the ground level as the reference, which is an artifact ~~of~~ in the manner in which the calculation is made (Turekian et al., 1983; Todd et al., 1989; McNeary and Baskaran, 2003). However, later works observed opposite results (Dueñas et al., 2005, 2017; Lozano et al., 2011; Mohan et al., 2019). The independent t-test analysis indicates that at 0.05 level the V_d calculated by [7]Be and ^{210}Pb are not significantly different in the global dataset, which suggests that [7]Be and ^{210}Pb attach onto the aerosols by similar mechanisms (Winkler et al., 1998; Papastefanou, 2006), and are affected by similar deposition processes (Lozano et al., 2013).
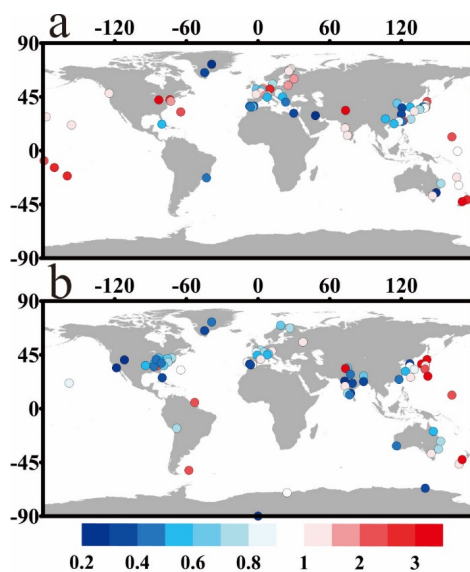
Figure 10: Global distribution of deposition velocities (V_d) of aerosols (in cm s^{-1}) obtained from (a)[7]Be and (b) [210]Pb. Note that the color bar below applies to both figures.

3.5 Investigations on global atmospheric dynamics and climate changes

Developing numerical models in which aerosols, chemistry, radiation, and clouds interact with one another and with atmospheric dynamics is important for understanding and predicting global climate

440   changes (Brost et al., 1991). In such atmospheric dynamic models, the major uncertainty is from the parameterization of subgrid-scale processes such as precipitation scavenging, vertical transport, and radiative effect. The cosmogenic ^{7}Be and terrigenous ^{210}Pb, taken together, offer an excellent tool in investigating wet scavenging and vertical transport in global models (Liu et al., 2001).

A set of data obtained prior to the 1990s were was used to compare simulated results in global models
445   such as ECHAM2 (Brost et al., 1991; Feichter et al, 1991), ECMWF (Rehfeld and Heimann, 1995), CTM based on GISS GCM (Balkanski et al., 1993; Koch et al., 1996), GEOS-CHEM (Liu et al., 2001), and LMDz (Preiss and Genthon, 1997; Heinrich and Pilon, 2013) and GMI CTM (Liu et al., 2016). By simulating the ratio of ^{7}Be/^{210}Pb, Koch et al. (1996) eliminated the error associated with the effect of precipitation and provided a better measure of vertical transport. After correcting the cross-tropopause
450   transport, simulation of observed ^{7}Be and ^{210}Pb surface concentrations and depositional fluxes with no significant global bias was obtained (Liu et al., 2001). Note that the spatial coverage of the dataset used in the previous modeling work was only partial, thus, reducing limiting the statistical significance of comparisons of simulated and observed results (Feither et al., 1991). Additional work with more data is needed for detailed comparison and successful validation of models (Brost et al., 1991). The size of the
455   ^{7}Be and ^{210}Pb datasets has greatly increased in the last three decades and our new dataset is expected to lay a foundation to develop in developing better parameterization and contribute to modeling efforts.

3.6 Soil erosion, Paquatic particle dynamics and ocean surface process studies

The atmospheric depositional flux data of ^{7}Be and ^{210}Pb are useful in utilizing these nuclides as tracers for soil erosion and redistribution studies in terrestrial environments (Mabit et al., 2008) as well as
460   particle dynamics study in aqueous aquatic environments (e.g., Du et al., 2012; Matisoff et al., 2014). The basic principles involved in using of ^{7}Be or ^{210}Pb$_{ex}$ as soil tracers are the same, which is to compare the measured inventory of ^{7}Be or ^{210}Pb$_{ex}$ (Bq m^{-2}) at a sampling point with the inventory of at an undisturbed (or reference) site (Blake et al., 1999; Walling and He, 1999). Depletion of the inventory means that soil erosion has occurred, whereas exceeding enrichment provides evidence of accumulation
465   and/or redistribution of surficial soil. The first step in these studies is to select a suitable undisturbed site and obtain the reference inventory (Mabit et al., 2009). However, as human activity intensifies, such undisturbed sites are not always readily available. In aquatic systems (including river, lake, estuary and coast), the estuarine and coastal areas, the mass balance calculation models of ^{7}Be and ^{210}Pb$_{ex}$ have

become powerful tools to understand the sediment source, transportation, and resuspension processes scavenging processes (e.g., Wieland et al., 1991; Feng et al., 1999; Su and Huh, 2002; Jweda et al., 2008; Du et al., 2010; Saari et al., 2010; Huang et al., 2013; Mudbidre et al., 2014). In such models, the atmospheric depositional input of ^{7}Be and ^{210}Pb is a required source term. The measured enhanced sediment inventory of ^{210}Pb$_{ex}$ compared to atmospheric deposition-based inventory (=annual deposition, Bq m^{-2} y^{-1}/ mean-life of the isotope, y) indicates notable sediment focusing or additional particle input other than atmospheric fallout (Swarzenski et al., 2006; Lepore et al., 2009; Wang et al., 2020). Furthermore, ^{7}Be/^{210}Pb$_{ex}$ 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, the atmospheric depositional flux data of ^{7}Be and ^{210}Pb are also important for tracing particle dynamics in aquatic systems. using ^{7}Be and ^{210}Pb$_{ex}$. We believe that the atmospheric depositional flux data presented in our dataset will benefit and facilitate soil or coastal sediment erosion/focusing and particle dynamics studies.

The atmospheric depositional flux (or ocean inventory) data of ^{7}Be serve as an indispensable parameter for tracing surface ocean process (e.g., subduction, upwelling, and depositional flux of trace metals) (Kadko, 2017; Kadko and Olsen, 1996; Kadko et al., 2015). Due to the low activity of ^{7}Be in open ocean waters, usually, 400-700 L seawater is needed, which imposes some limitations for sampling, especially for deep layers. This constraint has hampered limited its application. If the ^{7}Be ocean inventory can be accurately estimated, the collection of a large volume of seawater can be avoided and the application of ^{7}Be in open ocean will be expanded.

Scientific data are not simply the outputs of research but they also provide inputs to new hypotheses, extending research and enabling new scientific insights (Tenopir et al., 2011). Our dataset provides aa forum in which a large amount of ^{7}Be and ^{210}Pb atmospheric depositional flux data for the above-mentioned research communities. This database will help in identifying data gaps and evaluating the empirical relations between ^{7}Be and ^{210}Pb depositional fluxes and annual precipitation (Table 2). Researchers can rely on previously collected data in planning their research, without additional monitoring of ^{7}Be and/or ^{210}Pb depositional fluxes. Even for those areas with data gaps, the empirical equations between ^{7}Be and ^{210}Pb depositional fluxes and annual precipitation provide an empirical method for estimating fluxes, especially for ^{7}Be, as ^{7}Be depositional flux is independent of longitude and

is constant over broad latitudinal bands. In summary, the atmospheric depositional flux data presented in this our dataset along with the meta-analysis of the data will be useful in the investigations of soil erosion studies in terrestrial environments, particle dynamics studies in aquatic systems, and surface mixing process studies in open ocean.

3.7 Gaps and recommendations

Our dataset is a compilation of most of the published results in international peer-reviewed journal articles represents an ambitious expansion in comparison to the ^{7}Be or ^{210}Pb datasets currently available (Brost et al., 1991; Preiss et al., 1996; Persson et al., 2016). Although the spatial coverage of this dataset is more significant, the data available sites it is stillare unevenly distributed. Compared to spatial and temporal coverage of depositional flux data, the coverage of air concentration data is much largerlarge. The air concentration measurement at from deep ocean site is limited, but the data from coastal oceanic sites is adequate; however, , but the depositional flux measurement at oceanic sites is rare. Concerning air concentrations, in areas such as Europe, East Asia, eastern Oceania, and the eastern United States are well covered, whereas other areas such as the African continent and Northern Asia are underrepresentedlimited. A similar spatial coverage pattern exists for the depositional flux of these nuclides, but the regional gaps are more notable, especially for ^{7}Be flux data which are almost non-existent in Antarctica and African continents. In addition, it needs to be emphasized that the number of sampling sites, in which both concentration and flux of ^{7}Be and ^{210}Pb were measured simultaneously, are limited. Finally, we acknowledge that the seasonal information is indeed not much discussed for this dataset.

We recommend that future studies should pay more attention to those areas that are currently undersampled or unsampled to better characterize the expected global variability in the ^{7}Be and ^{210}Pb air concentrations and depositional fluxes, by measuring both nuclides simultaneously to obtain more data as well as ^{7}Be/^{210}Pb ratio and estimate deposition velocity of aerosols. In areas with very limited precipitation such as deserts, it is expected that the dry fallout will dominate the bulk depositional flux, and quantification of the role of dry fallout in the removal of these nuclides will provide insights on the removal of other analog species. As mentioned earlier, combining cosmogenic ^{7}Be with ^{210}Pb that has a predominantly Earth-surface origin will be useful to trace species that originate both from Earth' surface, such as Hg, SO_4^{2-}, NO_3^-, and those that originate in the upper atmosphere, such as O_3. TBesides, the size

distribution of aerosols particles carrying ^{7}Be and ^{210}Pb is crucial for understanding atmospheric behavior and tracing analogues, and such studies also need to be ~~strengthened.~~conducted ~~Further compilation of monthly data is also warranted to assess seasonal variability of ^{7}Be and ^{210}Pb and understand the relationship between these changes and influencing factors such as atmospheric dynamics, meteorological condition, and geographic location on a global scale. As mentioned earlier, combining cosmogenic ^{7}Be with ^{210}Pb that has a predominantly Earth-surface origin will be useful to trace species that originate both from Earth's surface, such as Hg, SO$_4^-$, NO$_2^-$, and those that originate in the upper atmosphere, such as O$_3$.~~ Besides, t~~T~~he troposphere contains ~99% of global water vapor with < 1% in the stratosphere. The depositional velocity of aerosol in the stratosphere is very low (~ 4×10^{-3} cm s^{-1}; Junge, 1963) with no precipitation. Thus, the ^{7}Be concentration is governed by local production, ~~meridional,~~ zonal and vertical downward transport, and its decay. 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 ~~Between the upper tropopause and cloud condensation height, the removal rate of aerosols is also slow. Collection of air samples about cloud condensation height to tropopause will provide useful information on the settling velocity of aerosols~~ (Lal and Baskaran, 2012).

Finally, we acknowledge that the seasonal data of ^{7}Be and ^{210}Pb has not been included in the current version of dataset, because compiling the seasonal data is more challenging than compiling the annual data. Unlike the annual data, most of the published seasonal data are presented in graphs, without giving in tables, and in some cases, the graph quality was poor and precision in data extraction is expected to be poor. Besides, in some papers, although seasonal data were measured, only the annual data were provided. Thus, the comprehensive compilation of seasonal data of ^{7}Be and ^{210}Pb may need collaboration with and data sharing from the scientific community. The compilation of seasonal data is expected to be useful to assess seasonal variability of ^{7}Be and ^{210}Pb and understand the relationship between these changes and influencing factors such as atmospheric dynamics, meteorological conditions, and geographic location on a global scale. And the seasonal data can also be useful in evaluating seasonality of transport in global atmospheric models.

4 Data formats and availability

For clarity and convenience, four separate worksheets, each named as ^{7}Be or ^{210}Pb annual air concentration and ^{7}Be or ^{210}Pb annual atmospheric flux, are available in one Microsoft Excel® file, although sometimes these data come from the same ~~literature~~article. In addition, the data of ^{7}Be/^{210}Pb air concenration ratio, ^{7}Be/^{210}Pb depositional flux ratio and deposition velocities for ^{7}Be and ^{210}Pb are also presented. The dataset can be downloaded from Zenodo (https://doi.org/10.5281/zenodo.4785136, Zhang et al., 2021). It is free for scientific applications, but the free availability does not constitute a license to reproduce or publish it. The compilation of seasonal data is ongoing, and the dataset will be updated in a future effort.

5 Conclusions

This paper summarizes the global dataset of ^{7}Be and ^{210}Pb for their concentration in atmospheric air and their depositional fluxes from 456 publications spanning the ~~time~~ period from 1955 to early 2020. The calculated activity ratios of ^{7}Be/^{210}Pb and deposition velocity of aerosols are also reported. Some noteworthy spatial gaps in the dataset are the African continent, Northern Asia, and Antarctica (only for ^{7}Be flux). Despite these gaps, our dataset is the largest compilation of ^{7}Be and ^{210}Pb air concentration and depositional flux up to date and could be used to better understand the transport processes of air masses and depositional processes of aerosols. This dataset not only lays a solid foundation to develop better parameterization contributing to future modeling efforts but also supply a basic parameter for tracing soil erosion on land, particle dynamics in aquatic systems, and ocean surface processes using ^{7}Be and/or ^{210}Pb.

Appendix A: List of references in the dataset

Aaboe et al. (1981), Aba et al. (2016), Ahmed et al. (2004), Akata et al. (2008, 2015, 2018a, 2018b), Akram et al. (1999), Al-Azmi et al. (2001), Alegría et al. (2010), Ali et al. (2011a, 2011b), Alonso-Hernández et al. (2004, 2014), Amano and Kasai (1981), Anand and Rangarajan (1990), Anderson et al. (1960), Andres (2018), Appleby et al. (2002, 2003, 2019), Arimoto et al. (1999), Arkian et al. (2010), Arnold and Al-Salih (1955), Azahra et al. (2003, 2004), Azimov et al. (2011, 2017), Bachhuber and Bunzl (1992), Baeza et al. (1996, 2016), Bas et al. (2017), Baskaran and Swarzenski (2007), Baskaran et al. (1993), Batraov et al. (2016), Bazarbaev et al. (2012), Begy et al. (2016), Beks et al. (1998), Belmaker

et al. (2011), Belyaev et al. (2004), Benitez-Nelson and Buesseler (1999), Benmansour et al. (2013), Bettoli et al. (1995), Bikkina et al. (2015), Blake et al. (2009), Blazej and Mietelski (2014), Bleichrodt (1978), Bleichrodt and van Abkoude (1963), Bourcier et al. (2011), Brandt et al. (2018), Branford et al. (2004), Brost et al. (1991), Brown et al. (1989), Buck et al. (2019), Buraeva et al. (2013a, 2013b), Burton and Stewart (1960), Caillet et al. (2001), Cámara-Mor et al. (2011), Cannizzaro et al. (1999, 2004), Canuel et al. (1990), Cao et al. (2018), Carpenter et al. (1981), Carvalho et al. (1995, 2013), Chae and Kim (2019), Chae et al. (2011), Chang et al. (2008), Chao et al. (2012, 2014), Chen (2014), Chen et al. (2016, 2020), Chham et al. (2017, 2018, 2019), Cho et al. (2011), Clifton et al. (1995), Conaway et al. (2013), Courtier et al. (2017), Crecelius (1981), Crozaz and Langway (1966). Crozaz et al. (1964), Cruikshank et al. (1956), Cruz et al. (2019), Cui et al. (2012), Daish et al. (2005), Damatto et al. (2005), Damnati et al. (2013), D'Amours et al. (2013), de Tombeur et al. (2020), Deng et al. (2020), Dibb (1989, 1990a, 1990b, 1992, 2007), Dibb and Jaffrezo (1993), Dibb et al. (1994), Ding et al. (2017), Dlugosz-Lisiecka (2019), Doering and Akber (2008a, 2008b), Doering and Saey (2014), Doering et al. (2006), Doi et al. (2007), Dominik et al. (1987, 1989), Dörr and Münnich (1991), Dovhyi et al. (2017), Du et al. (2008, 2015), Du and Walling (2012), Dueñas et al. (1999, 2004, 2005, 2009, 2011, 2017), Ďurana et al. (1996), Dutkiewicz and Husain (1985), El-Hussein et al. (2001), Elsässer et al. (2011), Eriksson et al. (2004), Fan et al. (2013), Fang et al. (2013), Feely et al. (1989), Filizok and Ugur Gorgun (2019), Filizok et al. (2013), Fogh et al. (1999), Fukuyama et al. (2008), Fuller and Hammond (1983), Gäggeler et al. (1983, 1995), Gai et al. (2015), García-Orellana et al. (2006), Garimella et al. (2003), Garspar et al. (2013), Gavini et al. (1974), Gerasopoulos et al. (2001), Gonzalez-Gomez et al. (2006), Gordo et al. (2015), Grabowska et al. (2003), Graham et al. (2003), Graustein and Turekian (1986, 1989), Grossi et al. (2016), Gustafson et al. (1961), Halstead et al. (2000), Harvey and Matthews (1989), Hasebe et al. (1981), Hasegawa et al. (2007), Haskell et al. (2015), He and Walling (1997), He et al. (2018), Heikkilä et al. (2008), Heinrich et al. (2007), Hernández et al. (2005, 2007, 2008), Hernandez-Ceballos et al. (2015), Hicks and Goodman (1977), Hirose et al. (2004), Hötzl et al. (1987), Houali et al. (2019), Hu (2016), Hu and Zhang (2019), Hu et al. (2020), Huang et al. (2019), Huh and Su (2004), Huh et al. (2006), Igarashi et al. (1998), Ioannidou and Paatero (2014), Ioannidou and Papastefanou (2006), Ioannidou et al. (2005, 2019), Irlweck et al. (1997), Isakar et al. (2016), Ishikawa et al. (1995), Itoh and Narazaki (2017), Itthipoonthanakorn et al. (2019), Iurian et al. (2013), Jankovic et al. (2014), Jasiulionis and Wershofen (2005), Jia and Jia (2014), Jia et al. (2003), Jiang (1999), Joshi (1985), Joshi et al. (1969),

