Review of *Reassessment of the radiocesium resuspension flux from contaminated ground surfaces in East Japan*

The manuscript touches an important aspect of atmospheric transport modelling, namely the assumptions made regarding aerosol size distributions. Often size distributions employed are simplified or even inappropriate. I think this work is an important contribution towards better understanding the issue of aerosol size-distributions.

Overall, the paper is well written and I can recommend its publication in ACP.

There are, however, some things which need clarification or correction.

<u>Specific comments:</u>

Fig. 1: source-receptor analysis presented in Sect. 3.5 -> source-receptor analysis presented in Sect. **3.2**

Section 2.1 Observation data: A few words about the sampling devices used for activity concentration and deposition measurements would be good.

l. 130: The Namie (Tsuhima) site is approximately 30 km northwest of the F1NPP, is -> The Namie (Tsu**s**hima) site [*skip "is"*] approximately 30 km northwest of the F1NPP [*skip comma*] is

l. 151/152: (only living areas; the removal of shrub and litter layers within 20 meters from the forest edges) *Please rephrase. Not fully clear what is meant.*

Section: 2.2 Numerical simulations: The first paragraph of this section is not well written.

- Errors between the original 1-D Eulerian model and the 1-D Lagrangian model developed and implemented to LM: *I guess you rather mean "deviations" instead of "errors". 1-D Lagrangian model was implemented to LM? Reads strange.*
- *You need to mention that a 3D model was employed. Evidently it is built on previous 1D models.*
- *What was the number of particles employed? What is the temporal resolution of input and output? Actually I would recommend a table with the run set-up.*
- from 138–140°E -> from 138–14**3**°E
- Grid Point Value-Mesoscale Model (GPV-MSM): *Reference is missing.*
- The GPV-MSM provides data on three hourly meteorological variables on the surface and at vertical layers from 1000 hPa to 100 hPa. -> The GPV-MSM provides data **for** meteorological variables **with 3-hourly resolution** on the surface and at vertical layers from 1000 hPa to 100 hPa. *How many layers are there?*
- *I have never heard the term "hydrometeor concentrations". Anyway: The "fundamental variables" need in any case to include precipitation rate P for wet deposition.*
- to simulate the locations and masses (or radioactivities) of Lagrangian particles -> to simulate the locations and masses (or **activity**) **carried by** Lagrangian particles.

- The simulation period is from December 1, 2012, to January 1, 2013, and the analysis period is the full year of 2013, from January 1, 2013, to January 1, 2014. *Do you mean in fact a spin-up period? Not clear.*

l. 213*: If the unit of FM is kg m^{-1} s^{-1} then the units on the left and right side of eq. 3 do not match.* "as a function of the friction velocity": *Please add dependency to eq. 3.*

Eq. 4: *No reference is provided.*

l. 227: derived from Advanced Very High Resolution Radiometer (AVHRR) normalized difference vegetation index (NDVI) data: *Reference is missing.*

l. 235: additionally consider areas with deposition amounts of 1–10 kBq m^{-2} *How can deposition amounts be quantified if below the detection limit?*

l. 237: NRA, 2014: *Reference does not exist. NRA, 2012?*

l. 263/264: the typical deposition rates of major carrier aerosols (submicron aerosols) are much smaller than the resuspension rates (supermicron aerosols). -> the typical deposition rates of major carrier aerosols (submicron aerosols) are much smaller than **those of the major carriers in this study** (supermicron aerosols). ?

l. 278-280: This analysis is novel because emission flux adjustments (C_{const} in Eq. 3 and r_{const} in Eq. 4) do not change the slope of the regressions, so the deposition parameters can be adjusted independently from the emission flux adjustment. *Please explain. Not obvious to me. Why should the two parameterizations be related at all?*

l. 289: are efficiently collected deposition samplers, as the traveling distance is approximately 1 km -> are efficiently collected **by** deposition samplers. *I think the last part of the sentence can be skipped. It looks lost to me.*

l. 332: Thus, for simplicity, we multiplied both fluxes used in K16 by 20: *Based on which considerations?*

l. 348: around the site (over the plain), the 137Cs of dust aerosols -> around the site (**of** the plain), the 137Cs **deposition** of dust aerosols

l. 351: (Sim/Obs = 4.8) -> (Sim/Obs = 4**.9**) *Value in the text and that in the figure should agree.*

l. 357: there are certain areas of snow coverage -> there are certain **periods** of snow coverage

l. 390: the simulations are high in summer due to forest aerosols -> the simulations are too high in summer due to forest aerosols **for the submicron case**

l. 393-395: The observed surface concentrations are high at Fukushima in winter, and the observed short-term peaks correspond to the simulated dust aerosols, indicating that the emission of resuspended 137Cs at Fukushima in winter is driven by wind. *Not only in winter. There are also similar peaks in the observations in late spring/early summer.*

