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# *Interactive comment on* "Quantitative evaluation of numerical integration schemes for Lagrangian particle dispersion models" *by* H. Mohd. Ramli and J. G. Esler

**Anonymous Referee #2**

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This is an interesting manuscript. It investigates the numerical solution of the stochastic differential equations (SDE) used for the Lagrangian vertical velocity in many operational Lagrangian stochastic (LS) models for turbulent dispersion. This is an aspect that has been often overlooked and a careful investigation is welcome and useful. Several schemes are compared and the authors even propose an original improvement/correction of a previously proposed method (LR 1982) used for long time-steps. However, their results suggest that, for long time-steps, the random displacement model may be a better model compared to the use of the SDE for the particle velocity. The manuscript certainly deserves to be published and I have only some minor comments that the authors should consider.



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Discussion paper

1) The calculation time (in seconds) required for any computational scheme should be given and discussed. This is a fundamental aspect and needs to be well clarified (for example in a table). 2) The authors consider only fixed time-step, while often LS models use a variable time-step (often linked to the Lagrangian integral time scale with some additional constraints). The authors should discuss this aspect. What are the expected consequence of a variable time-step in the comparison? 3) Equation 7 seems a Gram-Charlier series (of type A). 4) Do the authors find any issue of negative probability in their solution of the FPE using the polynomial expansion of the pdf? 5) I wonder if the solution of the SDE (1) with a much smaller time step and many more particles could be used as the reference solution, instead of the deterministic solution of the FPE. 6) It seems to me that to obtain 15 from 11 involves also the assumption that C_k+1=0. 7) Page 10, line 7. I think that (15) should be (16). 8) Page 11, line 15. May be it is worth commenting that the difference between the particles concentration and the concentration of a tracer is only in the normalization. 9) Page 18 line 6. I think it should be “we do not recommend it for . . .”. 10) Page 19 line 5-6. I think the phrase “. . ., all can obtained easily from results found in (see chapter 22. . .)” should be rewritten. 11) Eq. 18 and Appendix D. It would be better to use a different symbol for the bandwidth since “h” is previously used for the boundary-layer. 12) Page 25, line 6. What is c_zz?

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