

Interactive comment on “IL-GLOBO (1.0) – development and verification of the moist convection module” by D. Rossi et al.

Anonymous Referee #1

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The manuscript develops previous work on a coupled Eulerian GCM–Lagrangian dispersion model framework, introducing a novel approach to representing convective transport in a consistent way. This is based on an approach used in existing reanalysis-driven dispersion models, but coupled directly to the mass fluxes in the GCM’s convective parameterisation allowing for much greater consistency with the meteorology.

This topic is important because convection plays a very important role in determining transport of tracers away from their source. The new developments are mostly well presented and assessed, and subject to the comments below, the manuscript would be appropriate for publication in GMD.

C2496

1 General comments

Although its meaning is generally clear, the manuscript would benefit from copy-editing for English grammar and usage throughout. I have therefore not included individual corrections on that front here.

Some evaluation against observations in addition to the validation of the model’s self-consistency, although not a must, would greatly improve the significance of this work.

2 Specific comments

Page 8240, line 24: please explain why dispersion processes are Lagrangian “by nature”, rather than Eulerian and Lagrangian simply being two different perspectives.

Page 8241, lines 9–11: this is a very vague description of when convection occurs. It should be either made more specific about the necessary conditions, or removed.

Page 8242, line 20: the detail is sufficient, but I’m not sure “with great detail” is warranted.

Page 8241, lines 23–27: this paragraph appears to be addressing the similarities and differences between the representation of turbulent diffusion and moist convection in an LPDM, but the exact point is unclear – a little more explanation would be helpful.

Page 8242, line 14: I agree that, when coupled to a coarse-resolution GCM with parameterised convection, this mechanism is likely to be far more effective at redistribution than explicit vertical motion. However, the reasons why should be explained in the manuscript.

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Page 8242, line 25: II-GLOBO should be IL-GLOBO.

Page 8243, line 16: “very detailed” compared to what? The description sounds like a fairly standard bulk mass-flux parameterisation.

Page 8244, line 7: mass-flux parameterisations typically do not decompose the mass flux into updraught area and velocity. Please explain briefly how Kain–Fritsch differs from e.g. Tiedtke or Gregory & Rowntree, enabling it to do so.

Page 8245, line 18–page 8246, line 2: the presentation here is confusing, with the special case of cloud-top coming first but having the exact same formula as the general case. It might be clearer to present the formula first for the general case, and then note that this is equal to 1 at cloud top.

Page 8246, line 15: why is the formula for Eq. (7) not

$$p^u(j|i) = p_i^{u\epsilon} p_j^{u\delta} \prod_{k=i}^{j+1} (1 - p_k^{u\delta})? \quad (1)$$

Please explain the derivation more clearly.

Page 8248, line 21: “uniformly distributed” is the more usual term.

Page 8250, lines 8–9: finer resolution would only be expected to increase the ratio if the calculation is restricted to grid cells where some the convective parameterisation is triggered. Averaged over all cells, including those where no convection occurs, surely the ratio should remain similar?

Page 8253, lines 6–9: it’s not clear what these three sentences are trying to say, or how they relate to the results shown in the figures. Please explain further.

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Page 8253, lines 10–16: it could be made clearer what the main novel component is here (the use of the DPM approach in an online-coupled GCM–dispersion model, where it has previously been used for offline models).

Page 8253, lines 17–18: this is very brief – in what way is the model “fully consistent”?

Page 8254, line 6: it’s the GNU *General* Public Licence – see <https://www.gnu.org/licenses/gpl-3.0.en.html>.

Page 8254, line 7: it’s `libtool`, not `libtools` – see <https://www.gnu.org/software/libtool/>.

Page 8254, line 17: delete spurious “490” and correct FSF URL – it should be Free Software Foundation (<http://www.fsf.org>).

Figure 2: clear “updraft”, “downdraft” and “environment” labels on the schematic would be helpful.

Figure 4: column (absolute/relative) and row (vertical/horizontal) headings would make the subplots easier to understand at a glance.

Figures 3–5: show the line colours in a legend, rather than describing them in the text.

Interactive comment on Geosci. Model Dev. Discuss., 8, 8239, 2015.

C2499