l. 398/399: Nevertheless, Sim/Obs is not very low (0.80), and the R value obtained for supermicrons is improved from the submicron case -> The R value obtained for supermicrons is improved **compared to** the submicron case. *Skip the reference to Sim/obs – Sim/Obs with a value of 1.05 is even better for the submicron case. So Sim/Obs of the supermicron case is in fact not in favor of assuming larger particles.*

l. 406/407: that the numbers presented in these sections are associated with the discrepancies in the simulations described in the current section *Please rephrase. Not at all clear.*

l. 424/425: are derived using the seasonal mean concentrations from 300-kBq m^{-2} areas divided by those from whole areas (i.e., > 10 kBq m^{-2}) -> are derived using the seasonal mean **activity** concentrations **resulting** from 300-kBq m^{-2} areas divided by those from **the overall area** (i.e., > 10 kBq m^{-2})

l. 434/435: Even though the surface concentrations of supermicron particles over Fukushima Prefecture are larger than those of submicron particles (Fig. 5b), -> Even though the surface concentrations of supermicron particles **(Fig. 5b)** over Fukushima Prefecture are larger than those of submicron particles (Fig. 5**a**),

l. 436: < 0.01 mBg m^{-3} -> < 0.01 mB**q** m^{-3} *Analogous misspelling in l. 542.*

l. 445-447: Even though the seasonal mean wind fields over the ocean close to land are directed toward the land, substantial proportions of 137Cs in forest aerosols are transported toward the ocean in summer *Please elaborate what is the mechanism behind this feature.*

l. 448: the 137Cs transported toward the ocean are transported -> the 137Cs transported toward the ocean **is** transported

l. 473/474: the source contributions of submicrons (Fig. 6c) are similar to those for the concentrations (Fig. 6a), but the source contributions of supermicrons (Fig. 6d) are remarkably different. *Please elaborate why this is the case. I find it difficult to understand why the contributions from the re-suspension area is that different for concentration and deposition for the super-micron case.*

l. 490: (Figs. 7c–7d). -> (Figs. 7**a**–7d).

l. 490/491: resuspension amount was 1.28 TBq (Fig.7a) *Please cite Figs 7b to 7d in an equivalent manner.*

l. 512/513: the positive redistribution area (area enhanced deposition due to resuspension) is limited, and the amounts are up to 10 Bq m^{-2} per year. On the other hand, for the supermicron case (Fig. 8a), -> the positive redistribution area (area **with** enhanced deposition due to resuspension) is limited, and the amounts are up to 10 Bq m^{-2} per year. On the other hand, for the supermicron case (Fig. 8**d**),

Section: 3.4 Sensitivities: This section contains some weaknesses.

- l. 545/546: While this parameterization is complicated, the differences between[Cuml.] and [No cuml.] are exceedingly small. *Can be removed. The statement reappears in a similar manner in the 3rd paragraph.*
- l. 553/554: and over all prefectures numbered in Fig. 1b except the western part (Ou Mountains) of Fukushima Prefecture) *Please remove. First, it is Fig. 1a where prefectures are numbered and second there are prefectures (e.g., #4) with elevations > 1000 m.*
- l. 554: including at the Fukushima -> including [*skip "at"*] the Fukushima
- l. 558-561: *Should be removed completely. The discussion of submicron vs. supermicron is redundant (see section 3.1). Also, please avoid general statements which are not supported by the figures and only use the term "significant" if significance testing was performed.*
- l. 561/562: Including the cumulus parameterization was successful in the sense that it did not cause any significant deterioration in the statistical scores. *Strange sentence. A cumulus parameterization can be considered successful if it improves results but not when it does not deteriorate results!*
- l. 562-566: The supermicron simulations indicate slight improvements due to cumulus convection, such as increased R values of the concentrations at Fukushima and Tsukuba, but the FA2 values of the concentrations at Fukushima and Tsukuba are slightly decreased. The impact of including a 1–10-kBq m^{-2} area would be larger at Tsukuba, which is surrounded by less contaminated regions. The supermicron simulations indicate a slight improvement in the R value of the concentrations at Tsukuba, but the R value of the deposition at Tsukuba decreases. *Please remove these lines. There is no use in discussing the score differences detail, if these differences are deemed not substantial right afterward. And looking at Fig. 10 the statement about the change of R for Tsukuba when including deposition areas with 1-10 kBqm^{-2} is simply not true.*
- **Fig.10**: *I would remove those parts referring to the submicron results as this topic is already covered in section 3.1. This would help to make the subplots larger and labels easier to read (currently quite difficult due to font size). Caption:* Thus, "Submicron of [No cuml.]" is the simulation setting of K16, "Submicron of [Cuml.]" is the setting denoted as K16 in this paper, and "Supermicron of [Cuml.]" is the setting of this study. *Please remove entirely. Quite confusing. Rather explain in the first paragraph of the section that K16 simulations were redone using cumulus parameterization.*
- **Fig. 11:** *Add "(without snow cover)" in the legend for the red line.*
- l. 589: significant *Again, please use this term only in conjunction with a significance test.*
- l. 603-606: In addition, as previously… *Please remove. Redundant to what is said in the same paragraph above.*