Juri Ayub et al. (2009), Kadko (2000), Kadko and Johns (2011), Kadko and Olson (1996), Kadko and Prospero (2011), Kadko and Swart (2004), Kadko et al. (2015, 2016), Kapala et al. (2018), Karwan et al. (2016), Kato et al. (2010), Khan et al. (2008, 2009), Khodadadi et al. (2018), Kikuchi et al. (2009), Kim et al. (1998, 1999, 2000, 2005), Kitto et al. (2005, 2006), Klaminder et al. (2006), Koide et al. (1977, 1979), Kolb (1970), Kownacka et al. (1990), Krmar et al. (2015), Kulan et al. (2006), Kurata et al. (1986), Laguionie et al. (2014), Lal et al. (1979), Lambert et al. (1990), Lamborg et al. (2000, 2003), Landis et al. (2014), Larsen et al. (1995), Lee et al. (1985, 2002, 2015), Leppanen (2019), Li et al. (2009, 2013, 2017a, 2017b), Likuku (2006a, 2006b), Lin et al. (2014), Lindblom (1969), Liu et al. (2014), Lockhart Jr et al. (1966), Lozano et al. (2011, 2012, 2013), Lujanienë (2003), Luyanas et al. (1970), Mabit et al. (2009), Maenhaut et al. (1979), Magno et al. (1970), Marx et al. (2005), Mattsson (1970), McNeary and Baskaran (2003), Megumi et al. (2000), Mélières et al. (2003), Men et al. (2016), Meusburger et al. (2016, 2018), Mietelski et al. (2017), Milton et al. (2001), Miralles et al. (2004), Mohan et al. (2018, 2019), Mohery et al. (2014, 2016), Momoshima et al. (2006), Monaghan (1989), Monaghan and Holdsworth (1990), Monaghan et al. (1986), Moore and Poet (1976), Muramatsu et al. (2008), Narazaki and Fujitaka (2009), Narazaki et al. (2003), Neroda et al. (2016), Nijampurkar and Clausen (1990), Nijampurkar and Rao (1993), Nijampurkar et al. (2002), Noithong et al. (2019), Nozaki et al. (1978), O'Farrell et al. (2007), Olsen et al. (1985), Othman et al. (1998), Paatero and Hatakka (2000), Paatero et al. (2003, 2010, 2015, 2017), Pacini et al. (2011, 2015), Padilla et al. (2019), Pan et al. (2011, 2017), Papastefanou and Bondietti (1991), Papastefanou and Ioannidou (1991), Papastefanou et al. (1995), Parker (1962), Peirson (1963), Peirson et al. (1966), Peng et al. (2019), Perreault et al. (2017), Persson (2016), Peters et al. (1997), Pfahler et al. (2004), Pham et al. (2011, 2013), Picciotto et al. (1964, 1968), Piñero-García and Ferro-García (2013), Piñero-García et al. (2012, 2015), Poet,et al. (1972), Poreba et al. (2019), Porto and Walling (2012), Porto et al. (2006, 2009, 2013, 2014, 2016), Pourchet et al. (1997), Preiss et al. (1996), Prospero et al. (1995), Qian et al. (1985), Rabesiranana et al. (2016), Rajačić et al. (2015, 2016), Raksawong et al. (2017), Ram and Sarin (2012), Rangarajan et al. (1966, 1975, 1986), Rastogi and Sarin (2008), Realo et al. (2004, 2007), Reiter et al. (1983), Renfro et al. (2013), Rodas Ceballos et al. (2016), Ródenas et al. (1997), Rodriguez-Perulero et al. (2019), Saari et al. (2010), Sabuti and Mohamed (2016), Sakurai et al. (2005, 2011), Saleh and Abdel-Halim (2017), Sambayev et al. (2019), Samolov et al. (2014), San Miguel et al. (2019), Sanchez-Cabeza et al. (2007), Sanders et al. (2011), Sato et al. (1994, 2003), Savva et al. (2018), Schuler et al. (1991), Schumann and Stoeppler (1963), Shapiro and Forbes-Resha

(1976), Sheets et al. (1999), Shelley et al. (2016), Shi et al. (2011, 2017), Shleien and Friend (1966), Short et al. (2007), Silker (1972), Simon et al. (2009), Smith et al. (1997), Song et al. (2003, 2015),

645 Stamoulis et al. (2018), Steinmann et al. (1999, 2013), Stromsoe et al. (2016), Su et al. (2003), Sugihara et al. (2000), Suzuki and Shiono (1995), Suzuki et al. (1999, 2004, 2017), Sykora et al. (2017), Talbot and Andren (1983), Tan et al. (2013, 2016), Tanahara et al. (2014), Tanaka and Turekian (1995), Tateda and Iwao (2008), Taylor et al. (2016), Terzi and Kalinowski (2017), Thang et al. (2018), Thompson et al. (1984), Thor and Zutshi (1958), Todd et al. (1989), Todorovic et al. (1999, 2000, 2005, 2010), Tokieda

650 et al. (1996), Tositti et al. (2014), Tsunogai,et al. (1985, 1988), Tuo et al. (2018), Turekian and Cochran (1981), Turekian et al. (1977, 1983), Uchida et al. (2009), Uematsu et al. (1994), Ueno et al. (2003), Uğur et al. (2011), Uhlář et al. (2014), Valles et al. (2009), Van Metre and Fuller (2009), Vecchi and Valli (1997), Vecchi et al. (2005), Vogler et al. (1996), Von Gunten et al. (1993), Wagenbach et al. (1988), Wakiyama et al. (2010), Wallbrink and Murray (1994, 1996), Walling and He (1999), Walling et al.

655 (2003), Walton and Fried (1962), Wan et al. (2010), Wang (2010, 2011), Wang et al. (2014a, 2014b), Weiss and Naidu (1986), Wells et al. (2012), Windom (1969), Winkler and Rosner (2000), Winkler et al. (1998), Wu et al. (2011), Yamagata et al. (2019), Yamamoto et al. (2006), Yang et al. (1999, 2011, 2013), Yi et al. (2005, 2007), Yoshimori et al. (2005), Young and Silker (1980), Yu et al. (2017, 2018), Zanis et al. (1999, 2003), Zhang et al. (2003, 2006, 2014, 2016, 2018a, 2018b, 2019), Zheng et al. (2005, 2007),

660 Zhu and Olsen (2009).

Author contributions

FZ is responsible for most of the writing of this article, along with the assembly of the data and preparation of the figures. QZ and YW assisted FZ in compiling the data. JW, MB, QZ, PJ and JD contributed to the review of the manuscript.

665 **Competing interests**

The authors declare that they have no conflict of interest.

Acknowledgements

We thank all scientists conducting research on ^{7}Be and/or ^{210}Pb, whose previous work and published data

made our compilation possible. Fule Zhang would like to thank Yufeng Chen for his assistance in preparing graphics.

Financial support

This research has been supported by the Science and Technology Plan Projects of Guangxi Province (2017AB30024), 111 Program (BP0820020), and the ECNU Academic Innovation Promotion Program for Excellent Doctoral Students.

References

Aaboe, E., Dion, E. P., and Turekian, K. K.: ^{7}Be in Sargasso Sea and Long Island Sound waters, J. Geophys. Res., 86, 3255-3257, 1981.

Aba, A., Al-Dousari, A. M., and Ismaeel, A.: Depositional characteristics of ^{7}Be and ^{210}Pb in Kuwaiti dust, J. Radioanal. Nucl. Ch., 307, 15-23, 2016.

Ahmed, A. A., Mohamed, A., Ali, A. E., Barakat, A., Abd El-Hady, M., and El-Hussein, A.: Seasonal variations of aerosol residence time in the lower atmospheric boundary layer, J. Environ. Radioactiv., 77, 275-283, 2004.

Akata, N., Kawabata, H., Hasegawa, H., Sato, T., Chikuchi, Y., Kondo, K., Hisamatsu, S., and Inaba, J.: Total deposition velocities and scavenging ratios of ^{7}Be and ^{210}Pb at Rokkasho, Japan, J. Radioanal. Nucl. Ch., 277, 347-355, 2008.

Akata, N., Hasegawa, H., Kawabata, H., Kakiuchi, H., Chikuchi, Y., Shima, N., Suzuki, T., and Hisamatsu, S.: Atmospheric deposition of radionuclides (^{7}Be, ^{210}Pb, ^{134}Cs, ^{137}Cs and ^{40}K) during 2000–2012 at Rokkasho, Japan, and impact of the Fukushima Dai-ichi Nuclear Power Plant accident, J. Radioanal. Nucl. Ch., 303, 1217-1222, 2015.

Akata, N., Shiroma, Y., Furukawa, M., Kato, A., Kakiuchi, H., Hosoda, M., Kanai, Y., and Yanagisawa, F.: Concentrations of chemical components, including ^{210}Pb, present in aerosols collected at Naha, Okinawa prefecture, a sub-tropical region of Japan, Jpn. J. Health. Phys., 53, 17-22, 2018a.

Akata, N., Shiroma, Y., Ikemoto, N., Kato, A., Hegedus, M., Tanaka, M., Kakiuchi, H., and Kovacs, A.:

Atmospheric concentration and deposition flux of cosmogenic beryllium-7 at Toki, central part of

695   Japan, Radiat. Environ. Med., 7, 47-52, 2018b.

Akram, M., Aslam, M., Shafique, M., Jabbar, A., and Orfi, S. D.: Monitoring of radioactive air pollutants in the atmosphere of Karachi, Sindh, using gamma spectrometry technique, Nucleus, 36, 143-145, 1999.

Al-Azmi, D., Sayed, A. M., and Yatim, H. A.: Variations in ^{7}Be concentrations in the atmosphere of

700   Kuwait during the period 1994 to 1998, Appl. Radiat. Isot., 55, 413-417, 2001.

Alegría, N., Herranz, M., Idoeta, R., and Legarda, F.: Study of ^{7}Be activity concentration in the air of northern Spain, J. Radioanal. Nucl. Ch., 286, 347-351, 2010.

Ali, N., Khan, E. U., Akhter, P., Khattak, N. U., Khan, F., and Rana, M. A.: The effect of air mass origin on the ambient concentrations of ^{7}Be and ^{210}Pb in Islamabad, Pakistan, J. Environ. Radioactiv., 102,

705   35-42, 2011a.

Ali, N., Khan, E. U., Akhter, P., Rana, M. A., Rajput, M. U., Khattak, N. U., Malik, F., and Hussain, S.: Wet depositional fluxes of ^{210}Pb- and ^{7}Be-bearing aerosols at two different altitude cities of North Pakistan, Atmos. Environ., 45, 5699-5709, 2011b.

Alonso-Hernández, C. M., Aguila, H. C., Asencio, M. D., and Caravaca, A. M.: Reconstruction of ^{137}Cs

710   signal in Cuba using ^{7}Be as tracer of vertical transport processes in the atmosphere, J. Environ. Radioactiv., 75, 133-142, 2004.

Alonso-Hernández, C. M., Morera-Gómez, Y., Cartas-Águila, H., and Guillén-Arruebarrena, A.: Atmospheric deposition patterns of ^{210}Pb and ^{7}Be in Cienfuegos, Cuba, J. Environ. Radioactiv., 138, 149-155, 2014.

715 Amano, H., and Kasai, A.: Concentration of ^{7}Be in the lower atmosphere and fallout rate in Tokai, Jpn. J. Health. Phys., 16, 99-103, 1981 (in Japanese).

Anand, S. J. S. and Rangarajan, C.: Studies on the activity ratios of polonium-210 to lead-210 and their dry-deposition velocities at Bombay in India, J. Environ. Radioactiv., 11, 235-250, 1990.

Anderson, W., Bentley, R. E., Parker, R. P., Crookall, J. O., and Burton, L. K.: Comparison of fission

720   product and beryllium-7 concentrations in the atmosphere, Nature, 187, 550-553, 1960.

Andres, P.: Determination of atmospheric concentration of beryllium-7 at ground level, Radiat. Prot. Environ., 41, 148-151, 2018.

Andrews, J. E., Hartin, C., and Buesseler, K. O.: [7]Be analyses in seawater by low background gamma-spectroscopy, J. Radioanal. Nucl. Ch., 277, 253-259, 2008.

725 Appleby, P. G.: Three decades of dating recent sediments by fallout radionuclides: a review, Holocene, 18, 83-93, 2008.

Appleby, P. G., Koulikov, A. O., Camarero, L., and Ventura, M.: The input and transmission of fallout radionuclides through Redó, a high mountain lake in the Spanish Pyrenees, Water Air Soil Poll., 2, 19-31, 2002.

730 Appleby, P. G., Haworth, E. Y., Michel, H., Short, D. B., Laptev, G., and Piliposian, G. T.: The transport and mass balance of fallout radionuclides in Blelham Tarn, Cumbria (UK), J. Paleolimnol., 29, 459-473, 2003.

Appleby, P. G., Semertzidou, P., Piliposian, G. T., Chiverrell, R. C., Schillereff, D. N., and Warburton, J.: The transport and mass balance of fallout radionuclides in Brotherswater, Cumbria (UK), J. 735 Paleolimnol., 62, 389-407, 2019.

Arimoto, R., Snow, J. A., Graustein, W. C., Moody, J. L., Ray, B. J., Duce, R. A., Turekian, K. K., and Maring, H. B.: Influences of atmospheric transport pathways on radionuclide activities in aerosol particles from over the North Atlantic, J. Geophys. Res., 104, 21301-21316, 1999.

Arkian, F., Meshkatee, A. H., and Bidokhti, A. A.: The effects of large-scale atmospheric flows on 740 berylium-7 activity concentration in surface air, Environ. Monit. Assess., 168, 429-439, 2010.

Arnold, J. R. and Al-Salih, H. A.: Beryllium-7 produced by cosmic rays, Science, 121, 451-453, 1955.

Azahra, M., Camacho-García, A., González-Gómez, C., López-Peñalver, J. J., and El Bardouni, T.: Seasonal [7]Be concentrations in near-surface air of Granada (Spain) in the period 1993–2001, Appl. Radiat. Isot., 59, 159-164, 2003.

745 Azahra, M., González-Gómez, C., López-Peñalver, J. J., El Bardouni, T., Camacho García, A., Boukhal, H., El Moussaoui, F., Chakir, E., Erradi, L., Kamili, A., and Sekaki, A.: The seasonal variations of

[7]Be and ^{210}Pb concentrations in air, Radiat. Phys. Chem., 71, 789-790, 2004.

Azimov, A. N., Safarov, A. N., Kungurov, F. R., and Muminov, A. T.: [7]Be variation in monthly atmospheric precipitation in 2002–2005 in Samarkand, Atom. Energy, 111, 151-154, 2011.

750   Azimov, A. N., Mukhamedov, A. K., Safarov, A. A., Bazarbaev, N. N., Inoyatov, A. K., Muminov, I. T., Omonov, K. S., Rashidova, D. S., Kholbaev, I. K., and Eshkobilov, S. K.: Atmospheric Fallout of [7]Be in 2009–2014 in Tashkent and Samarkand, Atom. Energy, 123, 63-67, 2017.

Bachhuber, H. and Bunzl, K.: Background levels of atmospheric deposition to ground and temporal variation of [129]I, [127]I, ^{137}Cs and [7]Be in a rural area of Germany, J. Environ. Radioactiv., 16, 77-89,
755   1992.

Baeza, A., Delrío, L. M., Jiménez, A., Miró, C., Paniagua, J. M., and Rufo, M.: Analysis of the temporal evolution of atmospheric [7]Be as a vector of the behavior of other radionuclides in the atmosphere, J. Radioanal. Nucl. Ch., 207, 331-344, 1996.

Baeza, A., Rodriguez-Perulero, A., and Guillen, J.: Anthropogenic and naturally occurring radionuclide
760   content in near surface air in Caceres (Spain), J. Environ. Radioactiv., 165, 24-31, 2016.

Balkanski, Y. J., Jacob, D. J., Gardner, G. M., Graustein, W. C., and Turekian, K. K.: Transport and residence times of tropospheric aerosols inferred from a global three-dimension simulation of ^{210}Pb, J. Geophys. Res., 98, 20573-20586, 1993.

Bas, M. D., Ortiz, J., Ballesteros, L., and Martorell, S.: Evaluation of a multiple linear regression model
765   and SARIMA model in forecasting [7]Be air concentrations, Chemosphere, 177, 326-333, 2017.

Baskaran, M.: A search for the seasonal variability on the depositional fluxes of [7]Be and [210]Pb. J. Geophys. Res., 100: 2833-2840, 1995.

Baskaran, M.: Po-210 and Pb-210 as atmospheric tracers and global atmospheric Pb-210 fallout: a Review. J. Environ. Radioactiv., 102, 500-513, 2011.

770   Baskaran, M. and Santschi, P. H.: The role of particles and colloids in the transport of radionuclides in coastal environments of Texas, Mar. Chem., 43, 95-114, 1993.

Baskaran, M. and Swarzenski, P. W.: Seasonal variations on the residence times and partitioning of short-lived radionuclides ([234]Th, [7]Be and ^{210}Pb) and depositional fluxes of [7]Be and ^{210}Pb in Tampa Bay,

Florida, Mar. Chem., 104, 27-42, 2007.

Baskaran, M., Coleman, C. H., and Santschi, P. H.: Atmospheric depositional fluxes of ^{7}Be and ^{210}Pb at Galveston and College Station, Texas, J. Geophys. Res., 98, 20555-20571, 1993.

Baskaran, M., Ravichandran, M., and Bianchi, T. S.: Cycling of ^{7}Be and ^{210}Pb in a high DOC, shallow, turbid estuary of south-east Texas, Estuar. Coast. Shelf S., 45, 165-176, 1997.

Baskaran, M., Mudbidre, R., and Schweitzer, L.: Quantification of Po-210 and Pb-210 as tracer of sediment resuspension rate in a shallow riverine system: case study from Southeast Michigan, USA, J. Environ. Radioact., 222, http://doi.org/10.1016/j.jenvrad.2020.106339, 2020.

Batraov, G. F., Kremenchutskii, D. A., Nazarov, A. B. and Kholoptsev, A. V.: Factors influence on atmospheric concentrations of beryllium-7 (^{7}Be) in the Chernobyl zone, http://doi.org/10.20861/2304-2338-2016-45-002, 2016.

Bazarbaev, N. N., Inoyatov, A. K., Muminov, I. T., Rashidova, D. S., Mukhamedov, A. K., and Safarov, A. N.: Cosmogenic ^{7}Be fallout near Samarkand in 2002–2009, Atom. Energy, 111, 295-300, 2012.

Begy, R. C., Kovacs, T., Veres, D., and Simon, H.: Atmospheric flux, transport and mass balance of ^{210}Pb and ^{137}Cs radiotracers in different regions of Romania, Appl. Radiat. Isot., 111, 31-39, 2016.

Beks, J. P., Eisma, D., and van der Plicht, J.: A record of atmospheric ^{210}Pb deposition in The Netherlands, Sci. Total. Environ., 222, 35-44, 1998.

Belmaker, R., Lazar, B., Stein, M., and Beer, J.: Short residence time and fast transport of fine detritus in the Judean Desert: Clues from ^{7}Be in settled dust, Geophys. Res. Lett., 38, L16714, https://doi.org/10.1029/2011GL048672, 2011.

Benninger, L. K., Lewis, D. M., and Turekian, K. K.: The use of natural Pb-210 as a heavy metal tracer in the river-estuarine system, in: Marine Chemistry in the Coastal Environment/ACS Symposium Serious 18, Washington, D. C., USA, 202-210, 1975.

Belyaev, V. R., Wallbrink, P. J., Golosov, V. N., Murray, A. S., and Sidorchuk, A. Y.: Reconstructing the development of a gully in the upper Kalaus basin, Stavropol region (southern Russia), Earth Surf. Proc. Land., 29, 323-341, 2004.

800   Benitez-Nelson, C. R. and Buesseler, K. O.: Phosphorus 32, phosphorus 37, beryllium 7, and lead 210:
            Atmospheric fluxes and utility in tracing stratosphere/troposphere exchange, J. Geophys. Res., 104,
            11745-11754, 1999.

        Benmansour, M., Mabit, L., Nouira, A., Moussadek, R., Bouksirate, H., Duchemin, M., and Benkdad,
            A.: Assessment of soil erosion and deposition rates in a Moroccan agricultural field using fallout
805   ^{137}Cs and ^{210}Pb$_{ex}$, J. Environ. Radioactiv., 115, 97-106, 2013.

        Bettoli, M. G., Cantelli, L., Degetto, S., Tositti, L., Tubertini, O., and Valcher, S.: Preliminary
            investigations on ^{7}Be as a tracer in the study of environmental processes, J. Radioanal. Nucl. Ch.,
            190, 137-147, 1995.

        Bikkina, S., Sarin, M. M., and Chinni, V.: Atmospheric ^{210}Pb and anthropogenic trace metals in the
810   continental outflow to the Bay of Bengal, Atmos. Environ., 122, 737-747, 2015.

        Blake, W., Walling, D. E., and He, Q.: Fallout beryllium-7 as a tracer in soil erosion investigations, Appl.
            Radiat. Isotopes, 51, 599-605, 1999.

        Blake, W. H., Wallbrink, P. J., Wilkinson, S. N., Humphreys, G. S., Doerr, S. H., Shakesby, R. A., and
            Tomkins, K. M.: Deriving hillslope sediment budgets in wildfire-affected forests using fallout
815   radionuclide tracers, Geomorphology, 104, 105-116, 2009.

