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Interactive comment on "A Lagrangian Stochastic Model for the concentration fluctuations" *by* L. Mortarini and E. Ferrero

L. Mortarini and E. Ferrero

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First of all we would like to thank the Anonymous Referee for the suggestions that help us in making our paper more understandable.

As stated in a previous article (Mortarini and Ferrero, 2005, Atmos. Env.), the different behaviour between the separation and the barycentre standard deviations (equations (8) and (10)) is due to the non linear terms in the Langevin equations (6) and (7) respectively. As a matter of fact, the term $u_\Delta u_\Delta$ in (6) contains the interaction of the particles $u_1 u_2$, while the term $u_\Delta u_\Sigma$ in (7) lacks this part. When the intial separation memory is lost, the correlation between the particles influences only the separation and not the barycentre. This unbalanced behaviour is due to the model failing of the

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reduction to one particle criteria, if the barycentre standard deviation slope doesn't balance the separation's one, the single particle standard deviation can not follow the theoretical prediction as long as:

$\langle X^2 \rangle = \frac{1}{2} \left(\langle \Delta^2 \rangle + \langle \Sigma^2 \rangle \right)$

As for the separation PDFs, it can be easily noticed that Thomson PDF (12) is the first order expansion of the Richardson PDF (11) and that is not a proper PDF as long as does not tend to zero for $\Delta \rightarrow \infty$, but can be considered as a theoretical trend of the particle PDF separation when the particles are very close. Note that in the online paper there is a misprint in equation (11), the correct Richardson PDF reads:

$\mathrm{P}(\Delta|x,t) = \frac{9}{4\sqrt{\pi}} (\eta t)^{-3/2} e^{-\frac{9\Delta^{2/3}}{4\eta t}}$

Looking at the modelled PDF for the 1D, 2D and 3D case, we see that in the first case it fits the Richardson's prediction while, increasing the space dimensionality, the PDFs become less sharp and show a good agreement only with the first order expansion (Thomson's formula, 12), which still departs from the Gaussian statistics.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 3621, 2005.