Response to anonymous referee # 2's interactive comment on the manuscript "Measurements of dust deposition velocity in a wind-tunnel experiment"

We would like to thank the anonymous referee for his critical and insightful comments related to our manuscript. The details of responses are shown as following.

General comments

The deposition velocity obtained here is based the model particle SiO2, which is spherical. This will serves as reference data to validating deposition scheme model. I am wondering how ambient relevant are the results here considering the difference of the lab particles and ambient dust particles in term of particle size distribution, particle shape and density. For example, shape of dust particles are usually non-spherical and may have different densities.

Wind speed is an important parameter in this study. But the measurement of wind speed was not mentioned in the experimental part.

Response: normally, dust deposition schemes assume the shape of dust particle is spherical and particle size and density are considered as input parameters in the schemes. We select spherical particle SiO2 to satisfy the requirement of measuring device. The size of particle is measured by PDA. Particle density is provided by the producer and is validated before the experiment. So that's would be fine to validated the schemes by using the data of the lab-particles. But it's true that the shape of dust particles is usually non-spherical, which means that the dust deposition schemes should be extended for non-spherical particles after the validation by spherical particles. Many works are required in future.

As mentioned in page 9444, line 24-25, "As the particles are small, their horizontal velocities can be considered to be the same as the wind speed.", the horizontal wind speed is represented by horizontal particle velocity measured by PDA.

Specific comments

1. Pg 9442, line 4, specify which devices you are referring to (for fluxes and concentration?) and what uncertainties that the authors refer to. Elaborate a little on the advantage of the method.

Response: in most dust-deposition experimental studies, deposition velocity w_d is estimated by measurements of dust flux and concentration which are operated by at least two devices, such as artificial sampler for flux and OPC (Optical Particle Counter) for concentration. The more devices employed the higher measurement error should exist.

We will improve the expression of this part.

2. Pg 9443, line 4-5, does this "multi-light detector" include several "different detectors"? It does not sound very clear for me.

Response: That is a technic of PDA. In receiver probe (as shown in Fig 2), the photosensitive element is divided into several parts by the aperture plates. Each part serves as a light detector.

3. Pg 9444, line 9-10, is the bounce also not possible on the wood surface?
Response: we oiled the wood surface by lubricating oil. And the bounce is assumed be impossible over this sticky wood surface, for particles larger than 0.5 μm.

4. Pg 9445, line 9-11, is the particle size resolution determined by instrument or just data analysis? The arithmetic average diameter is used here. But when it comes to the terminal velocity (Eq. 6, Pg 9447, line 4), the terminal velocity is proportional to Dp2. The wt of upper limit of one bin is much different than the lower limit of the bin, for example, there is nine times different for the bin 0.5-1.5 um! Then when calculating wt, a geometric mean seems to be more reasonable. I am wondering how sensitive is the deposition velocity to wt.
Response: the particle size resolution is determined by data analysis. For the estimation of deposition velocity, we need enough number of measurement data. Then we divided the raw data into several particle size bins to satisfy that requirement. For each bin, the particles are considered to be mono-dispersed with the respective median sizes to calculate relevant terminal velocity. It indeed has some problems here, for the reasons mentioned by the referee. But the deposition velocity is only sensitive to w_t for particle larger than 100 μm (Droppo, 2006) and the distributions of particle size in every size bins may be different. So, for simplicity, we select arithmetic average diameter in the analysis.

5. Pg 9446, ï˜A ˇ aline 20, is ïA˛Dˇ ti determined by "time interval between the peaks of the pulses" as indicated in Pg 9442, line 25? If so, clarify it.
Response: this question of referee is not shown well. We guess the referee wonders if $\overline{w_p}$ is determined by "time interval between the peaks of the pulses". The answer is NOT. There are actually three kinds of time scale. The minimum is "time interval between the peaks of the pulses", which represents the time for particle to cross the adjacent bright and dark planes of the fringe. This time scale is determined by the velocity of particle. The other time scale is Δt_i, which represents the time for particle to cross the measuring point of PDA. The maximum time scale is *T*, which represents the time for measurement. $\overline{w_p}$ is the sum of terminal velocity and the average wind velocity in vertical over time *T*.

6. Pg 9447, line 2, Eq. 5, for a certain size bin, when calculating wd, is the same Dpi used for all particle in this size bin? If so, Dpi can be omitted from the equation to make it simple.
Response: in Eq. 5, D_{pi} is different and is measured by PDA. But when calculating w_t, D_p is the same and is evaluated by the medium value of the size bin.

7. Pg 9448, line 3-5, is (wp –wp)Nj the standard deviation of the subset Nj ? . It is not

very clear for me that why the Eq. 7 is used in such a way. Please elaborate it.

Response: $\overline{w_p - \overline{w}_p}^{N_j}$ is not the standard deviation of the subset N_j. $w_p - \overline{w}_p$ essentially represents the fluctuation of vertical wind speed. The average of $w_p - \overline{w}_p$ should be zero, if the information of wind is show completely (i.e. particles pass the measuring point one by one, during T). But in fact, there are not sufficient particles. The wind information is only shown partly and the sampling is biased due to the vertical variation of dust particle concentration. Eq. 7 is employed to correct the effect of this bias.

8. Pg 9448, line 13, how is Zd determined?

Response: there are several models to estimate z_d, sucha as Raupach (1994), Shao and Yang (2008), Tian et al. (2001). But for simplicity, z_d is arbitrarily set to 200mm, about $0.8h_c$ (according to Slinn (1982)), in this study.

9. Pg 9449, line 10, the figure "not shown" can be shown in the appendix.

Response: yes, we will add the figure in the appendix.

10. Pg 9449, line 17-18, from Fig. 11, one can not tell wd increase "linearly" with friction velocity. Maybe just state "increase".

Response: accepted.

11. Pg 9449, line 17-18, by "wp", do you mean wd since wp is not shown here?

Response: yes, it should be w_d.

12. Pg 9450, line 20, from Fig. 13, one cannot tell with which existing studies have you compared? Do you refer to the general range of all the studies in Fig. 1 or only part of them? Considering that wd seems to strongly depend on the surface materials, it is good to know that you are comparing similar things (although not much data in the literature on similar materials). And specify the dashed line is for wt in the caption.

Response: we only select the studies for measuring deposition of particles larger than 0.5 µm, from figure 1. We will add more information in figure 13.

13. Pg 9451, line 18-20, the comparison of different surfaces are only mentioned in the summary but not covered in the results part. Also the measuring height of tree surface is different from other surfaces, is the deposition velocity comparable?

Response: this is an insightful comment. We will add some discussions in the results part, based on figure 13, in which the deposition velocity is recalculated to the same reference height.

14. Fig. 9 can be put in the appendix since it is not a key figure.
Response: figure 9 is an example for wind profile, which illustrates that the boundary lay condition of wind-tunnel satisfies the requirement of our experiment and how to get the wind filed parameters from experimental data. It's an impartment picture and is necessary to appear here.

Technical comments

15. Pg 9454, line1 and line 4 are same references but different year. Please check.
Response: that's a mistake. We will correct it.