        Blazej, S. and Mietelski, J. W.: Cosmogenic ^{22}Na, ^{7}Be and terrestrial ^{137}Cs, ^{40}K radionuclides in ground
            level air samples collected weekly in Krakow (Poland) over years 2003-2006, J. Radioanal. Nucl.
            Chem., 300, 747-756, 2014.

        Bleichrodt, J. F.: Mean tropospheric residence time of cosmic-ray-produced beryllium 7 at north
820   temperate latitudes, J. Geophys. Res., 83, 3058-3062,1978.

        Bleichrodt, J. F. and van Abkoude, E. R.: On the deposition of cosmic-ray-produced beryllium 7, J.
            Geophys. Res., 68, 5283-5288, 1963.

        Bonniwell, E. C., Matisoff, G., and Whiting, P. J.: Determining the times and distances of particle transit
            in a mountain stream using fallout radionuclides, Geomorphology, 27, 75-92, 1999.

825   Bonnyman. J., and Molina-Ramos, J.: Concentrations of lead-210 in rainwater in Australia during the
            years 1964-1970, Tech. Rep. CXRL/7, Commonw. X-Ray Radium Lab., Melbourne, 1971.

Bourcier, L., Masson, O., Laj, P., Pichon, J. M., Paulat, P., Freney, E., and Sellegri, K.: Comparative trends and seasonal variation of [7]Be, ^{210}Pb and ^{137}Cs at two altitude sites in the central part of France, J. Environ. Radioactiv., 102, 294-301, 2011.

830   Brandt, C., Benmansour, M., Walz, L., Nguyen, L. T., Cadisch, G., and Rasche, F.: Integrating compound-specific δ^{13}C isotopes and fallout radionuclides to retrace land use type-specific net erosion rates in a small tropical catchment exposed to intense land use change, Geoderma, 310, 53-64, 2018.

Branford, D., Fowler, D., and Moghaddam, M. V.: Study of Aerosol Deposition at a Wind Exposed Forest
835   Edge Using ^{210}Pb and [137]Cs Soil Inventories, Water Air Soil Poll., 157, 107-116, 2004.Brost, R. A., Feichter, J., and Heimann, M.: Three-dimensional simulation of [7]Be in a global climate model, J. Geophys. Res., 96, 22423-22445, 1991.

Brown, L., Stensland, G. J., Klein, J., and Middleton, R.: Atmospheric deposition of [7]Be and [10]Be, Geochim. Cosmochim. Ac., 53, 135-142, 1989.

840   Buck, C. S., Aguilar-Islas, A., Marsay, C., Kadko, D., and Landing, W. M.: Trace element concentrations, elemental ratios, and enrichment factors observed in aerosol samples collected during the US GEOTRACES eastern Pacific Ocean transect (GP16), Chem. Geol., 511, 212-224, 2019.

Buraeva, E. A., Malyshevsky, V. S., Nephedov, V. C., Shramenko, B. I., Stasov, V. V., and Zorina, L. V.: Cosmogenic [7]Be in ground level air in Rostov-on-Don (Russia) (2001-2011), Physics,
845   http://arxiv.org/abs/1310.5271v1, 2013a.

Buraeva, E. A., Malyshevsky, V. S., Shramenko, B. I., Zorina, L. V., and Shramenko, B. I.: A record of atmospheric ^{210}Pb accumulation in the industrial city, Physics, https://arxiv.org/abs/1310.5305, 2013b.

Burton, W. M. and Stewart, N. G.: Use of long-lived natural radioactivity as an atmospheric tracer, Nature,
850   186, 584-589, 1960.

Caillet, S., Arpagaus, P., Monna, F., and Dominik, J.: Factors controlling [7]Be and ^{210}Pb atmospheric deposition as revealed by sampling individual rain events in the region of Geneva, Switzerland, J. Environ. Radioactiv., 53, 241-256, 2001.

Cámara-Mor, P., Masque, P., Garcia-Orellana, J., Kern, S., Cochran, J. K., and Hanfland, C.: Interception of atmospheric fluxes by Arctic sea ice: Evidence from cosmogenic [7]Be, J. Geophys. Res., 116, C12041, https://doi.org/10.1029/2010JC006847, 2011.

Cannizzaro, F., Greco, G., Raneli, M., Spitale, M. C., and Tomarchio, E.: Determination of ^{210}Pb concentration in the air at ground-level by gamma-ray spectrometry, Appl. Radiat. Isot., 51, 239-245, 1999.

Cannizzaro, F., Greco, G., Raneli, M., Spitale, M. C., and Tomarchio, E.: Concentration measurements of [7]Be at ground level air at Palermo, Italy—comparison with solar activity over a period of 21 years, J. Environ. Radioactiv., 72, 259-271, 2004.

Canuel, E. A., Martens, C. S., and Benninger, L. K.: Seasonal variations in [7]Be activity in the sediments of Cape Lookout Bight, North Carolina, Geochim. Cosmochim. Ac., 54, 237-245, 1990.

Cao, Z., Yang, Y., Wang, L., and Wang, K.: The activity concentration of ^{210}Pb and [210]Po in Hangzhou atmosphere and induced public dose assessment, Radiat. Prot., 38, 8-14, 2018 (in Chinese).

Carpenter, R., Bennett, J. T., and Peterson, M. L.: [210]Pb activities in and fluxes to sediments of the Washington continental slope and shelf, Geochim. Cosmochim. Ac., 45, 1155-1172, 1981.

Carvalho, F. P.: Origins and concentrations of [222]Rn, ^{210}Pb, [210]Bi and [210]Po in the surface air at Lisbon, Portugal, at the Atlantic edge of the European continental landmass, Atmos. Environ., 29, 1809-1819, 1995.

Carvalho, A. C., Reis, M., Silva, L., and Madruga, M. J.: A decade of [7]Be and ^{210}Pb activity in surface aerosols measured over the Western Iberian Peninsula, Atmos. Environ., 67, 193-202, 2013.

Chae, J. S. and Kim, G.: Large seasonal variations in fine aerosol precipitation rates revealed using cosmogenic [7]Be as a tracer, Sci. Total. Environ., 673, 1-6, 2019.

Chae, J. S., Byun, J. I., Yim, S. A., Choi, H. Y., and Yun, J. Y.: [7]Be in ground level air in Daejeon, Korea, Radiat. Prot. Dosim., 146, 334-337, 2011.

Chang, Y., Wang, X., Wang, S., and Wang, J.: Radionuclides monitoring in atmospheric aerosol samples in Xi'an, Nucl. Tech., 31, 796-800, 2008 (in Chinese).

880 Chao, J. H., Chiu, Y. J., Lee, H. P., and Lee, M. C.: Deposition of beryllium-7 in Hsinchu, Taiwan, Appl. Radiat. Isot., 70, 415-422, 2012.

Chao, J. H., Liu, C. C., Cho, I. C., and Niu, H.: Monitoring of ^{7}Be in surface air of varying PM_{10} concentrations, Appl. Radiat. Isot., 89, 95-101, 2014.

Chen, R.: Study on soil erosion tracer and nutrient element distribution in Honghu watershed, Jiangxi,
885 M.S. thesis, Nanjing Normal University, China, 2014 (in Chinese).

Chen, J., Luo, S., and Huang, Y.: Scavenging and fractionation of particle-reactive radioisotopes ^{7}Be, ^{210}Pb and ^{210}Po in the atmosphere, Geochim. Cosmochim. Ac., 188, 208-223, 2016.

Chen, J., Zhang, X., Navas, A., Wen, A., Wang, X., and Zhang, R.: A study on a ^{210}Pb$_{ex}$ accumulation-decay model for dating moraine soils to trace glacier retreat time, J. Environ. Radioactiv., 212,
890 https://doi.org/10.1016/j.jenvrad.2019.106124, 2020.

Chham, E., Pinero-Garcia, F., Gonzalez-Rodelas, P., and Ferro-Garcia, M. A.: Impact of air masses on the distribution of ^{210}Pb in the southeast of Iberian Peninsula air, J. Environ. Radioactiv., 177, 169-183, 2017.

Chham, E., Pinero-Garcia, F., Brattich, E., El Bardouni, T., and Ferro-Garcia, M. A.: ^{7}Be spatial and
895 temporal pattern in southwest of Europe (Spain): Evaluation of a predictive model, Chemosphere, 205, 194-202, 2018.

Chham, E., Milena-Pérez, A., Piñero-García, F., Hernández-Ceballos, M. A., Orza, J. A. G., Brattich, E., El Bardouni, T., and Ferro-García, M. A.: Sources of the seasonal-trend behaviour and periodicity modulation of ^{7}Be air concentration in the atmospheric surface layer observed in southeastern Spain,
900 Atmos. Environ., 213, 148-158, 2019.

Cho, H. M., Hong, Y. L., and Kim, G.: Atmospheric depositional fluxes of cosmogenic ^{35}S and ^{7}Be: Implications for the turnover rate of sulfur through the biosphere, Atmos. Environ., 45, 4230-4234, 2011.

Clifton, R. J., Watson, P. G., Davey, J. T., and Frickers, P. E.: A study of processes affecting the uptake
905 of contaminants by intertidal sediments, using the radioactive tracers: ^{7}Be, ^{137}Cs and unsupported ^{210}Pb, Estuar. Coast. Shelf S., 41, 459-474, 1995.

Conaway, C. H., Storlazzi, C. D., Draut, A. E., and Swarzenski, P. W.: Short-term variability of [7]Be atmospheric deposition and watershed response in a Pacific coastal stream, Monterey Bay, California, USA, J. Environ. Radioactiv., 120, 94-103, 2013.

910 Courtier, J., Sdraulig, S., and Hirth, G.: [7]Be and ^{210}Pb wet/dry deposition in Melbourne, Australia and the development of deployable units for radiological emergency monitoring, J. Environ. Radioactiv., 178-179, 419-425, 2017.

Covelo, E. F., Vega, F. A., and Andrade, M. L.: Sorption and desorption of Cd, Cr, Cu, Ni, Pb and Zn by a Fibric Histosol and its organo-mineral fraction, J. Hazard. Mater., 159, 342-347, 2008.

915 Crecelius, E. A.: Prediction of marine atmospheric deposition rates using total [7]Be deposition velocities, Atmospheric Environment (1967), 15, 579-582, 1981.

Crozaz, G. and Langway, C. C.: Dating Greenland firn-ice cores with Pb-210, Earth Planet. Sc. Lett., 1, 194-196, 1966.

Crozaz, G., Picciotto, E., and De Breuck, W.: Antarctic snow chronology with Pb[210], J. Geophys. Res., 920 69, 2597-2604, 1964.

Cruikshank, A. J., Cowper, G., and Grummitt, W. E.: Production of Be[7] in the atmosphere, Cann. J. Chem., 34, 214-219, 1956.

Cruz, P. T. F., Bonga III, A. C., Dela Sada, C. L., Olivares, J. U., Dela Cruz, F. M., Palad, L. J. H., Jesuitas, A. J., Cabatbat, E. C., Omandam, V. J., Garcia, T. Y., and Feliciano, C. P.: Assessment of 925 temporal variations of natural radionuclides Beryllium-7 and Lead-212 in surface air in Tanay, Philippines, J. Environ. Radioactiv., 208-209, https://doi.org/10.1016/j.jenvrad.2019.105989, 2019.

Cui, W., Zhang, M., Yang, H., Yang, B., and Lu, J.: Estimating soil erosion rates of cultivated fields using ^{137}Cs and [210]Pb$_{ex}$ in Jiangxi red soils region, J. Anhui Agri. Sci., 40, 8515-8517, 2012 (in Chinese).

Daish, S. R., Dale, A. A., Dale, C. J., May, R., and Rowe, J. E.: The temporal variations of [7]Be, [210]Pb 930 and [210]Po in air in England, J. Environ. Radioactiv., 84, 457-467, 2005.

Damatto, S. R., Máduar, M. F., Nisti, M. B., Nogueira, P. R., and Pecequilo, B. R. S.: Preliminary results of [7]Be concentrations in ground level air at So Paulo, Brazil, in: The 2nd International Conference

on Radioactivity in the Environment, Nice, France, 2-6 October 2005, 140-146, 2005.

Damnati, B., Ibrahimi, S., and Radakovitch, O.: Quantifying erosion using ^{137}Cs and ^{210}Pb in cultivated soils in three Mediterranean watershed: Synthesis study from El Hachef, Raouz and Nakhla (North West Morocco), J. Afr. Earth Sci., 79, 50-57, 2013.

Danielsen, E. F.: Stratospheric-tropospheric exchange based on radioactivity, ozone, and potential vorticity. J. Atmos. Sci., 25, 502-518, 1968.

D'Amours, R., Mintz, R., Mooney, C., and Wiens, B. J.: A modeling assessment of the origin of Beryllium-7 and Ozone in the Canadian Rocky Mountains, J. Geophys. Res-Atmos., 118, 10125-10138, 2013.

de Tombeur, F., Cornu, S., Bourlès, D., Duvivier, A., Pupier, J., Aster, T., Brossard, M., and Evrard, O.: Retention of ^{10}Be, ^{137}Cs and ^{210}Pb$_{xs}$ in soils: Impact of physico-chemical characteristics, Geoderma, 367, 114242, 2020.

Deng, B., Zhong, Q., Wang, Q., Du, J., and Zhang, X.: Temporal variation of ^{210}Pb concentration in the urban aerosols of Shanghai, China, J. Radioanal. Nucl. Ch., 323, 1135-1143, 2020.

Dibb, J. E.: Atmospheric deposition of beryllium 7 in the Chesapeake Bay region, J. Geophys. Res., 94, 2261-2265, 1989.

Dibb, J. E.: Recent deposition of ^{210}Pb on the Greenland Ice Sheet: variations in space and time, Ann. Glaciol., 14, 51-54, 1990a.

Dibb, J. E.: Beryllium-7 and lead-210 in the atmosphere and surface snow over the Greenland Ice Sheet in the summer of 1989, J. Geophys. Res., 95, 22407-22415, 1990b.

Dibb, J. E.: The accumulation of ^{210}Pb at Summit, Greenland since 1855, Tellus, 44B, 72-79, 1992.

Dibb, J. E.: Vertical mixing above Summit, Greenland: Insights into seasonal and high frequency variability from the radionuclide tracers ^{7}Be and ^{210}Pb, Atmos. Environ., 41, 5020-5030, 2007.

Dibb, J. E. and Jaffrezo, J. L.: Beryllium-7 and lead-210 in aerosol and snow in the dye 3 gas, aerosol and snow sampling program, Atmos. Environ., 27A, 2751-2760, 1993.

Dibb, J. E., Meeker, L. D., Finkel, R. C., Southon, J. R., Caffee, M. W., and Barrie, L. A.: Estimation of

stratospheric input to the Arctic troposphere: [7]Be and [10]Be in aerosols at Alert, Canada, J. Geophys. Res., 99, 12855-12864, 1994.

Ding, M., Su, L., Liu, G., Zhu, J., Feng, J., and Zhang, H.: Atmospheric depositional fluxes of [7]Be and depositional velocities of aerosols in Shenzhen, Geochimica, 46, 81-86, 2017 (in Chinese).

Dlugosz-Lisiecka, M.: Chemometric methods for source apportionment of ^{210}Pb, [210]Bi and [210]Po for 10 years of urban air radioactivity monitoring in Lodz city, Poland, Chemosphere, 220, 163-168, 2019.

Doering, C. and Akber, R.: Beryllium-7 in near-surface air and deposition at Brisbane, Australia, J. Environ. Radioactiv., 99, 461-467, 2008a.

Doering, C. and Akber, R.: Describing the annual cyclic behaviour of [7]Be concentrations in surface air in Oceania, J. Environ. Radioactiv., 99, 1703-1707, 2008b.

Doering, C. and Saey, P.: Hadley cell influence on [7]Be activity concentrations at Australian mainland IMS radionuclide particulate stations, J. Environ. Radioactiv., 127, 88-94, 2014.

Doering, C., Akber, R., and Heijnis, H.: Vertical distributions of ^{210}Pb excess, [7]Be and ^{137}Cs in selected grass covered soils in Southeast Queensland, Australia, J. Environ. Radioactiv., 87, 135-147, 2006.

Doi, T., Sato, S., and Sato, J.: Atmospheric concentration of ^{210}Pb in East Asia and its contribution to Japanese islands by long-range transport, Radioisotopes, 56, 115-130, 2007.

Dominik, J., Burrus, D., and Vernet, J. P.: Transport of the environmental radionuclides in an alpine watershed, Earth Planet. Sc. Lett., 84, 165-180, 1987.

Dominik, J., Schuler, C., and Santschi, P. H.: Residence times of [234]Th and [7]Be in Lake Geneva, Earth Planet. Sc. Lett., 93, 345-358, 1989.

Dörr, H. and Münnich, K. O.: Lead and cesium transport in European forest soils, Water Air Soil Poll., 57, 809-818, 1991.

Dovhyi, I. I., Kremenchutskii, D. A., Proskurnin, V. Y., and Kozlovskaya, O. N.: Atmospheric depositional fluxes of cosmogenic ^{32}P, ^{33}P and [7]Be in the Sevastopol region, J. Radioanal. Nucl. Ch., 314, 1643-1652, 2017.

Du, J., Zhang, J., Zhang, J., and Wu, Y.: Deposition patterns of atmospheric [7]Be and ^{210}Pb in coast of

985   East China Sea, Shanghai, China, Atmos. Environ., 42, 5101-5109, 2008.

Du, J., Wu, Y., Huang, D., and Zhang, J.: Use of [7]Be, ^{210}Pb and ^{137}Cs tracers to the transport of surface

sediments of the Changjiang Estuary, China, J. Marine Syst., 82, 286-294, 2010.

Du, J., Zhang, J., and Baskaran, M.: Applications of short-lived radionuclides ([7]Be, ^{210}Pb, [210]Po, [137]Cs

and [234]Th) to trace the sources, transport pathways and deposition of particles/sediments in rivers,

990   estuaries and coasts, in: Handbook of environmental isotope geochemistry, edited by: Baskaran, M.,

Springer, Berlin, Heidelberg, Germany, 305-329, https://doi.org/10.1007/978-3-642-10637-8_16,

2012.

Du, J., Du, J., Baskaran, M., Bi, Q., Huang, D., and Jiang, Y.: Temporal variations of atmospheric

depositional fluxes of [7]Be and ^{210}Pb over 8 years (2006-2013) at Shanghai, China, and synthesis of

995   global fallout data, J. Geophys. Res-Atmos., 120, 4323-4339, 2015.

Du, J., Baskaran, M., and Du, J.: Atmospheric deposition of [7]Be, ^{210}Pb and [210]Po during typhoons and

thunderstorm in Shanghai, China and global data synthesis, Sci. China-Earth Sci., 63, 602-614, 2020.

Du, P. and Walling, D. E.: Using ^{210}Pb measurements to estimate sedimentation rates on river floodplains,

J. Environ. Radioactiv., 103, 59-75, 2012.

1000   Dueñas, C., Fernández, M. C., Liger, E., and Carretero, J.: Gross alpha, gross beta activities and [7]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

concentrations of long-lived Rn descendants and cosmogenic [7]Be and determination of the MRT of

1005   aerosols, Atmos. Environ., 38, 1291-1301, 2004.

Dueñas, C., Fernández, M. C., Carretero, J., Liger, E., and Cañete, S.: Deposition velocities and washout

ratios on a coastal site (southeastern Spain) calculated from [7]Be and ^{210}Pb measurements, Atmos.

Environ., 39, 6897-6908, 2005.

Dueñas, C., Fernández, M. C., Cañete, S., and Pérez, M.: [7]Be to ^{210}Pb concentration ratio in ground level

1010   air in Málaga (36.7°N, 4.5°W), Atmos. Res., 92, 49-57, 2009.