<u>In addition, authors could considers making the following changes:</u>

l. 51: which is not included -> which **are** not included

l. 73: In addition to spatial observations -> In addition to **spatiotemporal** observations

l. 81: Vertical measurements obtained on mountains -> **Altitude-dependent** measurements obtained on mountains

l. 83: in other models: *Which other models?*

l. 105/106: In fact, number of pollen particles was 1/10 of number of bacteria -> In fact, **the** number of pollen particles was 1/10 of **the** number of bacteria

l. 113: the major carriers of 137Cs -> the major carriers of **re-suspended** 137Cs

l. 136: The concentration measurements are conducted -> The concentration measurements **were** conducted

l. 137/138: the deposition measurements are made by Fukushima Prefecture at Tsushima Screening Center -> the deposition measurements **were** made by Fukushima Prefecture at **the** Tsushima Screening Center

l. 144: The concentration and deposition measurements are -> The concentration and deposition measurements **were**

l. 155/156: The concentrations and deposition amounts are measured -> The concentrations and deposition amounts **were** measured

l. 200/201: are the orders of these submicron particles -> are **valid for** these submicron particles

l. 203: improved from those used in K16 -> improved **compared to** those used in K16

l. 207/208: K16 simulated the contributions from these additional emissions as being two to three orders of magnitude smaller than the observed surface activity concentrations, -> K16 simulated the contributions from these additional emissions **and resulting activity concentrations were** two to three orders of magnitude smaller than the observed surface activity concentrations,

l. 232: only emissions from the grids -> only emissions from the **grid boxes**

l. 245: or Tsukuba sites, and -> or Tsukuba sites, **but**

l. 261: at Fukushima sites -> at Fukushima **city** sites

l. 273: which is on the dimension -> which is **of** the dimension

l. 300: deposition rates obtained in this study are much faster -> deposition rates obtained in this study are much **higher**

l. 353: we regard this application -> we regard **a uniform** application

l. 393: due to forest aerosols is less dominant -> due to forest aerosols is less dominant **for the supermicron case**

l. 398: compared to the observations in winter -> compared to the observations in winter **in both cases**

l. 401: 10^0 -> **1**

l. 421: is defined as grids in which the grid-mean initial deposition -> is defined as **domain** in which the **grid box** mean initial deposition

l. 450/451: over Ibaraki and Miyagi exceeded 30% at a limited number of grids, but the mean concentrations were much lower (Fig. 5d) than those in the submicron case (Fig. 5c) over the prefectures -> over Ibaraki and Miyagi **exceed** 30% at a limited number of **grid boxes**, but the mean concentrations **are** much lower (Fig. 5d) than those in the submicron case (Fig. 5c) over **these** prefectures

l. 537: from the grids in which the grid-mean -> from the **grid boxes** in which the **grid box** mean
I would also recommend replacing "grids" with "grid boxes" in the subsequent lines.

l. 543-545: Thus, the submicron case of [No cuml.] was used in the study of K16, and the supermicron case of [Cuml.] is used as the simulation in this study. Note that the submicron simulations shown in the current study are [Cuml.].-> Thus, the submicron case **with** [No cuml.] was used in the study of K16, and the supermicron case **with** [Cuml.] is used as the **reference** simulation in this study. Note that the submicron simulations shown in the current study are **also with** [Cuml.].

l. 555/556: Some areas over the Kanto Plain are covered with snow in January. Extensive snow cover is also observed in the Abukuma Highlands, including in Namie (Tsushima), in February. -> Some areas over the Kanto Plain are **also** covered with snow in January. Extensive snow cover is **in addition** observed in the Abukuma Highlands, including [*skip "in"*] Namie (Tsushima), in February.

l. 576: emissions from grids in which the initial deposition -> emissions from **grid boxes where** the initial deposition

l. 597: people lived in Fukushima -> people **live** in Fukushima

l. 603: why [Snow cover] deteriorated -> why [Snow cover] deteriorate**s**

l.616: faster supermicron deposition rates necessitated higher emission fluxes -> faster supermicron deposition rates **necessitate** higher emission fluxes

l. 619: the resuspension source area is defined as areas in which -> the resuspension source area is defined as **area where**

l. 629: Additional forest emissions with a factor of 10^{-7} h^{-1} -> Additional forest emissions with **applying a constant** factor of 10^{-7} h^{-1}

l. 633: The annual mean source contributions for the concentrations -> The annual mean source contributions **of the re-suspension source area** for the concentrations

l. 648: 9.1%, and 5.4% *Floating point vs. integer notation in section 3.1*

l. 657: the maximum values are up to 100 Bq m^{-2}, -> the maximum values are up to 100 Bq m^{-2} **for the supermicron case**,

l. 665: which may cause exceptionally -> which may **in turn** cause exceptionally

l. 673/674: is not proven at all. -> is not proven **yet**. *I would not be that strict.*