

## ***Interactive comment on “IL-GLOBO (1.0) – integrated Lagrangian particle model and Eulerian general circulation model GLOBO: development of the vertical diffusion module” by D. Rossi and A. Maurizi***

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We would like to thank both Referees who raised interesting points about the manuscript which helped us to improve it.

==General comments==

As noted by both Referees, Equation (11) is wrong. However, this was just a problem of typesetting. Numerical code implemented the right Equation, otherwise the WMC couldn't be satisfied at all. As suggestes by the Referee, we added some detail about

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the derivation of Equation (11) in the revised manuscript.

==Other comments==

1. The abstract is revised to make it clear the offline nature of the experiments. However, we felt that adding an experiment with the full 3D, online coupled model, though preliminary, would add some value to the paper. We added the result of the WMC test in a 3D experiment with the correct horizontal advection and a crude assumption on the vertical profile of  $K$  which is kept horizontally uniform across a grid column. This experiment can be regarded as ensemble of 1D experiments of all the realization of vertical profile in a given period of time (24h) and for a specific date.
2. We revised the derivation of Equation (11) (12, in the revised version) and we think that it is now more clear. In our opinion, reporting Equation 2 of Thomson 1995 would not be very useful in the revised version.
3. Equation (11) is rewritten correctly and its derivation refined.
4. Revised version modified accordingly.
5. We found Referee's comment very appropriate. The reason why we omitted the comparison is that we could not find any clearly verifiable improvement (this is made clear in the revised version of the manuscript). We cannot exclude that, in very specific situations, there can be a benefit using Milnstein, but we couldn't find any, so far. However, because using Milnstein does not add extra computational cost, we decide to use it mainly because of its formal equivalence with the Euler deterministic scheme.
6. This comment, along with an equivalent comment by Referee#1, lead us to perform extra simulation considering one profile sampled among those presenting isolated strong maxima. It turned out to be extremely useful and lead to a deep revision of the manuscript.
7. The "fitted peaked" profile was substituted by an observed extreme profile (see above) which is even more critical from numerical point of view.

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8. We performed extra simulations with  $4*N$  and  $N/4$  in order to double or half the statistical limit. The results is that  $CT=0.01$  is still the value where RMSE becomes comparable to the statistical error, without improvement for smaller CT. This result is reported in the revised version of the manuscript.

9. Normalized concentration profiles also for Akima are shown in the revised version.

10. Please, refer to point 6 and 7 above.

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