Dueñas, C., Orza, J. A. G., Cabello, M., Fernández, M. C., Cañete, S., Pérez, M., and Gordo, E.: Air mass

origin and its influence on radionuclide activities ([7]Be and ^{210}Pb) in aerosol particles at a coastal site in the western Mediterranean, Atmos. Res., 101, 205-214, 2011.

Dueñas, C., Gordo, E., Liger, E., Cabello, M., Canete, S., Perez, M., and Torre-Luque, P.: [7]Be, ^{210}Pb and

1015   [40]K depositions over 11 years in Malaga, J. Environ. Radioactiv., 178-179, 325-334, 2017.

Ďurana, L., Chudý, M., and Masarik, J.: Investigation of [7]Be in the Bratislava atmosphere, J. Radioanal. Nucl. Ch., 207, 345-356, 1996.

Dutkiewicz, V. A. and Husain, L.: Stratospheric and tropospheric components of [7]Be in surface air, J. Geophys. Res., 90, 5783-5788, 1985.

1020   El-Hussein, A., Mohamemed, A., Abd El-Hady, M., Ahmed, A. A., Ali, A. E., and Barakat, A.: Diurnal and seasonal variation of short-lived radon progeny concentration and atmospheric temporal variations of ^{210}Pb and [7]Be in Egypt, Atmos. Environ., 35, 4305-4313, 2001.

Elsässer, C., Wagenbach, D., Weller, R., Auer, M., Wallner, A., and Christl, M.: Continuous 25-yr aerosol records at coastal Antarctica, Tellus B, 63, 920-934, 2011.

1025   Eriksson, M., Holm, E., Roos, P., and Dahlgaard, H.: Distribution and flux of [238]Pu, [239,240]Pu, [241]Am, ^{137}Cs and ^{210}Pb to high arctic lakes in the Thule district (Greenland), J. Environ. Radioactiv., 75, 285-299, 2004.

Fan, Y., Wang, S., Li, H., Zhang, X., Li, Q., Jia, H., Zhao, Y., Chen, Z., Chang, Y., and Liu, S.: Preliminary study of [7]Be, ^{137}Cs and ^{131}I activity concentration distribution rule in Beijing aerosol, At. Energy Sci.

1030   Technol., 47, 189-192, 2013 (in Chinese).

Fang, H. Y., Sheng, M. L., Tang, Z. H., and Cai, Q. G.: Assessment of soil redistribution and spatial pattern for a small catchment in the black soil region, Northeastern China: Using fallout [210]Pb$_{ex}$, Soil. Till. Res., 133, 85-92, 2013.

Feely, H. W., Larsen, R. J., and Sanderson, C. G.: Factors that cause seasonal variations in beryllium-7

1035   concentrations in surface air, J. Environ. Radioactiv., 9, 223-249, 1989.

Feng, H., Cochran, J. K., and Hirschberg, D. J.: [234]Th and [7]Be as tracers for the transport and dynamics of suspended particles in a partially mixed estuary, Geochim. Cosmochim. Ac., 63, 2487-2505, 1999.

Feichter, J., Brost, R. A., and Heimann, M.: Three-dimensional modeling of the concentration and deposition of ^{210}Pb aerosols, J. Geophys. Res., 96, 22447-22460, 1991.

1040 Filizok, I. and Ugur Gorgun, A.: Atmospheric depositional characteristics of [210]Po, ^{210}Pb and some trace elements in Izmir, Turkey, Chemosphere, 220, 468-475, 2019.

Filizok, I., Uğur, A., and Özden, B.: Local Enhancement of [210]Po Atmospheric Flux at a Site in İzmir, Turkey, Water Air Soil Poll., 225, 2013.

Fisenne, I. M.: Distribution of lead-210 and radium-226 in soil, U.S. Dep. of Energy, Rep. UCRL-18140,

1045 Washington, D. C., 1968.

Fogh, C. L., Roed, J., and Andersson, K. G.: Radionuclide resuspension and mixed deposition at different heights, J. Environ. Radioactiv., 46, 67-75, 1999.

Fukuyama, T., Onda, Y., Takenaka, C., and Walling, D. E.: Investigating erosion rates within a Japanese cypress plantation using Cs-137 and Pb-210 exmeasurements, J. Geophys. Res., 113, F02007,

1050 https://doi.org/10.1029/2006JF000657, 2008.

Fuller, C. and Hammond, D. E.: The fallout rate of Pb-210 on the western coast of the United States, Geophys. Res. Lett., 10, 1164-1167, 1983.

Gäggeler, H., von Gunten, H. R., Rössler, E., Oeschger, H., and Schotterer, U.: ^{210}Pb-dating of cold alpine firn/ice cores from Colle Gnifetti, Switzerland, J. Glaciol., 29, 165-177, 1983.

1055 Gäggeler, H. W., Jost, D. T., Baltensperger, U., Schwikowski, M., and Seibert, P.: Radon and thoron decay product and ^{210}Pb measurements at Jungfraujoch, Switzerland, Atmos. Environ., 29, 607-616, 1995.

Gai, N., Pan, J., Yin, X. C., Zhu, X. H., Yu, H. Q., Li, Y., Tan, K. Y., Jiao, X. C., and Yang, Y. L.: Latitudinal distributions of activities in atmospheric aerosols, deposition fluxes, and soil inventories

1060 of [7]Be in the East Asian monsoon zone, J. Environ. Radioactiv., 148, 59-66, 2015.

García-Orellana, J., Sánchez-Cabeza, J. A., Masqué, P., Ávila, A., Costa, E., Loÿe-Pilot, M. D., and Bruach-Menchén J. M.: Atmospheric fluxes of ^{210}Pb to the western Mediterranean Sea and the Saharan dust influence, J. Geophys. Res., 111, D15305, https://doi.org/10.1029/2005JD006660, 2006.

1065   Garimella, S., Koshy, K., and Singh, S.: Concentration of ^{7}Be in surface air at Suva, Fiji, S. Pac. J. Nat. Appl. Sci., 21, 15-19, 2003.

Gaspar, L., Navas, A., Machín, J., and Walling, D. E.: Using ^{210}Pb$_{ex}$ measurements to quantify soil redistribution along two complex toposequences in Mediterranean agroecosystems, northern Spain, Soil. Till. Res., 130, 81-90, 2013.

1070   Gavini, M. B., Beck, J. N., and Kuroda, P. K.: Mean residence times of the long-lived radon daughters in the atmosphere, J. Geophys. Res., 79, 4447-4452, 1974.

Gerasopoulos, E., Zanis, P., Stohl, A., Zerefos, C. S., Papastefanou, C., Ringer, W., Tobler, L., Hübener, S., Gäggeler, H. W., Kanter, H. J., Tositti, L., and Sandrini, S.: A climatology of ^{7}Be at four high-altitude stations at the Alps and the Northern Apennines, Atmos. Environ., 35, 6347-6360, 2001.

1075   Goldberg, E. D.: Geochronology with lead-210, in: Radioactive Dating, Int. At. Energy Agency, Vienna, 1963.

Gonzalez-Gomez, C., Azahra, M., Lopez-Penalver, J. J., Camacho-Garcia, A., El Bardouni, T., and Boukhal, H.: Seasonal variability in ^{7}Be depositional fluxes at Granada, Spain, Appl. Radiat. Isot., 64, 228-234, 2006.

1080   Gordo, E., Liger, E., Dueñas, C., Fernandez, M. C., Canete, S., and Perez, M.: Study of ^{7}Be and ^{210}Pb as radiotracers of African intrusions in Malaga (Spain), J. Environ. Radioactiv., 148, 141-153, 2015.

Grabowska, S., Mietelski, J. W., Kozak, K., and Gaca, P.: Gamma emitters on micro-becquerel activity level in air at Kraków (Poland), J. Atmos. Chem., 46, 103-116, 2003.

Graham, I., Ditchburn, R., and Barry, B.: Atmospheric deposition of ^{7}Be and ^{10}Be in New Zealand rain 1085   (1996-98), Geochim. Cosmochim. Ac., 67, 361-373, 2003.

Graustein, W. C. and Turekian, K. K.: ^{210}Pb and ^{137}Cs in air and soils measure the rate and vertical profile of aerosol scavenging, J. Geophys. Res., 91, 14355-14366, 1986.

Graustein, W. C. and Turekian, K. K.: The effects of forests and topography on the deposition of sub-micrometer aerosols measured by lead-210 and cesium-137 in soils, Agr. Forest Meteorol., 47, 199-1090   220, 1989.

Graustein, W. C. and Turekian, K. K.: ^{7}Be and ^{210}Pb indicate an upper troposphere source for elevated ozone in the summertime subtropical free troposphere of the eastern North Atlantic, Geophys. Res. Lett., 23, 539-542, 1996.

Grossi, C., Ballester, J., Serrano, I., Galmarini, S., Camacho, A., Curcoll, R., Morgui, J. A., Rodo, X., and Duch, M. A.: Influence of long-range atmospheric transport pathways and climate teleconnection patterns on the variability of surface ^{210}Pb and ^{7}Be concentrations in southwestern Europe, J. Environ. Radioactiv., 165, 103-114, 2016.

Gustafson, P. F., Kerrigan, M. A., and Brar, S. S.: Comparison of beryllium-7 and cæsium-137 radioactivity in ground-level air, Nature, 191, 454-456, 1961.

Halstead, M. J. R., Cunninghame, R. G., and Hunter, K. A.: Wet deposition of trace metals to a remote site in Fiordland, New Zealand, Atmos. Environ., 34, 665-676, 2000.

Harvey, M. J. and Matthews, K. M.: ^{7}Be deposition in a high-rainfall area of New Zealand, J. Atmos. Chem., 8, 299-306, 1989.

Hasebe, N., Doke, T., Kikuchi, J., Takeuchi, Y., and Sugiyama, T.: Observation of fallout rates of atmospheric ^{7}Be and ^{22}Na produced by cosmic rays—concerning estimation of the fallout rate of atmospheric ^{26}Al, J. Geophys. Res., 86, 520-524, 1981.

Hasegawa, H., Akata, N., Kawabata, H., Chikuchi, Y., Sato, T., Kondo, K., and Inaba, J.: Mechanism of ^{7}Be scavenging from the atmosphere through precipitation in relation to seasonal variations in Rokkasho Village, Aomori Prefecture, Japan, J. Radioanal. Nucl. Ch., 273, 171-175, 2007.

Haskell, W. Z., Kadko, D., Hammond, D. E., Knapp, A. N., Prokopenko, M. G., Berelson, W. M., and Capone, D. G.: Upwelling velocity and eddy diffusivity from ^{7}Be measurements used to compare vertical nutrient flux to export POC flux in the Eastern Tropical South Pacific, Mar. Chem., 168, 140-150, 2015.

He, Q. and Walling, D. E.: The distribution of fallout ^{137}Cs and ^{210}Pb in undisturbed and cultivated soils, Appl. Radiat. Isot., 48, 677-690, 1997.

He, X., Liao, Y., Lu, D., Peng, C., Chen, B., Zhou, H., Lin, M., Wang, L., & Yang, Y.: A preliminary analysis of the distribution of ^{7}Be in the ground-level air in Nanning, Sci-Tech. Dev. Enterp., 3, 98-

99, 2018 (in Chinese).

Heikkilä, U., Beer, J., and Alfimov, V.: Beryllium-10 and beryllium-7 in precipitation in Dübendorf (440 m) and at Jungfraujoch (3580 m), Switzerland (1998–2005), J. Geophys. Res., 113, D11104, https://doi.org/10.1029/2007JD009160, 2008.

Heinrich, P. and Pilon, R.: Simulation of ^{210}Pb and ^{7}Be scavenging in the tropics by the LMDz general circulation model, Atmos. Res., 132-133, 490-505, 2013.

Heinrich, P., Coindreau, O., Grillon, Y., Blanchard, X., and Gross, P.: Simulation of the atmospheric concentrations of ^{210}Pb and ^{7}Be and comparison with daily observations at three surface sites, Atmos. Environ., 41, 6610-6621, 2007.

Hernández, F., Hernández-Armas, J., Catalán, A., Fernández-Aldecoa, J. C., and Karlsson, L.: Gross alpha, gross beta activities and gamma emitting radionuclides composition of airborne particulate samples in an oceanic island, Atmos. Environ., 39, 4057-4066, 2005.

Hernández, F., Karlsson, L., and Hernandez-Armas, J.: Impact of the tropical storm Delta on the gross alpha, gross beta, ^{90}Sr, ^{210}Pb, ^{7}Be, ^{40}K and ^{137}Cs activities measured in atmospheric aerosol and water samples collected in Tenerife (Canary Islands), Atmos. Environ., 41, 4940-4948, 2007.

Hernández F., Rodríguez, S., Karlsson, L., Alonso-Pérez, S., López-Pérez, M., Hernandez-Armas, J., and Cuevas, E.: Origin of observed high ^{7}Be and mineral dust concentrations in ambient air on the Island of Tenerife, Atmos. Environ., 42, 4247-4256, 2008.

Hernandez-Ceballos, M. A., Cinelli, G., Ferrer, M. M., Tollefsen, T., De Felice, L., Nweke, E., Tognoli, P. V., Vanzo, S., and De Cort, M.: A climatology of ^{7}Be in surface air in European Union, J. Environ. Radioactiv., 141, 62-70, 2015.

Hicks, B. B. and Goodman, H. S.: Seasonal and latitudinal variations of atmospheric radioactivity along Australia's east coast (150°E longitude), Tellus, 29, 182-188, 1977.

Hirose, K., Honda, T., Yagishita, S., Igarashi, Y., and Aoyama, M.: Deposition behaviors of ^{210}Pb, ^{7}Be and thorium isotopes observed in Tsukuba and Nagasaki, Japan, Atmos. Environ., 38, 6601-6608, 2004.

Hötzl, H. and Winkler, R.: Activity concentrations of ^{226}Ra, ^{228}Ra, ^{210}Pb, ^{40}K and ^{7}Be and their temporal

1145   variations in surface air, J. Environ. Radioactiv., 5, 445-458, 1987.

Houali, A., Azahra, M., El Bardouni, T., Ferro García, M. A., Piňero García, F., and Chham, E.: Impact of the meteorological parameters on the behaviour of ^{7}Be at ground level in Tetouan city, Morocco from June 2015 to February 2017, J. Radioanal. Nucl. Ch., 322, 271-280, 2019.

Hu, J.: Distribution characteristics and tracing techniques using ^{210}Pb$_{ex}$ applied to soil erosion in alpine

1150   grassland region-illustrated by a case of Ziketan of Xinghai basin, M.S. thesis, University of Chinese Academy of Sciences, 2016 (in Chinese).

Hu, Y., and Zhang, Y.: Using ^{137}Cs and ^{210}Pb$_{ex}$ to investigate the soil erosion and accumulation moduli on the southern margin of the Hunshandake Sandy Land in Inner Mongolia, Acta Geol. Sin., 74, 1890-1903, 2019 (in Chinese).

1155   Hu, J., Sha, Z., Wang, J., Du, J., and Ma, Y.: Atmospheric deposition of ^{7}Be, ^{210}Pb in Xining, a typical city on the Qinghai-Tibet Plateau, China, J. Radioanal. Nucl. Ch., 324, 1141-1150, 2020.

Huang, D., Du, J., Moore, W. S., and Zhang, J.: Particle dynamics of the Changjiang Estuary and adjacent coastal region determined by natural particle-reactive radionuclides (^{7}Be, ^{210}Pb, and ^{234}Th), J. Geophys. Res-Oceans, 118, 1736-1748, 2013.

1160   Huang, D., Bao, H., and Yu, T.: Temporal Variations in Radionuclide Activity (^{7}Be and ^{210}Pb) in Surface Aerosols at a Coastal Site in Southeastern China, Aerosol Air Qual. Res., 19, 1969-1979, 2019.

Huh, C. A. and Su, C. C.: Distribution of fallout radionuclides (^{7}Be, ^{137}Cs, ^{210}Pb and ^{239,240}Pu) in soils of Taiwan, J. Environ. Radioactiv., 77, 87-100, 2004.

Huh, C. A., Su, C. C., and Shiau, L. J.: Factors controlling temporal and spatial variations of atmospheric

1165   deposition of ^{7}Be and ^{210}Pb in northern Taiwan, J. Geophys. Res., 111, D16304, https://doi.org/10.1029/2006JD007180, 2006.

Igarashi, Y., Hirose, K., and Otsuji-Hatori, M.: Beryllium-7 deposition and its relation to sulfate deposition, J. Atmos. Chem., 29, 217-231, 1998.

Ioannidou, A. and Paatero, J.: Activity size distribution and residence time of ^{7}Be aerosols in the Arctic

1170   atmosphere, Atmos. Environ., 88, 99-106, 2014.

Ioannidou, A. and Papastefanou, C.: Precipitation scavenging of ^{7}Be and ^{137}Cs radionuclides in air, J. Environ. Radioactiv., 85, 121-136, 2006.

Ioannidou, A., Manolopoulou, M., and Papastefanou, C.: Temporal changes of ^{7}Be and ^{210}Pb concentrations in surface air at temperate latitudes (40 °N), Appl. Radiat. Isot., 63, 277-284, 2005.

1175   Ioannidou, A., Eleftheriadis, K., Gini, M., Gini, L., Manenti, S., and Groppi, F.: Activity size distribution of radioactive nuclide ^{7}Be at different locations and under different meteorological conditions, Atmos. Environ., 212, 272-280, 2019.

Irlweck, K., Hinterdorfer, K., and Karg, V.: Beryllium-7 and ozone correlations in surface atmosphere, Naturwissenschaften, 84, 353-356, 1997.

1180   Isakar, K., Kiisk, M., Realo, E., and Suursoo, S.: Lead-210 in the atmospheric air of North and South Estonia: long-term monitoring and back-trajectory calculations, P. Est. Acad. Sci., 65, 442-451, 2016.

Ishikawa, Y., Murakami, H., Sekine, T., and Yoshihara, K.: Precipitation scavenging studies of radionuclides in air using cosmogenic ^{7}Be, J. Environ. Radioactiv., 26, 19-36, 1995.

1185   Itoh, H. and Narazaki, Y.: Meteorological Notes for Understanding the Transport of Beryllium-7 in the Troposphere, Jpn. J. Health. Phys., 52, 122-133, 2017.

Itthipoonthanakorn, T., Dann, S. E., Crout, N. M. J., and Shaw, G.: Nuclear weapons fallout ^{137}Cs in temperate and tropical pine forest soils, 50 years post-deposition, Sci. Total. Environ., 660, 807-816, 2019.

1190   Iurian, A. R., Mabit, L., Begy, R., and Cosma, C.: Comparative assessment of erosion and deposition rates on cultivated land in the Transylvanian Plain of Romania using ^{137}Cs and ^{210}Pb$_{ex}$, J. Environ. Radioactiv., 125, 40-49, 2013.

Jankovic, M., Todorovic, D., Nikolic, J., Rajacic, M., Pantelic, G., and Sarap, N.: Temporal changes of beryllium-7 and lead-210 in ground level air in Serbia, Hem. Ind., 68, 83-88, 2014.

1195   Jasiulionis, R. and Wershofen, H.: A study of the vertical diffusion of the cosmogenic radionuclides, ^{7}Be and ^{22}Na in the atmosphere, J. Environ. Radioactiv., 79, 157-169, 2005.

Jia, G. and Jia, J.: Atmospheric Residence Times of the fine-aerosol in the region of south Italy estimated from the activity concentration ratios of ^{210}Po/^{210}Pb in air particulates, J. Anal. Bioanal. Tech., 5, https://doi.org/10.4172/2155-9872.1000216, 2014.

Jia, C., Liu, G., Yang, W., Zhang, L., and Huang, Y.: Atmospheric depositional fluxes of ^{7}Be and ^{210}Pb at Xiamen, J. Xiamen Univ., 42, 352-357, 2003 (in Chinese).

