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Interactive comment on "A new Lagrangian in-time particle simulation module (ltpas v1) for atmospheric particle dispersion" *by* Matthias Faust et al.

Matthias Faust et al.

faust@tropos.de

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1 Review #2

We would like to thank the Editor and the reviewer for their time spent on the manuscript and the comments and suggestions made. We carefully considered all of them; they helped us to improve the manuscript. Please find below the point-by-point reply with reviewer's comments printed in italics. Authors' comments are given below the reviewer's comment.

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Discussion paper

The authors presented new Lagrangian particle dispersion model (ltpas) for particle transport within a boundary layer which can be, possibly, turbolent. The model is online coupled with weather forcast model COSMO (German Weather Servise). The ltpas model is applied to two fields experiments studing the behavior of particles released by the agricultural activities (fertilization and cultivation with tractor). The paper is well writen and clear to understand, however, my main concern is regarding the validation of the ltpas model, see comments.

1.1 General comments

1. p.3 l.31 and p.5 l.16: please, specify the probability function, is it normal distribution with mean 0 and variance 1? Could you please, briefly verify this choice?

Many thanks for this comment. Two different things were mentioned here. Regarding the first part: p.3 l.31 refers to the probability function of the dry deposition (eq (16)). We have added a reference to clarify this. Regarding the second part: p.5 l.16 refers to the random number of the Lagrangian process(ξ). This is indeed taken from a normal distribution with a mean value of zero and a standard deviation of 1. We have added this information to the manuscript. The random number deflects the trajectory from its current path. As this process has to be symmetric, the mean value of the random number has to be zero. The magnitude of the disturbance is the standard deviation of the wind σ multiplied by the random number. With the chosen random number distribution we then estimate the turbulent disturbance that is most likely (68%) as this is the behaviour needed here.

2. p.9 l.10: I am quite confused by the assumption that "the particle concentration becomes zero at a height of 5 m". Is this realistic? Could you, please, discuss this choice? Maybe, it can be seen from photos.

The source function describes the initial state of the particles before they start to travel. Here, dust particles were uplifted mechanically by the tool pulled by a tractor. Once airborne, the particles immediately start to disperse with the ambient airflow so that the process of the initial emission transforms seamlessly into the process of transport. So the upper edge of the emitting plume cannot clearly be defined. However, with regard to the model application, we need to define an initial state of the particles as starting point. The measurements show that there was a reasonable concentration evident at 3.8m, so we defined 5m as the upper edge of the emission plume.

3. I am not sure about the role of two measurement points mentioned in the Experiment part. Are the roles of these points only to concstruct the source function? If this is the case, than I do not see the merit of the simulation experiment in Sec. 3.3 regarding validation of the ltpas model itself (although the simulation itself is interesting with discussion on Fig. 6). However, this means that the ltpas model is not validated in the paper. Please, clarify.

The measurements are used to construct the source plume. The two vertically stacked measurement points allowed us to define an idealised particle plume behind the tractor that represents the measured particle number for different particle size ranges. This itself is (as far as we know) a novel approach to define this kind of particle source. The measurements are indeed not used for validation, mainly because we cannot validate the model's source function with the data that we used for determining the source function. Additionally, the data are not suitable for validating particle transport as the measurements are too close to the source and therefore do not reflect any occurring particle transport.

1.2 Minor comments

1. Eq. (5): u, v, and w are probably spatial directions but it should be stated in the text.

Done

2. Eq. (17): erf *should be probably* $erf(\gamma)$.

Done

3. p.15 l.20: crating –> creating

Done

4. Reference (Pisso et al., 2019) is already published, please, update the citation.

Done

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