Review on the manuscript Atmos. Chem. Phys. Discuss. acp-2016-19, Reynolds-number dependence of turbulence enhancement on collision growth, by Ryo Onishi and Axel Seifert

In this paper, the authors intend to compare two descriptions of turbulent collision kernels (Onishi vs Ayala-Wang) in evaluating the Reynolds number dependence of the turbulence enhancement (relative to the base gravitational kernel). They provided additional geometric collision statistics (g_{11}) for R_λ up to 1140, which could be valuable. They also provide a model to explain the Reynolds number dependence of the radial distribution function using dissipation intermittency. However, their DNS data for turbulent collision efficiency and droplet-droplet hydrodynamic interactions, due to their BiSM approximation, may underestimate the collision efficiency particularly for the monodisperse case (also see comment 10 below). It should be noted that, even the more rigorous HDNS model developed in Ayala et al. (2007) does not treat short-range interactions correctly (e.g., see Rosa et al., J. Comp. Phys., 230, 8109-8133). In other words, while the authors' DNS data for the geometric collisions and the Reynolds number dependence of g_{11} are carefully obtained, their DNS data for turbulent collision efficiency may not be accurate. This brings a question if their LCS results are accurate and can be used as a benchmark in Figs. 9 and 10.
The paper may be published, if the following issues can be considered and clarified in the revision.

1. Page 7, Eq. (16), what ρ_{12} expression is used? Please provide the detail. $St_{\max}$ is not defined.

2. Eq. (20) is missing a description for T_L.

3. The rationale for the St-dependence in the two limits of small and large St should be provided. At large R_λ, St_a can even be large than one. I think the St^2 dependence, derived from small St, would not apply.

4. Eq. (21): In the limit of very large $V_{p,\infty}$, the fluid time scale seen by a sedimenting particle approach $L_f/V_{p,\infty}$, where L_f is the longitudinal spatial velocity correlation length (e.g, Wang and Stock, J. Atmos. Sci. 50:1897-1913, 1993). Then $\theta_{i,sed}$ becomes $\tau_p V_{p,\infty}/L_f$. Eq. (21) does not seem to reduce to this result.

5. Page 8, the last sentence following Eq. (22) is confusing in two regards. First, clarify what the notation $\langle|w_r|\rangle$ is. If it is already averaged as the angle brackets usually mean, it should not have a distribution. Second, for the case of gravity only, the distribution of $|w_r|$ can be derived (see, e.g., Wang et al. J. Atmos. Sci. 63, 881 - 900.) and it is not Gaussian.

6. Page 9, first paragraph. The meaning of $E_{c,PKS01}$ needs to be clarified. Is this the collision efficiency for gravitational collision from PKS01? Other places in the paper, E_c is used to indicate the collision efficiency for turbulent collision.

7. The dissipation ratio in Eq. (33) is more like $\langle(\partial u_1/\partial x_1)^4\rangle/(\langle(\partial u_1/\partial x_1)^2\rangle)^2$, so it is not flatness.

8. The symbols in Fig. 2 need to be better explained. Why are there six different types of symbols and what do they represent?

9. Fig. 4, the large value for the monodisperse case in Ayala model is due to large collision efficiency. The reference DNS data is based on the binary based superposition method (BiSM). Wang et al. (2008) found that the turbulent collision efficiency depends on the liquid water content, implying that the long-range multiple-droplet hydrodynamic interactions are important. I wonder if BiSM will encounter systematic error when simulating turbulent collision efficiency for the monodisperse case, so the reference DNS data and LCS data can no longer be used as the benchmark.

10. Figs. 5 to 8: When the droplet radius is above 100 μm, droplet deformation and coagulation efficiency must be considered. I think the discussions in this paper should be focused on $a < 100\mu m$, due to the large number of assumptions involved.