Jiang, R.: ^{7}Be content and its seasonal variation in the ground air around Hangzhou area, Nucl. Sci. Tech., 10, 230-234, 1999.

Joshi, S. R.: Recent sedimentation rates and ^{210}Pb fluxes in Georgian Bay and Lake Huron, Sci. Total. Environ., 41, 219-233, 1985.

Joshi, L. U., Rangarajan, C., and Gopalakrishnan, S.: Measurement of lead-210 in surface air and precipitation, Tellus, 21, 107-112, 1969.

Junge, C. E., Air chemistry and radioactivity, Academic Press, San Diego, USA, 1963.

Juri Ayub, J., Di Gregorio, D. E., Velasco, H., Huck, H., Rizzotto, M., and Lohaiza, F.: Short-term seasonal variability in ^{7}Be wet deposition in a semiarid ecosystem of central Argentina, J. Environ. Radioactiv., 100, 977-981, 2009.

Jweda, J., Baskaran, M., van Hees, E., and Schweitzer, L.: Short-lived radionuclides (^{7}Be and ^{210}Pb) as tracers of particle dynamics in a river system in southeast Michigan, Limnol. Oceanogr., 53, 1934-1944, 2008.

Kadko, D.: Modeling the evolution of the Arctic mixed layer during the fall 1997 Surface Heat Budget of the Arctic Ocean (SHEBA) Project using measurements of ^{7}Be, J. Geophys. Res., 105, 3369-3378, 2000.

Kadko, D.: Rapid oxygen utilization in the ocean twilight zone assessed with the cosmogenic isotope 7Be, Global Biogeochem. Cy., 23, https://doi.org/10.1029/2009GB003510, 2009.

Kadko, D.: Upwelling and primary production during the U.S. GEOTRACES East Pacific Zonal Transect, Global Biogeochem. Cy., 31, 218-232, 2017.

Kadko, D. and Johns, W.: Inferring upwelling rates in the equatorial Atlantic using ^{7}Be measurements in

the upper ocean, Deep-Sea Res. Part. I, 58, 647-657, 2011.

Kadko, D. and Olson, D.: Beryllium-7 as a tracer of surface water subduction and mixed-layer history, Deep-Sea Res. Part. I, 43, 89-116, 1996.

Kadko, D. and Prospero, J.: Deposition of 7Be to Bermuda and the regional ocean: Environmental factors affecting estimates of atmospheric flux to the ocean, J. Geophys. Res., 116, C02013, http://doi.org/10.1029/2010JC006629, 2011.

Kadko, D. and Swart, P.: The source of the high heat and freshwater content of the upper ocean at the SHEBA site in the Beaufort Sea in 1997, J. Geophys. Res., 109, C01022, http://doi.org/10.1029/2004GL021262, 2004.

Kadko, D., Landing, W. M., and Shelley, R. U.: A novel tracer technique to quantify the atmospheric flux of trace elements to remote ocean regions, J. Geophys. Res-Oceans, 120, 848-858, 2015.

Kadko, D., Galfond, B., Landing, W. M., and Shelley, R. U.: Determining the pathways, fate, and flux of atmospherically derived trace elements in the Arctic ocean/ice system, Mar. Chem., 182, 38-50, 2016.

Kapala, J., Karpinska, M., Mnich, S., Gromotowicz-Poplawska, A., and Kulesza, G.: ^{7}Be concentration in the near-surface layer of the air in Bialystok (north-eastern Poland) in the years 1992-2010, J. Environ. Radioactiv., 187, 40-44, 2018.

Karwan, D. L., Siegert, C. M., Levia, D. F., Pizzuto, J., Marquard, J., Aalto, R., and Aufdenkampe, A. K.: Beryllium-7 wet deposition variation with storm height, synoptic classification, and tree canopy state in the mid-Atlantic USA, Hydrol. Process., 30, 75-89, 2016.

Kaste, J. M., Elmore, A. J., Vest, K. R., and Okin, G. S.: Beryllium-7 in soils and vegetation along an arid precipitation gradient in Owens Valley, California, Geophys. Res. Lett., 38, L09401, http://dx.doi.org/10.1029/2011GL047242, 2011.

Kato, H., Onda, Y., and Tanaka, Y.: Using ^{137}Cs and ^{210}Pb$_{ex}$ measurements to estimate soil redistribution rates on semi-arid grassland in Mongolia, Geomorphology, 114, 508-519, 2010.

Khan, S., Alaamer, A. S., and Tahir, S. N.: Assessment of ^{7}Be concentration in outdoor ambient air, Health Phys., 95, 433-435, 2008.

1250   Khan, K., Jabbar, A., and Akhter, P.: Climatic variations of beryllium-7 activity in the atmosphere of
        Peshawar basin, Pakistan, during 2001-2006, Nucl. Technol. Radiat. Prot., 2, 104-108, 2009.

        Khodadadi, M., Mabit, L., Zaman, M., Porto, P., and Gorji, M.: Using ^{137}Cs and ^{210}Pb$_{ex}$ measurements to
        explore the effectiveness of soil conservation measures in semi-arid lands: a case study in the
        Kouhin region of Iran, J. Soil. Sediment., 19, 2103-2113, 2018.

1255   Kikuchi, S., Sakurai, H., Gunji, S., and Tokanai, F.: Temporal variation of ^{7}Be concentrations in
        atmosphere for 8y from 2000 at Yamagata, Japan: solar influence on the ^{7}Be time series, J. Environ.
        Radioactiv., 100, 515-521, 2009.

        Kim, S. H., Hong, G. H., Baskaran, M., Park, K. M., Chung, C. S., and Kim, K. H.: Wet removal of
        atmospheric ^{7}Be and ^{210}Pb at the Korean Yellow Sea coast, Yellow Sea, 4, 58-68, 1998.

1260   Kim, G., Alleman, L. Y., and Church, T. M.: Atmospheric depositional fluxes of trace elements, ^{210}Pb,
        and ^{7}Be to the Sargasso Sea, Global Biogeochem. Cy., 13, 1183-1192, 1999.

        Kim, G., Hussain, N., Scudlark, J. R., and Church, T. M.: Factors influencing the atmospheric
        depositional fluxes of stable Pb, ^{210}Pb, and ^{7}Be into Chesapeake Bay, J. Atmos. Chem., 36, 65-79,
        2000.

1265   Kim, G., Hong, Y. L., Jang, J., Lee, I., Hwang, D. W., and Yang, H. S.: Evidence for anthropogenic ^{210}Po
        in the urban atmosphere of Seoul, Korea, Environ. Sci. Technol., 39, 1519-1522, 2005.

        Kitto, M. E., Hartt, G. M.,Gillen, E. A.: Airborne activities of gross beta, ^{7}Be, and ^{131}I in New York, J.
        Radioanal. Nucl. Ch., 264, 387-392, 2005.

        Kitto, M. E., Fielman, E. M., Hartt, G. M., Gillen, E. A., Semkow, T. M., Parekh, P. P., and Bari, A.:
1270   Long-term monitoring of radioactivity in surface air and deposition in New York State, Health Phys.,
        90, 31-37, 2006.

        Klaminder, J., Bindler, R., Emteryd, O., Appleby, P., and Grip, H.: Estimating the mean residence time
        of lead in the organic horizon of boreal forest soils using 210-lead, stable lead and a soil
        chronosequence, Biogeochemistry, 78, 31-49, 2006.

1275   Koch, D. M. and Mann, M. E.: Spatial and temporal variability of ^{7}Be surface concentration, Tellus B,

48, 387-396, 1996.

Koch, D. M., Jacob, D. J., and Graustein, W. C.: Vertical transport of tropospheric aerosols as indicated by and in a chemical tracer model, J. Geophys. Res., 101, 18651-18618, 1996.

Koide, M., Goldberg, E. D., Herron, M. M., and Langway, C. C.: Transuranic depositional history in South Greenland firn layers, Nature, 269, 137-139, 1977.

Koide, M., Michel, R., Goldberg, E. D., Herron, M. M., and Langway, C. C.: Depositional history of artificial radionuclides in the Ross Ice Shelf, Antarctica, Earth Planet. Sc. Lett., 44, 205-223, 1979.

Kolb, W.: Jahreszeitliche Schwankungen der [7]Be-, [54]Mn- und Spaltprodukt-Konzentrationen der bodennahen Luft, Tellus, 22, 443-450, 1970 (in German).

Kownacka, L., Jaworowski, Z., and Suplinska, M.: Vertical distribution and flows of lead and natural radionuclides in the atmosphere, Sci. Total. Environ., 91, 199-221, 1990.

Kritz, M. A., Rosner, S. W., Kelly, K. K., Loewenstein, M., and Chan, K. R.: Radon measurements in the lower tropical stratosphere: evidence for rapid vertical transport and dehydration of tropospheric air, J. Geophys. Res., 98, 8725-8736.

Krmar, M., Velojić, M., Hansman, J., Ponjarac, R., Mihailović, A., Todorović, N., Vučinić-Vasić, M., and Savić, R.: Wind erosion on Deliblato (the largest European continental sandy terrain) studied using $^{210}Pb_{ex}$ and ^{137}Cs measurements, J. Radioanal. Nucl. Ch., 303, 2511-2515, 2015.

Kulan, A., Aldahan, A., Possnert, G., and Vintersved, I.: Distribution of [7]Be in surface air of Europe, Atmos. Environ., 40, 3855-3868, 2006.

Kurata, T. and Tsunogai, S.: Exhalation rates of ^{222}Rn and deposition surface estimated from ^{226}Ra and rates of ^{210}Pb at the earth's ^{210}Pb profiles in soils, Geochem. J., 20, 81-90, 1986.

Laguionie, P., Roupsard, P., Maro, D., Solier, L., Rozet, M., Hébert, D., and Connan, O.: Simultaneous quantification of the contributions of dry, washout and rainout deposition to the total deposition of particle-bound [7]Be and ^{210}Pb on an urban catchment area on a monthly scale, J. Aerosol Sci., 77, 67-84, 2014.

Lal, D. and Baskaran, M.: Applications of cosmogenic isotopes as atmospheric tracers, in: Handbook of environmental isotope geochemistry, edited by: Baskaran, M., Springer, Berlin, Heidelberg,

Germany, 575-589, https://doi.org/10.1007/978-3-642-10637-8_28, 2012.

Lal, D. and Peters, B.: Cosmic ray produced radioactivity on the Earth, in: Handbuch der Physik / Encyclopedia of Physics, edited by: Sittle, K., Springer, Berlin, Heidelberg, Germany, 551-612, https://doi.org/10.1007/978-3-642-46079-1_7, 1967.

Lal, D., Malhotra, P. K., and Peters, B.: On the production of radioisotopes in the atmosphere by cosmic radiation and their application to meteorology, J. Atmos. Sol-Terr. Phys., 12, 306-328, 1958.

Lal, D., Nijampurkar, V. N., Rajagopalan, G., and Somayajulu, B. L. K.: Annual fallout of ^{32}Si, ^{210}Pb, ^{22}Na, ^{35}S and ^{7}Be in rains in India, P. Indian Acad. Sci., 88, 29-40, 1979.

Lambert, G., Ardouin, B., and Sanak, J.: Atmospheric transport of trace elements toward Antarctica, Tellus, 42B, 76-82, 1990.

Lamborg, C. H., Fitzgerald, W. F., Graustein, W. C., and Turekian, K. K.: An examination of the atmospheric chemistry of mercury using ^{210}Pb and ^{7}Be, J. Atmos. Chem., 36, 325-338, 2000.

Lamborg, C. H., Engstrom, D. R., Fitzgerald, W. F., and Balcom, P. H.: Apportioning global and non-global components of mercury deposition through ^{210}Pb indexing, Sci. Total. Environ., 448, 132-140, 2013.

Landis, J. D., Renshaw, C. E., and Kaste, J. M.: Quantitative retention of atmospherically deposited elements by native vegetation is traced by the fallout radionuclides ^{7}Be and ^{210}Pb, Environ. Sci. Technol., 48, 12022-12030, 2014.

Larsen, R. J., Sanderson, C. G., and Kada, J.: EML Surface Air Sampling Program, 1990-1993 Data, U.S. Dep. of Energy, New York, Environ. Rep. EML-572, 1995.

Le Roux, G., Pourcelot, L., Masson, O., Duffa, C., Vray, F., and Renaud, P.: Aerosol deposition and origin in French mountains estimated with soil inventories of ^{210}Pb and artificial radionuclides, Atmos. Environ., 42, 1517-1524, 2008.

Lee, S. C., Saleh, A. I., Banavali, A. D., Jonooby, L., and Kuroda, P. K.: Beryllium-7 deposition at Fayetteville, Arkansas, and excess polonium-210 from the 1980 eruption of Mount St. Helens, Geochem. J., 19, 317-322, 1985.

Lee, S. H., Pham, M. K., and Povinec, P. P.: Radionuclide variations in the air over Monaco, J. Radioanal.

1330   Nucl. Ch., 254, 445-453, 2002.

Lee, H. N., Tositti, L., Zheng, X., and Bonasoni, P.: Analyses and comparisons of variations of ^{7}Be, ^{210}Pb and ^{7}Be/^{210}Pb with ozone observations at two Global Atmosphere Watch stations from high mountains, J. Geophys. Res., 112, D05303. http://dx.doi.org/10.1029/2006JD007421, 2007.

Lee, H. I., Huh, C. A., Lee, T., and Huang, N. E.: Time series study of a 17-year record of ^{7}Be and ^{210}Pb
1335   fluxes in northern Taiwan using ensemble empirical mode decomposition, J. Environ. Radioactiv., 147, 14-21, 2015.

Lepore, K., Moran, S. B., and Smith, J. N.: ^{210}Pb as a tracer of shelf–basin transport and sediment focusing in the Chukchi Sea, Deep-Sea Res. Pt. II, 56, 1305-1315, 2009.

Leppanen, A. P.: Deposition of naturally occurring ^{7}Be and ^{210}Pb in Northern Finland, J. Environ.
1340   Radioactiv., 208-209, https://doi.org/10.1016/j.jenvrad.2019.105995, 2019.

Li, J., Li, Y., Wang, Y., and Wu, J.: Study of soil erosion on the east-west transects in the Three-Rivers headwaters region using ^{137}Cs and ^{210}Pb$_{ex}$ tracing, Res. Environ. Sci., 22, 1452-1459, 2009 (in Chinese).

Li, J., Wang, Y., Li, D., Zhuo, M., and Wu, J.: Characterization and evaluation of agricultural soil erosion
1345   in Shenzhen City using environmental radionuclides, Res. Environ. Sci., 26, 780-786, 2013 (in Chinese).

Li, C., Le Roux, G., Sonke, J., van Beek, P., Souhaut, M., Van der Putten, N., and De Vleeschouwer, F.: Recent ^{210}Pb, ^{137}Cs and ^{241}Am accumulation in an ombrotrophic peatland from Amsterdam Island (Southern Indian Ocean), J. Environ. Radioactiv., 175-176, 164-169, 2017a.

1350   Li, X., Zhao, Q., Wang, Q., and Luo, M.: Application of ^{210}Pb analysis method in aerosol determination of Chengdu, Sichuan Environ., 36, 142-146, 2017b (in Chinese).

Likuku, A. S.: Factors influencing ambient concentrations of ^{210}Pb and ^{7}Be over the city of Edinburgh (55.9 °N, 03.2 °W), J. Environ. Radioactiv., 87, 289-304, 2006a.

Likuku, A. S., Branford, D., Fowler, D., and Weston, K. J.: Inventories of fallout ^{210}Pb and ^{137}Cs
1355   radionuclides in moorland and woodland soils around Edinburgh urban area (UK), J. Environ. Radioactiv., 90, 37-47, 2006b.

Lin, Y. C., Huh, C. A., Hsu, S. C., Lin, C. Y., Liang, M. C., and Lin, P. H.: Stratospheric influence on the concentration and seasonal cycle of lower tropospheric ozone: Observation at Mount Hehuan, Taiwan, J. Geophys. Res-Atmos., 119, 3527-3536, 2014.

1360   Lindblom, G.: Fallout gamma-emitting radionuclides in air, precipitation, and the human body up to spring 1967, Tellus, 22, 443-450, 1969.

Liu, S. C., McAfee, J. R., and Cicerone, R. J.: Radon 222 and tropospheric vertical transport, J. Geophys. Res., 89, 7291-7297, 1984.

Liu, H., Jacob, D. J., Hey, I., and Yantosca, R. M.: Constraints from ^{210}Pb and ^{7}Be on wet deposition and

1365   transport in a global three-dimensional chemical tracer model driven by assimilated meteorological fields, J. Geophys. Res., 106, 12109-12128, 2001.

Liu, H., Considine, D. B., Horowitz, L. W., Crawford, J. H., Rodriguez, J. M., Strahan, S. E., Damon, M. R., Steenrod, S. D., Xu, X., Kouatchou, J., Carouge, C., and Yantosca, R. M.: Using beryllium-7 to assess cross-tropopause transport in global models, Atmos. Chem. Phys., 16, 4641-4659, 2016.

1370   Liu, G., Luo, Q., Pan, Y., Liu, D., Li, Z., Zhang, H., and Sun, H.: Variations of airborne ^{7}Be in Shenzhen and its implication for atmospheric transport, Geochimica, 43, 32-38, 2014 (in Chinese).

Lockhart Jr., L. B., Patterson Jr., R. L., and Saunders Jr., A. W.: Airborne radioactivity in Antarctica, J. Geophys. Res., 71, 1985-1991, 1966.

Lozano, R. L., San Miguel, E. G., Bolívar, J. P., and Baskaran, M.: Depositional fluxes and

1375   concentrations of ^{7}Be and ^{210}Pb in bulk precipitation and aerosols at the interface of Atlantic and Mediterranean coasts in Spain, J. Geophys. Res., 116, D18213, https://doi.org/10.1029/2011JD015675, 2011.

Lozano, R. L., Hernández-Ceballos, M. A., San Miguel, E. G., Adame, J. A., and Bolívar, J. P.: Meteorological factors influencing the ^{7}Be and ^{210}Pb concentrations in surface air from the

1380   southwestern Iberian Peninsula, Atmos. Environ., 63, 168-178, 2012.

Lozano, R. L., Hernández-Ceballos, M. A., Rodrigo, J. F., San Miguel, E. G., Casas-Ruiz, M., García-Tenorio, R., and Bolívar, J. P.: Mesoscale behavior of ^{7}Be and ^{210}Pb in superficial air along the Gulf of Cadiz (south of Iberian Peninsula), Atmos. Environ., 80, 75-84, 2013.

Lujanienë, G.: Study of removal processes of ^{7}Be and ^{137}Cs from the atmosphere, Czech. J. Phys., 53,

1385   A57-A65, 2003.

Luyanas, V. Y., Yasyulyonis, R. Y., Shopauskiene, D. A., and Styra, B. I.: Cosmogenic ^{22}Na, ^{7}Be, ^{32}P,

and ^{33}P in atmospheric dynamics research, J. Geophys. Res., 75, 3665-3667, 1970.

Mabit, L., Benmansour, M., and Walling, D. E.: Comparative advantages and limitations of the fallout

radionuclides ^{137}Cs, ^{210}Pb$_{ex}$ and ^{7}Be for assessing soil erosion and sedimentation, J. Environ.

1390   Radioactiv., 99, 1799-1807, 2008.

Mabit, L., Klik, A., Benmansour, M., Toloza, A., Geisler, A., and Gerstmann, U. C.: Assessment of

erosion and deposition rates within an Austrian agricultural watershed by combining ^{137}Cs, ^{210}Pb$_{ex}$

and conventional measurements, Geoderma, 150, 231-239, 2009.

