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Geoscientific Model Development Discussions

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

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1.1 – grammar/usage

We tried to correct all grammar errors. As for usage, none of us is a native English speaker, so it is a bit difficult for us to identify the points that need correction.

1.2 – evaluation against observations

We understand the importance of validation vs. real data and we are planning a future presentation accordingly. However this is only the technical presentation of the development where we only deal with verification and not validation.

1.3 pg 8240 ln 24 – Sentence modified to:

The description of the dispersion comes more naturally in the Lagrangian framework, and etc

1.4 pg 8241 ln 9-11 – Joined two paragraphs and modified to:

Moist convection is widespread in the Earth's atmosphere where it displays a wide range of space and time scales in response to the variability of environmental parameters, ranging from the sub-kilometer / tens-of-minutes of individual cumuli to hundred-of-km / several days of mesoscale convective complexes \citep[see, \textit{e.g.},][]{emanuel-1994}.

1.5 pg 8241 ln 23-27 – The paragraphs has been modified to address the Reviewer's comment trying to make the point more clear.

1.6 pg 8242 ln 14 – Added explanation:

In the absence of a convective parameterization, explicit convection can occur, and thus some vertical transport of tracers was present in the previous version of the model. However, since the scales of convection are in the sub-km range, any explicit representation of it at coarser resolution is bound to misrepresent most of those scales, and create updrafts that are incorrect in location and strength. Therefore the inclusion of a moist convction Lagrangian redistribution mechanism is essential to the completeness of the model.

1.7 pg 8242 ln 20 – Removed "with great detail'.

1.8 pg 8242 ln 25 – corrected accordingly

1.9 pg 8243 ln 16 – Changed "The updraft is very detailed and accounts for the thermodynamics" to: "The updraft is a detailed account of the thermodynamics"

1.10 pg 8244 ln 7 – No change

In the code, vertical mass flux is defined as vertical velocity times area times density. Closure then determines the value of an adjustment factor to be applied to mass flux as

a whole. The scheme makes explicit use of vertical velocity in the trigger function and in the computation of precipitation and condensate loading. We therefore interpret the adjustment factor as applied to the area occupied by the convective ensemble, since any change of vertical velocity would influence nonlinearly the geometric and physical characteristics of the plume and render inconsistent a closure expressed by a single scalar factor. As far as we understand it, not having seen the code, both Tiedke, and Gregory and Rowntree use different approaches to closure and plume models that do not require such a distinction. This level of detail seems outside the scope of this presentation so we have not included it in the text.

1.11 pg 8245 ln 18 etc – Paragraph rewritten in order to present first the general formula, and then the special case of cloud top.

1.12 pg 8246 ln 15 – Equation corrected according to the Reviewer's comment

1.13 pg 8248 ln 21 – Changed to "uniformly distributed"

1.14 pg 8250 ln 8-9 – Sentence removed. We meant exactly what the reviewer wrote, just expressed it badly.

1.15 pg 8253 ln 6-9 – Changed to:

The structure of convective updrafts (see e.g figure 1) is such that most of the upward moving mass comes from the lowest levels of the atmosphere (below cloud base) and is returned to the environment in the upper troposphere, in the strong outflow at the top of the cloud, while areas of weak subsidence surround the updrafts

1.16 pg 8253 ln 10-18 – The first part of Conclusions have been rewritten to make the novel aspect more clear. "Fully consistency" is now explained using the theoretical equivalence of Lagrangian and Eulerian description of fluid flows.

1.18 pg 8254 ln 6 – OK

1.19 pg 8254 ln 7 – OK

1.20 pg 8254 ln 17 – OK

1.21 Figure 2 – OK

1.22 Figure 4 – OK

1.23 Figures 3-5 – OK

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