Mabit, L., Benmansour, M., Abril, J. M., Walling, D. E., Meusburger, K., Iurian, A. R., Bernard, C.,

1395   Tarjan, S., Owens, P. N., Blake, W. H., and Alewell, C.: Fallout ^{210}Pb as a soil and sediment tracer

in catchment sediment budget investigations: a review. Earth-Sci. Rev., 138, 335-351, 2014.

Maenhaut, W., Zoller, W. H., and Coles, D. G.: Radionuclides in the south pole atmosphere, J. Geophys.

Res., 84, 3131-3138, 1979.

Magno, P. J., Groulx, P. R., and Apidianakis, J. C.: Lead-210 in air and total diets in the United States

1400   during 1966, Health Phys., 18, 383-388, 1970.

Marx, S. K., Kamber, B. S., and McGowan, H. A.: Estimates of Australian dust flux into New Zealand:

Quantifying the eastern Australian dust plume pathway using trace element calibrated ^{210}Pb as a

monitor, Earth Planet. Sc. Lett., 239, 336-351, 2005.

Matisoff, G.: ^{210}Pb as a tracer of soil erosion, sediment source area identification and particle transport

1405   in the terrestrial environment, J. Environ. Radioactiv., 138, 343-354, 2014.

Matisoff, G., and Whiting, P. J.: Measuring soil erosion rates using natural (^{7}Be, ^{210}Pb) and anthropogenic

(^{137}Cs, ^{239,240}Pu) radionuclides, in: Handbook of environmental isotope geochemistry, edited by:

Baskaran, M., Springer, Berlin, Heidelberg, Germany, 487-519, https://doi.org/10.1007/978-3-642-

10637-8_25, 2012.

1410   Matisoff, G., Bonniwell, E. C., and Whiting, P. J.: Radionuclides as indicators of sediment transport in

带格式的: 上标

agricultural watersheds that drain to Lake Erie, J. Environ. Qual., 31, 62-72, 2002.

Matisoff, G., Wilson, C. G., and Whiting, P. J.: The ^{7}Be/^{210}Pb$_{xs}$ ratio as an indicator of suspended sediment age or fraction new sediment in suspension, Earth Surf. Proc. Land., 30, 1191-1201, 2005.

Mattsson, R.: Seasonal variation of short-lived radon progeny, Pb^{210} and Po^{210}, in ground level air in Finland, J. Geophys. Res., 75, 1741-1744, 1970.

Mattsson, R.: ^{210}Pb and ^{222}Rn as guides in adjudicating SO$_4^{2-}$ and SO$_2$ air concentrations sulphate in the air in Finland 1962…1985, Sci. Total Environ., 69, 211-224, 1988.

Mattsson, R., Paatero, J., and Hatakka, J.: Automatic alpha/beta analyser for air filter samples-absolute determination of radon progeny by pseudo-coincidence techniques, Radiat. Prot. Dosim., 63, 133-139, 1996.

Megumi, K., Matsunami, T., Ito, N., Kiyoda, S., Mizohata, A., and Asano, T.: Factors, especially sunspot number, causing variations in surface air concentrations and depositions of ^{7}Be in Osaka, Japan, Geophys. Res. Lett., 27, 361-364, 2000.

Mélières, M. A., Pourchet, M., and Richard, S.: Surface air concentration and deposition of lead-210 in French Guiana: two years of continuous monitoring, J. Environ. Radioactiv., 66, 261-269, 2003.

Men, W., Lin, J., Wang, F., and Yin, M.: Atmospheric processes studies and radiation dose assessment based on ^{7}Be, ^{210}Pb and ^{210}Po around Xiamen Island, J. Appl. Oceanogr., 35, 266-274, 2016 (in Chinese).

Meusburger, K., Mabit, L., Ketterer, M., Park, J. H., Sandor, T., Porto, P., and Alewell, C.: A multi-radionuclide approach to evaluate the suitability of $^{239+240}$Pu as soil erosion tracer, Sci. Total. Environ., 566-567, 1489-1499, 2016.

Meusburger, K., Porto, P., Mabit, L., La Spada, C., Arata, L., and Alewell, C.: Excess Lead-210 and Plutonium-239+240: Two suitable radiogenic soil erosion tracers for mountain grassland sites, Environ. Res., 160, 195-202, 2018.

Mietelski, J. W., Nalichowska, E., Tomankiewicz, E., Brudecki, K., Janowski, P., and Kierepko, R.: Gamma emitters in atmospheric precipitation in Krakow (Southern Poland) during the years 2005-2015, J. Environ. Radioactiv., 166, 10-16, 2017.

Milton, G. M., Kramer, S. J., Watson, W. L., and Kotzer, T. G.: Qualitative estimates of soil disturbance in the vicinity of CANDUS stations, utilizing measurements of ^{137}Cs and ^{210}Pb in soil cores, J. Environ. Radioactiv., 55, 195-205, 2001.

Miralles, J., Radakovitch, O., Cochran, J. K., Véron, A., and Masqué, P.: Multitracer study of anthropogenic contamination records in the Camargue, Southern France, Sci. Total. Environ., 320, 63-72, 2004.

Mohan, M. P., D'Souza, R. S., Rashmi Nayak, S., Kamath, S. S., Shetty, T., Sudeep Kumara, K., Yashodhara, I., Mayya, Y. S., and Karunakara, N.: A study of temporal variations of [7]Be and ^{210}Pb concentrations and their correlations with rainfall and other parameters in the South West Coast of India, J. Environ. Radioactiv., 192, 194-207, 2018.

Mohan, M. P., D'Souza, R. S., Nayak, S. R., Kamath, S. S., Shetty, T., Kumara, K. S., Mayya, Y. S., and Karunakara, N.: Influence of rainfall on atmospheric deposition fluxes of [7]Be and ^{210}Pb in Mangaluru (Mangalore) at the Southwest Coast of India, Atmos. Environ., 202, 281-295, 2019.

Mohery, M., Abdallah, A. M., Al-Amoudi, Z. M., and Baz, S. S.: Activity size distribution of some natural radionuclides, Radiat. Prot. Dosim., 158, 435-441, 2014.

Mohery, M., Abdallah, A. M., Ali, A., and Baz, S. S.: Daily variation of radon gas and its short-lived progeny concentration near ground level and estimation of aerosol residence time, Chinese Phys. B, 25, 2016.

Momoshima, N., Nishio, S., Kusano, Y., Fukuda, A., and Ishimoto, A.: Seasonal variations of atmospheric ^{210}Pb and [7]Be concentrations at Kumamoto, Japan and their removal from the atmosphere as wet and dry depositions, J. Radioanal. Nucl. Ch., 268, 297-304, 2006.

Monaghan, M. C.: Lead 210 in surface air and soils from California: Implications for the behavior of trace constituents in the planetary boundary layer, J. Geophys. Res., 94, 6449-6456, 1989.

Monaghan, M. C. and Holdsworth, G.: The origin of non-sea-salt sulphate in the Mount Logan ice core, Nature, 343, 245-248, 1990.

Monaghan, M. C., Krishnaswami, S., and Turekian, K. K.: The global-average production rate of [10]Be, Earth Planet. Sc. Lett., 76, 279-287, 1986.

1465   Moore, H. E. and Poet, S. E.: ^{210}Pb fluxes determined from ^{210}Pb and ^{226}Ra soil profiles, J. Geophys. Res., 81, 1056-1058, 1976.

Moore, H. E., Poet, S. E., Martell, E. A.: Vertical profiles of ^{222}Rn and its long-lived daughters over the eastern Pacific, Environ. Sci. Technol., 11, 1207-1210, 1977.

Mudbidre, R., Baskaran, M., and Schweitzer, L.: Investigations of the partitioning and residence times 1470   of Po-210 and Pb-210 in a riverine system in Southeast Michigan USA. J. Environ. Radioact., 138, 375-383, 2014.

Muramatsu, H., Yoshizawa, S., Abe, T., Ishii, T., Wada, M., Horiuchi, Y., and Kanekatsu, R.: Variation of ^{7}Be concentration in surface air at Nagano, Japan, J. Radioanal. Nucl. Ch., 275, 299-307, 2008.

Narazaki, Y., and Fujitaka, K.: Cosmogenic ^{7}Be: atmospheric concentration and deposition in Japan, Jpn. 1475   J. Health Phys., 44, 95-105, 2009.

Narazaki, Y., Fujitaka, K., Igarashi, S., Ishikawa, Y., and Fujinami, N.: Seasonal variation of ^{7}Be deposition in Japan, J. Radioanal. Nucl. Ch., 256, 489-496, 2003.

Nazaroff, W. W.: Radon transport from soil to air, Rev. Geophys., 30, 137-160, 1992.

Neroda, A. S., Goncharova, A. A., Goryachev, V. A., Mishukov, V. F., and Shlyk, N. V.: Long-range 1480   atmospheric transport Beryllium-7 to region the Sea of Japan, J. Environ. Radioactiv., 160, 102-111, 2016.

Nijampurkar, V. N. and Clausen, H. B.: A century old record of lead-210 fallout on the Greenland ice sheet, Tellus B, 42, 29-38, 1990.

Nijampurkar, V. N. and Rao, D. K.: Polar fallout of radionuclides ^{32}Si, ^{7}Be and ^{210}Pb and past 1485   accumulation rate of ice at Indian station, Dakshin Gangotri, East Antarctica, J. Environ. Radioactiv., 21, 107-117, 1993.

Nijampurkar, V. N., Rao, D. K., Clausen, H. B., Kaul, M. K., and Chaturvedi, A.: Records of climatic changes and volcanic events in an ice core from Central Dronning Maud Land (East Antarctica) during the past century, Proc. Indian Acad. Sci. (Earth Planet. Sci.), 111, 39-49, 2002.

1490   Noithong, P., Rittirong, A., and Hazama, R.: Study of the factors influence on variation of Be-7 concentration in surface air at Osaka, Japan, J. Phys.: Conf. Ser., 1285, 012016,

http://dx.doi.org/10.1088/1742-6596/1285/1/012016, 2019.

Nozaki, Y., DeMaster, D. J., Lewis, D. M., and Turekian, K. K.: Atmospheric ^{210}Pb fluxes determined from soil profiles, J. Geophys. Res., 83, 4047-4051, 1978.

O'Farrell, C. R., Heimsath, A. M., and Kaste, J. M.: Quantifying hillslope erosion rates and processes for a coastal California landscape over varying timescales, Earth Surf. Proc. Land., 32, 544-560, 2007.

Olsen, C. R., Larsen, I. L., Lowry, P. D., Cutshall, N. H., Todd, J. F., Wong, G. T. F., and Casey, W. H.: Atmospheric fluxes and marsh-soil inventories of [7]Be and ^{210}Pb, J. Geophys. Res., 90, 10487-10495, 1985.

Olsen, C. R., Larsen, I. L., Lowry, P. D., Cutshall, N. H., and Nichols, M. M.: Geochemistry and deposition of [7]Be in river, estuarine and coastal waters, J. Geophys. Res., 91, 896-908, 1986.

Othman, I., Al-Masri, M. S., and Hassan, M.: Fallout of [7]Be in Damascus City, J. Radioanal. Nucl. Ch., 238, 187-192, 1998.

Paatero, J. and Hatakka, J.: Source areas of airborne [7]Be and ^{210}Pb measured in Northern Finland, Health Phys., 79, 691-696, 2000.

Paatero, J., Hatakka, J., Holmén, K., Eneroth, K., and Viisanen, Y.: Lead-210 concentration in the air at Mt. Zeppelin, Ny-Ålesund, Svalbard, Phys. Chem. Earth., 28, 1175-1180, 2003.

Paatero, J., Buyukay, M., Holmén, K., Hatakka, J., and Viisanen, Y.: Seasonal variation and source areas of airborne lead-210 at Ny-Ålesund in the High Arctic, Polar Res., 29, 345-352, 2010.

Paatero, J., Vaaramaa, K., Buyukay, M., Hatakka, J., and Lehto, J.: Deposition of atmospheric ^{210}Pb and total beta activity in Finland, J. Radioanal. Nucl. Ch., 303, 2413-2420, 2015.

Paatero, J., Ioannidou, A., Ikonen, J., and Lehto, J.: Aerosol particle size distribution of atmospheric lead-210 in northern Finland, J. Environ. Radioactiv., 172, 10-14, 2017.

Pacini, A. A., Usoskin, I. G., Evangelista, H., Echer, E., and de Paula, R.: Cosmogenic isotope [7]Be: A case study of depositional processes in Rio de Janeiro in 2008–2009, Adv. Space Res., 48, 811-818, 2011.

Pacini, A. A., Usoskin, I. G., Mursula, K., Echer, E., and Evangelista, H.: Signature of a sudden

stratospheric warming in the near-ground [7]Be flux, Atmos. Environ., 113, 27-31, 2015.

Padilla, S., Lopez-Gutierrez, J. M., Manjon, G., Garcia-Tenorio, R., Galvan, J. A., and Garcia-Leon, M.: Meteoric [10]Be in aerosol filters in the city of Seville, J. Environ. Radioactiv., 196, 15-21, 2019.

Pan, J., Yang, Y. L., Zhang, G., Shi, J. L., Zhu, X. H., Li, Y., and Yu, H. Q.: Simultaneous observation of seasonal variations of beryllium-7 and typical POPs in near-surface atmospheric aerosols in Guangzhou, China, Atmos. Environ., 45, 3371-3380, 2011.

Pan, J., Wen, F., Chen, L., Ren, X., Zhang, J., Zhao, S., Cao, Z., and Pan, Z.: Preliminary analysis of activity concentration distributions of airborne [210]Po and ^{210}Pb in major cities in China, Radiat. Prot., 37, 433-437, 2017 (in Chinese).

Papastefanou, C.: Residence time of tropospheric aerosols in association with radioactive nuclides, Appl. Radiat. Isotopes, 64, 93-100, 2006.

Papastefanou, C. and Bondietti, E. A.: Mean residence times of atmospheric aerosols in the boundary layer as determined from [210]Bi/^{210}Pb activity ratios, J. Aerosol Sci., 22, 927-931, 1991.

Papastefanou, C. and Ioannidou, A.: Depositional fluxes and other physical characteristics of atmospheric beryllium-7 in the temperate zones (40°N) with a dry (precipitation-free) climate, Atmos. Environ., 25A, 2335-2343, 1991.

Papastefanou, C., Ioannidou, A., Stoulos, S., and Manolopoulou, M.: Atmospheric deposition of cosmogenic [7]Be and ^{137}Cs from fallout of the Chernobyl accident, Sci. Total. Environ., 170, 151-156, 1995.

Parker, R. P.: Beryllium-7 and fission products in surface air, Nature, 193, 967-968, 1962.

Peirson, D. H.: Beryllium 7 in air and rain, J. Geophys. Res., 68, 3831-3832, 1963.

Peirson, D. H., Cambray, R. S., and Spicer, G. S.: Lead-210 and polonium-210 in the atmosphere, Tellus, 18, 427-433, 1966.

Peng, A., Liu, G., Jiang, Z., Liu, G., and Liu, M.: Wet depositional fluxes of [7]Be and ^{210}Pb and their influencing factors at two characteristic cities of China, Appl. Radiat. Isot., 147, 21-30, 2019.

Perreault, L. M., Yager, E. M., and Aalto, R.: Effects of gradient, distance, curvature and aspect on steep

burned and unburned hillslope soil erosion and deposition, Earth Surf. Proc. Land., 42, 1033-1048,

1545   2017.

Persson, B. R. R.: Global distribution of [7]Be, ^{210}Pb and, [210]Po in the surface air, (with Appendix A-E), Acta Sci. Lundensia, 008, 1-241, https://doi.org/10.13140/RG.2.1.4196.2960, 20162015.

Peters, A. J., Gregor, D. J., Wilkinson, P., and Spencer, C.: Deposition of ^{210}Pb to the Agassiz Ice Cap, Canada, J. Geophys. Res., 102, 5971-5978, 1997.

1550   Pfahler, V., Glaser, B., McKey, D., and Klemt, E.: Soil redistribution in abandoned raised fields in French Guiana assessed by radionuclides, J. Plant. Nutr. Soil Sci., 178, 468-476, 2015.

Pfitzner, J., Brunskill, G., and Zagorskis, I.: [137]Cs and excess ^{210}Pb deposition patterns in estuarine and marine sediment in the central region of the Great Barrier Reef Lagoon, north-eastern Australia, J. Environ. Radioactiv., 76, 81-102, 2004.

1555   Pham, M. K., Betti, M., Nies, H., and Povinec, P. P.: Temporal changes of [7]Be, ^{137}Cs and ^{210}Pb activity concentrations in surface air at Monaco and their correlation with meteorological parameters, J. Environ. Radioactiv., 102, 1045-1054, 2011.

Pham, M. K., Povinec, P. P., Nies, H., and Betti, M.: Dry and wet deposition of [7]Be, ^{210}Pb and ^{137}Cs in Monaco air during 1998-2010: seasonal variations of deposition fluxes, J. Environ. Radioactiv., 120,

1560   45-57, 2013.

Picciotto, E., Crozaz, G., and De Breuck, W.: Rate of accumulation of snow at the south pole as determined by radioactive measurements, Nature, 203, 393-394, 1964.

Picciotto, E., Cameron, R., Crozaz, G., Deutsch, S., and Wiloain, S.: Determination of the rate of snow accumulation at the pole of relative inaccessibility, Eastern Antarctica: a comparison of glaciological

1565   and isotopic methods, J. Glaciol., 7, 273-287, 1968.

Piñero-García, F. and Ferro-García, M. A.: Evolution and solar modulation of [7]Be during the solar cycle 23, J. Radioanal. Nucl. Ch., 296, 1193-1204, 2013.

Piñero-García, F., Ferro-García, M. A., and Azahra, M.: [7]Be behaviour in the atmosphere of the city of Granada January 2005 to December 2009, Atmos. Environ., 47, 84-91, 2012.

1570   Piñero-García, F., Ferro-García, M. A., Chham, E., Cobos-Díaz, M., and González-Rodelas, P.: A cluster analysis of back trajectories to study the behaviour of radioactive aerosols in the south-east of Spain, J. Environ. Radioactiv., 147, 142-152, 2015.

Poet, S. E., Moore, H. E., and Martell, E. A.: Lead 210, bismuth 210, and polonium 210 in the atmosphere: Accurate ratio measurement and application to aerosol residence time determination, J. Geophys.
1575   Res., 77, 6515-6527, 1972.

Poreba, G., Snieszko, Z., Moska, P., Mroczek, P., and Malik, I.: Interpretation of soil erosion in a Polish loess area using OSL, ^{137}Cs, ^{210}Pb$_{ex}$, dendrochronology and micromorphology-case study: Biedrzykowice site (S Poland), Geochronometria, 46, 57-78, 2019.

Porto, P. and Walling, D. E.: Validating the use of ^{137}Cs and ^{210}Pb$_{ex}$ measurements to estimate rates of
1580   soil loss from cultivated land in southern Italy, J. Environ. Radioactiv., 106, 47-57, 2012.

Porto, P., Walling, D. E., Callegari, G., and Catona, F.: Using fallout lead-210 measurements to estimate soil erosion in three small catchments in southern Italy, Water Air Soil Poll., 6, 657-667, 2006.

Porto, P., Walling, D. E., Callegari, G., and Capra, A.: Using caesium-137 and unsupported lead-210 measurements to explore the relationship between sediment mobilisation, sediment delivery and
1585   sediment yield for a Calabrian catchment, Mar. Freshwater Res., 60, 680-689, 2009.

Porto, P., Walling, D. E., and Callegari, G.: Using ^{137}Cs and ^{210}Pb$_{ex}$ measurements to investigate the sediment budget of a small forested catchment in southern Italy, Hydrol. Process., 27, 795-806, 2013.

Porto, P., Walling, D. E., and Capra, A.: Using ^{137}Cs and ^{210}Pb$_{ex}$ measurements and conventional surveys
1590   to investigate the relative contributions of interrill/rill and gully erosion to soil loss from a small cultivated catchment in Sicily, Soil. Till. Res., 135, 18-27, 2014.

Porto, P., Walling, D. E., Cogliandro, V., and Callegari, G.: Exploring the potential for using ^{210}Pb$_{ex}$ measurements within a re-sampling approach to document recent changes in soil redistribution rates within a small catchment in southern Italy, J. Environ. Radioactiv., 164, 158-168, 2016.

1595   Pourchet, M., Bartarya, S. K., Maignan, M., Jouzel, J., Pinglot, J. F., Aristarain, A. J., Furdada, G., Kotlyakov, V. M., Mosley-Thompson, E., Preiss, N., and Young, N. W.: Distribution and fall-out of

137Cs and other radionuclides over Antarctica, J. Glaciol., 43, 435-445, 1997.

Preiss, N. and Genthon, C.: Use of a new database of lead 210 for global aerosol model validation, 102, 25347-25357, 1997.

1600   Preiss, N., Mélières, M. A., and Pourchet, M.: A compilation of data on lead 210 concentration in surface air and fluxes at the air-surface and water-sediment interfaces, J. Geophys. Res., 101, 28847-28862, 1996.

Prospero, J. M., Schmitt, R., Cuevas, E., Savoie, D. L., Graustein, W. C., Turekian, K. K., Volz-Thomas, A., Díaz, A., Oltmans, S. J., and Levy II, H.: Temporal variability of summer-time ozone and 1605   aerosols in the free troposphere over the eastern North Atlantic, Geophys. Res. Lett., 22, 2925-2928, 1995.

Qian, J., Wang, X., and Xu, Z.: The Pb-210 atmospheric precipitation flux near the East China Sea, Donghai Mar. Sci., 4, 27-33, 1985 (in Chinese).

Rabesiranana, N., Rasolonirina, M., Solonjara, A. F., Ravoson, H. N., Raoelina, A., and Mabit, L.: 1610   Assessment of soil redistribution rates by ^{137}Cs and ^{210}Pb$_{ex}$ in a typical Malagasy agricultural field, J. Environ. Radioactiv., 152, 112-118, 2016.

Rajačić, M. M., Todorović, D. J., Janković, M. M., Nikolić, J. D., Sarap, N. B., and Pantelić, G. K.: ^{7}Be in atmospheric deposition: determination of seasonal indices, J. Radioanal. Nucl. Ch., 303, 2535-2538, 2015.

1615   Rajačić, M. M., Todorovic, D. J., Krneta Nikolic, J. D., Jankovic, M. M., and Djurdjevic, V. S.: The Fourier analysis applied to the relationship between ^{7}Be activity in the Serbian atmosphere and meteorological parameters, Environ. Pollut., 216, 919-923, 2016.

Raksawong, S., Krmar, M., and Bhongsuwan, T.: The ^{7}Be profiles in the undisturbed soil used for reference site to estimate the soil erosion, J. Phys.: Conf. Ser., 860, 012009, 1620   http://dx.doi.org/10.1088/1742-6596/860/1/012009, 2017.

Ram, K. and Sarin, M. M.: Atmospheric ^{210}Pb, ^{210}Po and ^{210}Po/^{210}Pb activity ratio in urban aerosols: temporal variability and impact of biomass burning emission, Tellus B, 64, https://doi.org/10.3402/tellusb.v64i0.17513, 2012.

Rama, and Zutshi, P. K.: Annual deposition of cosmic ray produced Be[7] at equatorial latitudes, Tellus, 10, 99-103, 1958.

Rangarajan, C., Gopalakrishnan, S. S., Sadasivan, S., and Chitale, P. V.: Atmospheric and precipitation radioactivity in India, Tellus, 20, 269-283, 1966.

Rangarajan, C., Gopalakrishnan, S., Chandrasekaran, V. R., and Eapen, C. D.: The relative concentrations of radon daughter products in surface air and the significance of their ratios, J. Geophys. Res., 80, 845-848, 1975.

Rangarajan, C., Madhavan, R., and Gopalakrishnan, S. S.: Spatial and temporal distribution of lead-210 in the surface layers of the atmosphere, J. Environ. Radioactiv., 3, 23-33, 1986.

Rastogi, N. and Sarin, M. M.: Atmospheric ^{210}Pb and ^{7}Be in ambient aerosols over low- and high-altitude sites in semiarid region: Temporal variability and transport processes, J. Geophys. Res., 113, D11103, https://doi.org/10.1029/2007JD009298, 2008.

Realo, E., Realo, K., Lust, M., Koch, R., and Uljas, A.: Lead-210 in air and in surface soil in NE Estonia, in: 11th International Congress of International Radiation Protection Association, Madrid, Spanish, 23-28 May 2004, 1-8, 2004.

Realo, K., Isakar, K., Lust, M., and Realo, E.: Weekly variation of the ^{210}Pb air concentration in North Estonia, Boreal Environ. Res., 12, 37-41, 2007.

Rehfeld, S. and Helmann, M.: Three dimensional atmospheric transport simulation of the radioactive tracers ^{210}Pb, ^{7}Be, ^{10}Be and ^{90}Sr, J. Geophys. Res., 100, 26141-26161, 1995.

Reiter, R., Munzert, K., Kanter, H. J., and Pötzl, K.: Cosmogenic radionuclides and ozone at a mountain station at 3.0 km a.s.l, Arch. Met. Geoph. Biocl. Ser. B, 32, 131-160, 1983.

Renfro, A. A., Cochran, J. K., and Colle, B. A.: Atmospheric fluxes of ^{7}Be and ^{210}Pb on monthly time-scales and during rainfall events at Stony Brook, New York (USA), J. Environ. Radioactiv., 116, 114-123, 2013.

Rodas Ceballos, M., Borras, A., Gomila, E., Estela, J. M., Cerda, V., and Ferrer, L.: Monitoring of ^{7}Be and gross beta in particulate matter of surface air from Mallorca Island, Spain, Chemosphere, 152, 481-489, 2016.

Ródenas, C., Gómez, J., Quindós, L. S., Fernández, P. L., and Soto, J.: [7]Be concentrations in air, rain water and soil in Cantabria (Spain), Appl. Radiat. Isot., 48, 545-548, 1997.

Rodriguez-Perulero, A., Baeza, A., and Guillen, J.: Seasonal evolution of [7, 10]Be and [22]Na in the near surface atmosphere of Caceres (Spain), J. Environ. Radioactiv., 197, 55-61, 2019.

1655   Saari, H. K., Schmidt, S., Castaing, P., Blanc, G., Sautour, B., Masson, O., and Cochran, J. K.: The particulate ^{7}Be/^{210}Pb$_{xs}$ and ^{234}Th/^{210}Pb$_{xs}$ activity ratios as tracers for tidal-to-seasonal particle dynamics in the Gironde estuary (France): implications for the budget of particle-associated contaminants, Sci. Total. Environ., 408, 4784-4794, 2010.

Sabuti, A. A. and Mohamed, C. A.: Impact of northern and southern air mass transport on the temporal
1660   distribution of atmospheric ^{210}Po and ^{210}Pb in the east coast of Johor, Malaysia, Environ. Sci. Pollut. Res., 23, 18451-18465, 2016.

Sakurai, H., Shouji, Y., Osaki, M., Aoki, T., Gandou, T., Kato, W., Takahashi, Y., Gunji, S., and Tokanai, F.: Relationship between daily variation of cosmogenic nuclide Be-7 concentration in atmosphere and solar activities, Adv. Space Res., 36, 2492-2496, 2005.

1665   Sakurai, H., Sato, T., Oe, T., Takahashi, Y., Matsubara, Y., Miyahara, H., Ohashi, H., Tavera, W., and Salinas, J.: Daily variation of cosmogenic nuclide Be-7 concentrations in high altitude atmosphere at Mt. Chacaltaya at the solar minimum from 2009, in: 32nd International Cosmic Ray Conference, Beijing, China, 11-18 August 2011, 420-423, 2011.

Saleh, I. H. and Abdel-Halim, A. A.: ^{7}Be in soil, deposited dust and atmospheric air and its using to infer
1670   soil erosion along Alexandria region, Egypt, J. Environ. Radioactiv., 172, 24-29, 2017.

Sambayev, Y. K., Zhumalina, A. G., Zhumadilov, K. S., Sakaguchi, A., Kajimoto, T., Tanaka, K., Endo, S., Kawano, N., Hoshi, M., and Yamamoto, M.: Temporal variation of atmospheric ^{7}Be and ^{210}Pb concentrations and their activity size distributions at Astana, Kazakhstan in Central Asia, J. Radioanal. Nucl. Ch., 323, 663-674, 2019.

1675   Samolov, A., Dragovic, S., Dakovic, M., and Bacic, G.: Analysis of ^{7}Be behaviour in the air by using a multilayer perceptron neural network, J. Environ. Radioactiv., 137, 198-203, 2014.

Samuelsson, C., Hallstadius, L., Persson, B., Hedvall, R., and Holm, E.: ^{222}Rn and ^{210}Pb in the Arctic

summer air, J. Environ. Radioact., 3, 35-54, 1986.

San Miguel, E. G., Hernández-Ceballos, M. A., García-Mozo, H., and Bolívar, J. P.: Evidences of different meteorological patterns governing [7]Be and ^{210}Pb surface levels in the southern Iberian Peninsula, J. Environ. Radioactiv., 198, 1-10, 2019.

Sanchez-Cabeza, J. A., Garcia-Talavera, M., Costa, E., Peña, V., Garcia-Orellana, J., Masqué, P., and Nalda, C.: Regional calibration of erosion radiotracers (^{210}Pb and ^{137}Cs): atmospheric fluxes to soils (northern Spain), Environ. Sci. Technol., 41, 1324-1330, 2007.

Sanders, C. J., Smoak, J. M., Cable, P. H., Patchineelam, S. R., and Sanders, L. M.: Lead-210 and Beryllium-7 fallout rates on the southeastern coast of Brazil, J. Environ. Radioactiv., 102, 1122-1125, 2011.

Sangiorgi, M., Hernández Ceballos, M. A., Iurlaro, G., Cinelli, G., and de Cort, M.: 30 years of European Commission Radioactivity Environmental Monitoring data bank (REMdb) - an open door to boost environmental radioactivity research, Earth Syst. Sci. Data, 11, 589-601, 2019.

Sato, J., Doi, T., Segawa, T., and Sugawara, S.: Seasonal variation at Tsukuba, Japan, from the 1991 of atmospheric concentrations of ^{210}Pb and [7]Be with a possible observation of ^{210}Pb originating from the 1991 eruption of Pinatubo volcano, Philippines, Geochem. J., 28, 123-129, 1994.

Sato, S., Koike, Y., Saito, T., and Sato, J.: Atmospheric concentration of ^{210}Pb and [7]Be at Sarufutsu, Hokkaido, Japan, J. Radioanal. Nucl. Ch., 255, 351-353, 2003.

Savva, M. I., Karangelos, D. J., and Anagnostakis, M. J.: Determination of [7]Be and [22]Na activity in air and rainwater samples by gamma-ray spectrometry, Appl. Radiat. Isot., 134, 466-469, 2018.

Schuler, C., Wieland, E., Santschi, P. H., Sturm, M., Lueck, A., Bollhalder, S., Beer, J., Bonani, G., Hofmann, H. J., Suter, M., and Wolfli, W.: A multitracer study of radionuclides in Lake Zurich, Switzerland: 1. Comparison of atmospheric and sedimentary fluxes of [7]Be, [10]Be, ^{210}Pb, [210]Po, and ^{137}Cs, J. Geophys. Res., 96, 17051-17065, 1991.

Schumann, G. and Stoeppler, M.: Beryllium 7 in the atmosphere, J. Geophys. Res., 68, 3827-3830, 1963.

Shapiro, M. H. and Forbes-Resha, J. L.: Mean residence time of [7]Be-bearing aerosols in the troposphere, J. Geophys. Res., 81, 2647-2649, 1976.

1705   Sheets, R. W. and Lawrence, A. E.: Temporal dynamics of airborne lead-210 in Missouri (USA): implications for geochronological methods, Environ. Geol., 38, 343-348, 1999.

Shelley, R. U., Roca-Martí, M., Castrillejo, M., Sanial, V., Masqué, P., Landing, W. M., van Beek, P., Planquette, H., and Sarthou, G.: Quantification of trace element atmospheric deposition fluxes to the Atlantic Ocean (>40°N; GEOVIDE, GEOTRACES GA01) during spring 2014, Deep-Sea Res.

1710   Part. I, 119, 34-49, 2016.

Shi, Z., Wen, A., Yan, D., Zhang, X., and Ju, L.: Temporal variation of ^{7}Be fallout and its inventory in purple soil in the Three Gorges Reservoir region, China, J. Radioanal. Nucl. Ch., 288, 671-676, 2011.

Shi, H., Zhang, Y., Deng, A., and Dong, Z.: Variation in activity concentration of ^{210}Pb in atmospheric

1715   aerosol and its radiation dose assessment in Qingdao, Chin. J. Radiol. Med. Prot., 37, 372-375, 2017 (in Chinese).

Shleien, B. and Friend, A. G.: Local ground-level air concentrations of lead-210 at Winchester, Massachusetts, Nature, 210, 579-580, 1966.

Short, D. B., Appleby, P. G., and Hilton, J.: Measurement of atmospheric fluxes of radionuclides at a UK

1720   site using both direct (rain) and indirect (soils) methods, Int. J. Environ. Pollut., 29, 392-404, 2007.

Silker, W. B.: Beryllium-7 and fission products in the Geosecs II water column and applications of their oceanic distributions, Earth Planet. Sc. Lett., 16, 131-137, 1972.

Simon, J., Meresova, J., Sykora, I., Jeskovsky, M., and Holy, K.: Modeling of temporal variations of vertical concentration profile of ^{7}Be in the atmosphere, Atmos. Environ., 43, 2000-2004, 2009.

1725   Smith, J. T., Appleby, P. G., Hilton, J., and Richardson, N.: Inventories and fluxes of ^{210}Pb, ^{137}Cs and ^{241}Am determined from the soils of three small catchments in Cumbria, UK, J. Environ. Radioactiv., 37, 127-142, 1997.

Song, H., Li, L., Li, Q., Mo, G., and Huang, N.: Levels of ^{210}Pb in aerosols of Daya Bay, Guangdong, in: National Seminar on Radioactive Effluent and Environmental Monitoring and Evaluation,

1730   Hangzhou, China, 25-27 November 2003, 484-486, 2003 (in Chinese).

Song, H., Mo, G., Li, L., Chen, W., Wang, J, Li, Q., and Huang, N.: Variations of [7]Be concentrations in the atmosphere of Guangdong Daya Bay district, China during the period 1994 to 2003, Prog. Rep. China Nucl. Sci. Technol., 4, 46-50, 2015 (in Chinese).

Stamoulis, K. C., Tsiligou, Z., Aslanoglou, X., and Ioannides, K. G.: Variation of both tritium (^{3}H) and beryllium ([7]Be) concentrations in air, rain and humidity samples collected at Ioannina, North-western Greece, HNPS Proc., 0, 220-223, 2018.

Steinmann, P., Billen, T., Loizeau, J. L., and Dominik, J.: Beryllium-7 as a tracer to study mechanisms and rates of metal scavenging from lake surface waters, Geochim. Cosmochim. Ac., 63, 1621-1633, 1999.

Steinmann, P., Zeller, M., Beuret, P., Ferreri, G., and Estier, S.: Cosmogenic [7]Be and [22]Na in ground level air in Switzerland (1994-2011), J. Environ. Radioactiv., 124, 68-73, 2013.

Stromsoe, N., Marx, S. K., Callow, N., McGowan, H. A., and Heijnis, H.: Estimates of late Holocene soil production and erosion in the Snowy Mountains, Australia, Catena, 145, 68-82, 2016.

~~Su, C. C. and Huh, C. A.: [210]Pb, ^{137}Cs and [239,240]Pu in East China Sea sediments: sources, pathways and budgets of sediments and radionuclides, Mar. Geol., 183, 163-178, 2002~~

Su, C. C., Huh, C. A., and Lin, F. J.: Factors controlling atmospheric fluxes of [7]Be and ^{210}Pb in northern Taiwan, Geophys. Res. Lett., 30, https://doi.org/10.1029/2003GL018221, 2003.

Sugihara, S., Momoshima, N., Maeda, Y., Osaki, S.: Variation of atmospheric [7]Be and ^{210}Pb depositions at Fukuoka, Japan, in: 10th International Congress of the International Radiation Protection Association, Hiroshima, Japan, 10-16 May 2000, P-1a–11, 2000.

Suzuki, T., and Shiono, H.: Comparison of [210]Po/^{210}Pb activity ratio between aerosol and deposition in the atmospheric boundary layer over the west coast of Japan, Geochem. J., 29, 287-291, 1995.

Suzuki, T., Maruyama, Y., Nakayama, N., Yamada, K., and Ohta, K.: Measurement of the [210]Po/^{210}Pb activity ratio in size fractionated aerosols from the coast of the Japan sea, Atmos. Environ., 33, 2285-2288, 1999.

Suzuki, T., Kamiyama, K., Furukawa, T., and Fujii, Y.: Lead-210 profile in firn layer over Antarctic ice sheet and its relation to the snow accumulation environment, Tellus B, 56, 85-92, 2004.

Suzuki, T., Sakurai, H., Tokanal, F., Inul, E., Shimizu, H., Masuda, K., Mitthumslrl, W., Ruffolo, D., Macatangay, R., Kikuchi, S., and Kurebayashi, Y.: Observation of cosmogenic nuclide Be-7 concentrations in the air at Bangkok and trajectory analysis of global air-mass motion, in: 35th International Cosmic Ray Conference, Busan, Korea, 10-20 Jul 2017, https://doi.org/10.22323/1.301.0070, 2017.

Swarzenski, P. W., Baskaran, M., Rosenbauer, R. J., and Orem, W. H.: Historical trace element distribution in sediments from the Mississippi River delta, Estuar. Coast., 29, 1094-1107, 2006.

Sykora, I., Holy, K., Jeskovsky, M., Mullerova, M., Bulko, M., and Povinec, P. P.: Long-term variations of radionuclides in the Bratislava air, J. Environ. Radioactiv., 166, 27-35, 2017.

Talbot, R. W. and Andren, A. W.: Relationships between Pb and ^{210}Pb in aerosol and precipitation at a Semiremote Site in northern Wisconsin, J. Geophys. Res-Oceans, 88, 6752-6760, 1983.

Tan, K., Yang, Y., Zhu, X., Li, Y., Chen, S., Yu, H., Jiao, X., Gai, N., and Huang, Y.: Beryllium-7 in near-surface atmospheric aerosols in mid-latitude (40°N) city Beijing, China, J. Radioanal. Nucl. Ch., 298, 883-891, 2013.

Tan, J., Li, M., Jiang, L., and Song, H.: Radioactivity characteristics of atmospheric aerosol samples in Guangzhou, Nucl. Tech., 39, 1-7, 2016 (in Chinese).

Tanahara, A., Nakaema, F., Zamami, Y., and Arakaki, T.: Atmospheric concentrations of ^{210}Pb and ^{7}Be observed in Okinawa Islands, Radioisotopes, 63, 175-181, 2014.

Tanaka, N. and Turekian, K. K.: Determination of the dry deposition flux of SO_2 using cosmogenic ^{35}S and ^{7}Be measurements, J. Geophys. Res., 100, 2841-2848, 1995.

Tateda, Y. and Iwao, K.: High ^{210}Po atmospheric deposition flux in the subtropical coastal area of Japan, J. Environ. Radioactiv., 99, 98-108, 2008.

Taylor, A., Keith-Roach, M. J., Iurian, A. R., Mabit, L., and Blake, W. H.: Temporal variability of beryllium-7 fallout in southwest UK, J. Environ. Radioactiv., 160, 80-86, 2016.

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.

1785   Terzi, L. and Kalinowski, M.: World-wide seasonal variation of [7]Be related to large-scale atmospheric circulation dynamics, J. Environ. Radioactiv., 178-179, 1-15, 2017.

Thang, D., Bac, V., Long, N., Thu Ha, N., Quynh, N., Khanh, N., Oanh, N., and Viet, C.: Activity concentrations of ^{210}Pb in the aerosol at Hanoi, Nucl. Sci. Technol., 8, 17-22, 2018.

Thompson, L. G., Mosley-Thompson, E., Grootes, P. M., Pourchet, M., and Hastenrath, S.: Tropical

1790   glaciers: Potential for ice core paleoclimatic reconstructions, J. Geophys. Res., 89, 4638-4646, 1984.

Thor, R. and Zutshi, P. K.: Annual deposition of cosmic ray produced Be[7] at equatorial latitudes, Tellus, 10, 99-103, 1958.

Todd, J. F., Wong, G. T. F., Olsen, C. R., and Larsen, I. L.: Atmospheric depositional characteristics of beryllium 7 and lead 210 along the southeastern Virginia coast, J. Geophys. Res., 94, 11106-11116,

1795   1989.

Todorovic, D., Popovic, D., and Djuric, G.: Concentration measurements of [7]Be and ^{137}Cs in ground level air in the Belgrade City area, Environ. Int., 25, 59-66, 1999.

Todorovic, D., Popovic, D., Djuric, G., and Radenkovic, M.: [210]Pb in ground-level air in Belgrade city area, Atmos. Environ., 34, 3245-3248, 2000.

1800   Todorovic, D., Popovic, D., Djuric, G., and Radenkovic, M.: [7]Be to ^{210}Pb concentration ratio in ground level air in Belgrade area, J. Environ. Radioactiv., 79, 297-307, 2005.

Todorovic, D., Popovic, D., Nikolic, J., and Ajtic, J.: Radioactivity monitoring in ground level air in Belgrade urban area, Radiat. Prot. Dosim., 142, 308-313, 2010.

Tokieda, T., Yamanaka, K., Harada, K., and Tsunogai, S.: Seasonal variations of residence time and

1805   upper atmospheric contribution of aerosols studied with Pb-210, Bi-210, Po-210 and Be-7, Tellus, 48B, 690-702, 1996.

Tositti, L., Brattich, E., Cinelli, G., and Baldacci, D.: 12 years of [7]Be and ^{210}Pb in Mt. Cimone, and their correlation with meteorological parameters, Atmos. Environ., 87, 108-122, 2014.

Tsunogai, S., Suzuki, T., Kurata, T., and Uematsu, M.: Seasonal and areal variation of continental aerosol

1810   in the surface air over the western North Pacific region, J. Oceanogra. Soc. Jpn., 41, 427-434, 1985.

Tsunogai, S., Kurata, T., Suzuki, T., and Yokota, K.: Seasonal variation of atmospheric ^{210}Pb and Al in the western North Pacific region, J. Atmos. Chem., 7, 389-407, 1988.

Tuo, F., Pang, C., Wang, W., Zhang, J., Zhou, Q., Yao, S., Li, W., and Li, Z.: Level, distribution, variation and sources of Pb-210 in atmosphere in North China, J. Radioanal. Nucl. Ch., 318, 1855-1862, 2018.

1815   Turekian, K. K. and Cochran, J. K.: ^{210}Pb in surface air at Enewetak and the Asian dust flux to the Pacific, Nature, 292, 522-524, 1981.

Turekian, K. K., Nozaki, Y., and Benninger, L. K.: Geochemistry of atmospheric radon and radon products, Ann. Rev. Earth Planet. Sc., 5, 227-255, 1977.

Turekian, K. K., Benninger, L. K., and Dion, E. P.: ^{7}Be and ^{210}Pb total deposition fluxes at New Haven,
1820   Connecticut and at Bermuda, J. Geophys. Res., 88, 5411-5415, 1983.

Uchida, T., Takahashi, F., Onda, Y., Sisingghi, D., Kato, H., Noro, T., and Osanai, N.: Estimating soil erosion rate and sediment sources using radionuclide Pb-210$_{ex}$ in upper Brantas River basin in Indonesia, J. Japan Soc. Hydrol. Water Resour., 22, 188-197, 2009 (in Japanese).

Uematsu, M., Duce, R. A., and Prospero, J. M.: Atmosphere beryllium-7 concentrations over the Pacific
1825   Ocean, Geophys. Res. Lett., 21, 561-564, 1994.

Ueno, T., Nagao, S., and Yamazawa, H.: Atmospheric deposition of ^{7}Be, ^{40}K, ^{137}Cs and ^{210}Pb during 1993-2001 at Tokai-mura, Japan, J. Radioanal. Nucl. Ch., 255, 335-339, 2003.

Uğur, A., Özden, B., and Filizok, I.: Determination of ^{210}Po and ^{210}Pb concentrations in atmospheric deposition in İzmir (Aegean sea-Turkey), Atmos. Environ., 45, 4809-4813, 2011.

1830   Uhlář, R., Količová, P., and Alexa, P.: Short-term variations in ^{7}Be wet deposition in the eastern part of the Czech Republic, J. Radioanal. Nucl. Ch., 304, 89-93, 2014.

Valles, I., Camacho, A., Ortega, X., Serrano, I., Blazquez, S., and Perez, S.: Natural and anthropogenic radionuclides in airborne particulate samples collected in Barcelona (Spain), J. Environ. Radioactiv., 100, 102-107, 2009.

1835   Van Metre, P. C. and Fuller, C. C.: Dual-core mass-balance approach for evaluating mercury and ^{210}Pb atmospheric fallout and focusing to lakes, Environ. Sci. Technol., 43, 26-32, 2009.

Vecchi, R. and Valli, G.: ^{7}Be in surface air: A natural atmospheric tracer, J. Aerosol Sci., 28, 895-900, 1997.

Vecchi, R., Marcazzan, G., and Valli, G.: Seasonal variation of ^{210}Pb activity concentration in outdoor air of Milan (Italy), J. Environ. Radioactiv., 82, 251-266, 2005.

Vogler, S., Jung, M., and Mangini, A.: Scavenging of ^{234}Th and ^{7}Be in Lake Constance, Limnol. Oceanogr., 41, 1384-1393, 1996.

Von Gunten, H. R., and Moser, R. N.: How reliable is the ^{210}Pb dating method? Old and new results from Switzerland, J. Paleolimnol., 9, 161-178, 1993.

Wagenbach, D., Görlach, U., Moser, K., and Münnich, K. O.: Coastal Antarctic aerosol: the seasonal pattern of its chemical composition and radionuclide content, Tellus, 40B, 426-436, 1988.

Wakiyama, Y., Onda, Y., Mizugaki, S., Asai, H., and Hiramatsu, S.: Soil erosion rates on forested mountain hillslopes estimated using ^{137}Cs and ^{210}Pb$_{ex}$, Geoderma, 159, 39-52, 2010.

Wallbrink, P. J. and Murray, A. S.: Use of fallout radionuclides as indicators of erosion processes, Hydrol. Process., 7, 297-304, 1993.

Wallbrink, P. J. and Murray, A. S.: Fallout of ^{7}Be in south eastern Australia, J. Environ. Radioactiv., 25, 213-228, 1994.

Wallbrink, P. J. and Murray, A. S.: Determining soil loss using the inventory ratio of excess lead-210 to cesium-137, Soil Sci. Soc. Am. J., 60, 1201-1208, 1996.

Walling, D. E. and He, Q.: Using fallout lead-210 measurements to estimate soil erosion on cultivated land, Soil Sci. Soc. Am. J., 63, 1404-1412, 1999.

Walling, D. E., He, Q., and Blake, W.: Use of ^{7}Be and ^{137}Cs measurements to document short-and medium-term rates of water-induced soil erosion on agricultural land, Water Resour. Res., 35, 3865-3874, 1999.

Walling, D. E., Collins, A. L., and Sichingabula, H. M.: Using unsupported lead-210 measurements to investigate soil erosion and sediment delivery in a small Zambian catchment, Geomorphology, 52, 193-213, 2003.

Walling, D. E., Schuller, P., Zhang, Y., and Iroume, A.: Extending the timescale for using beryllium 7 measurements to document soil redistribution by erosion, Water Resour. Res., 45, W02418, https://doi.org/10.1029/2008WR007143, 2009.

Walton, A. and Fried, R. E.: The deposition of beryllium 7 and phosphorus 32 in precipitation at north temperate latitudes, J. Geophys. Res., 67, 5335-5340, 1962.

Wan, G., Zheng, X., Lee, H. N., Bai, Z. G., Wan, E., Wang, S., Yang, W., Su, F., Yang, J., Wang, C., Huang, R., and Liu, P.: ^{210}Pb and ^{7}Be as tracers for aerosol transfers at center Guizhou, China: II. the interpretation by monthly and yearly intervals, Adv. Earth Sci., 25, 505-514, 2010 (in Chinese).

Wang, Y.: Investigating the soil erosion rates on the cultivated slopes in the northeast black soil region of China using ^{137}Cs and ^{210}Pb$_{ex}$ measurements, M.S. thesis, University of Chinese Academy of Sciences, China, 2010 (in Chinese).

Wang, L.: Study on soil erosion rates in Zhenjiang district using ^{137}Cs and ^{210}Pb$_{ex}$ tracers, M.S. thesis, Nanjing Normal University, China, 2011 (in Chinese).

Wang, B., Wu, J., Sun, W., Luo, W., Zhang, F., and Wang, Y.: Monitoring the variation of ^{210}Pb concentration in aerosol of Lanzhou from 2009-2012, Nucl. Electron. Detect. Technol., 34, 114-116, 2014a (in Chinese).

Wang, Z., Yang, W., Chen, M., Lin, P., and Qiu, Y.: Intra-Annual Deposition of Atmospheric ^{210}Pb, ^{210}Po and the Residence Times of Aerosol in Xiamen, China, Aerosol Air Qual. Res., 14, 1402-1410, 2014b.

Wang, J., Du, J., Baskaran, M., and Zhang, J.: Mobile mud dynamics in the East China Sea elucidated using ^{210}Pb, ^{137}Cs, ^{7}Be, and ^{234}Th as tracers, J. Geophys. Res-Oceans, 121, 224-239, 2016.

Wang, J., Huang, D., Xie, W., He, Q., and Du, J.: Particle dynamics in a managed navigation channel under different tidal conditions as determined using multiple radionuclide tracers, J. Geophys. Res-Oceans, 126, e2020JC016683, https://doi.org/10.1029/2020JC016683, 2021.

Wang, J., Baskaran, M., Kumar, A. et al. Reconstruction of temporal variations of metal concentrations using radiochronology ($^{239+240}$Pu and ^{137}Cs) in sediments from Kizilirmak River, Turkey. J. Paleolimnol., 65, 137-149, 2020.

Weiss, H. V., and Naidu, H. V.: ^{210}Pb flux in an Arctic coastal region, Arctic, 39, 59-64, 1986.

Wells, T., Hancock, G. R., Dever, C., and Murphy, D.: Prediction of vertical soil organic carbon profiles using soil properties and environmental tracer data at an untilled site, Geoderma, 170, 337-346, 2012.

Whiting, P. J., Matisoff, G., Fornes, W., and Soster, F. M.: Suspended sediment sources and transport distances in the Yellowstone River basin, Geol. Soc. Am. Bull., 117, 515-529, 2005.

Wieland, E., Santschi, P. H., and Beer, J.: A multitracer study of radionuclides in Lake Zurich, Switzerland: 2. Residence times, removal processes, and sediment focusing, J. Geophys. Res-Oceans, 96, 17067-17080, 1991.

Wilkening, M. H., and Clements, W. E.: Radon 222 from the ocean surface, J. Geophys. Res., 80, 3828-3830, 1975.

Wilson, C., Matisoff, G., and Whiting, P.: Short-term erosion rates from a ^{7}Be inventory balance, Earth Surf. Proc. Land., 28, 967-977, 2003.

Windom, H. L.: Atmospheric dust records in permanent snowfields: Implications to marine sedimentation, Geol. Soc. Am. Bull., 80, 761-782, 1969.

Winkler, R. and Rosner, G.: Seasonal and long-term variation of ^{210}Pb concentration in air, atmospheric deposition rate and total deposition velocity in south Germany, Sci. Total. Environ., 263, 57-68, 2000.

Winkler, R., Dietl, F., Frank, G., and Tschiersch, J.: Temporal variation of ^{7}Be and ^{210}Pb size distributions in ambient aerosol, Atmos. Environ., 32, 983-991, 1998.

Wu, J., Sun, W., Wang, B., Luo, W., Kang, F., Zhang, B., and Wang, Y.: The concentrations of ^{7}Be in air aerosols of Lanzhou City, Chin. J. Radiol. Health., 20, 333-334, 2011 (in Chinese).

Yamagata, T., Nagai, H., Matsuzaki, H., and Narasaki, Y.: Decadal variations of atmospheric ^{7}Be and ^{10}Be concentrations between 1998 and 2014 in Japan, Nucli. Instrum. Meth. B, 455, 265-270, 2019.

Yamamoto, M., Sakaguchi, A., Sasaki, K., Hirose, K., Igarashi, Y., and Kim, C. K.: Seasonal and spatial variation of atmospheric ^{210}Pb and ^{7}Be deposition: features of the Japan Sea side of Japan, J. Environ. Radioactiv., 86, 110-131, 2006.

Yang, H., Jun, E., Kim, Y., and Ok, G.: Residence times and chemical composition of atmospheric

aerosols: II. Residence times of aerosols in Pusan, J. Korean Environ. Sci. Soc., 8, 171-176, 1999 (in Korean).

1920   Yang, Y. H., Yan, B. X., and Zhu, H.: Estimating soil erosion in northeast China using ^{137}Cs and ^{210}Pb$_{ex}$, Pedosphere, 21, 706-711, 2011.

Yang, Y. L., Gai, N., Geng, C. Z., Zhu, X. H., Li, Y., Xue, Y., Yu, H. Q., and Tan, K. Y.: East Asia monsoon's influence on seasonal changes of beryllium-7 and typical POPs in near-surface atmospheric aerosols in mid-latitude city Qingdao, China, Atmos. Environ., 79, 802-810, 2013.

1925   Yi, Y., Bai, J., Liu, G., Yang, W., Yi, Q., Huang, Y., and Chen, H.: Measurements of atmospheric deposition fluxes of ^{7}Be, ^{210}Pb and ^{210}Po, Mar. Sci., 29, 20-24, 2005 (in Chinese).

Yi, Y., Zhou, P., and Liu, G.: Atmospheric deposition fluxes of ^{7}Be, ^{210}Pb and ^{210}Po at Xiamen, China, J. Radioanal. Nucl. Ch., 273, 157-162, 2007.

Yoshimori, M.: Beryllium 7 radionucleide as a tracer of vertical air mass transport in the troposphere,
1930   Adv. Space Res., 36, 828-832, 2005.

Young, J. A. and Silker, W. B.: The determination of air-sea exchange and oceanic mixing rates using ^{7}Be during the BOMEX experiment, J. Geophys. Res., 79, 4481-4489, 1974.

Young, J. A. and Silker, W. B.: Aerosol deposition velocities on the Pacific and Atlantic oceans calculated from ^{7}Be measurements, Earth Planet. Sc. Lett., 50, 92-104, 1980.

1935   Yu, Z., Tang, L., Qiu, X., Xiao, P., and Wu, Y.: Research about the change trend of ^{210}Pb and ^{210}Po of a year in aerosol, Prog. Rep. China Nucl. Sci. Technol., 5, 61-65, 2017 (in Chinese).

Yu, D., Sha, Z., Wang, Q., Hu, J., and Wang, Z.: Distribution characteristics of ^{137}Cs and ^{210}Pb$_{ex}$ in soil of grassland region in the northeastern of Qinghai-Tibet Plateau, J. Arid. Land Resour. Environ., 32, 160-166, 2018 (in Chinese).

1940   Zanis, P., Schuepbach, E., Gäggeler, H. W., Hubener, S., and Tobler, L.: Factors controlling beryllium-7 at Jungfraujoch in Switzerland, Tellus, 51B, 789-805, 1999.

Zanis, P., Gerasopoulos, E., Priller, A., Schnabel, C., Stohl, A., Zerefos, C., Gäggeler, H. W., Tobler, L., Kubik, P. W., Kanter, H. J., Scheel, H. E., Luterbacher, J., and Berger, M.: An estimate of the impact

of stratosphere-to-troposphere transport (STT) on the lower free tropospheric ozone over the Alps using ^{10}Be and ^{7}Be measurements, J. Geophys. Res., 108, D12, https://doi.org/10.1029/2002JD002604, 2003.

Zhang, X., Walling, D. E., Feng, M., and Wen, A.: ^{210}Pb$_{ex}$ depth distribution in soil and calibration models for assessment of soil erosion rates from ^{210}Pb$_{ex}$ measurements, Chinese Sci. Bull., 48, 813-818, 2003 (in Chinese).

Zhang, X., Qi, Y., Walling, D. E., He, X., Wen, A., and Fu, J.: A preliminary assessment of the potential for using ^{210}Pb$_{ex}$ measurement to estimate soil redistribution rates on cultivated slopes in the Sichuan Hilly Basin of China, Catena, 68, 1-9, 2006.

Zhang, F., Zhang, B., and Yang, M.: Beryllium-7 atmospheric deposition and soil inventory on the northern Loess Plateau of China, Atmos. Environ., 77, 178-184, 2013.

Zhang, Y., Long, Y., Yu, X., and An, J.: A comparison of measured ^{137}Cs and excess ^{210}Pb levels in the cultivated brown and cinnamon soils of the Yimeng Mountain area, Chin. J. Geochem., 33, 155-162, 2014.

Zhang, L., Yang, W., Chen, M., Wang, Z., Lin, P., Fang, Z., Qiu, Y., and Zheng, M.: Atmospheric Deposition of ^{7}Be in the southeast of China: A case study in Xiamen, Aerosol Air Qual. Res., 16, 105-113, 2016.

Zhang, Y., and Jiang, Z.: Estimation of Po-210 and Pb-210 emissions from coal energy use in China, Adv. Eng. Res., 163, 1576-1581, 2018a (in Chinese).

Zhang, W., Lam, K., and Ungar, K.: The development of a digital gamma-gamma coincidence/anticoincidence spectrometer and its applications to monitor low-level atmospheric ^{22}Na/^{7}Be activity ratios in Resolute Bay, Canada, J. Environ. Radioactiv., 192, 434-439, 2018b.

Zhang, L., Yang, W., Chen, M., Zhu, Y., and Wang, Z.: Atmospheric deposition of ^{210}Po and ^{210}Pb near the coast of Xiamen, Acta Oceanol. Sin., 41, 114-122, 2019 (in Chinese).

Zheng, X., Wan, G., Yang, J., Zhang, X., Yang, W., Lee, H. N., and Wang, C.: ^{7}Be and ^{210}Pb radioactivity and implications on sources of surface ozone at Mt. Waliguan, Chinese Sci. Bull., 50, 167-171, 2005 (in Chinese).

Zheng, J. J., He, X. B., Walling, D., Zhang, X. B., Flanagan, D., and Qi, Y. Q.: Assessing soil erosion rates on manually-tilled hillslopes in the Sichuan hilly basin using ^{137}Cs and ^{210}Pb$_{ex}$ measurements, Pedosphere, 17, 273-283, 2007.

Zhu, J. and Olsen, C. R.: Beryllium-7 atmospheric deposition and sediment inventories in the Neponset River estuary, Massachusetts, USA, J. Environ. Radioactiv., 100, 192-197, 2009.

1975