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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling deep convection and its impacts on the tropical tropopause layer" *by* J. S. Hosking et al.

Anonymous Referee #2

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The manuscript by Hoskin et al., uses a high resolution weather forecasting model to investigate transport and deep convection in the tropics. The focus is on the role of direct injection high above Q=0 versus injection into the lower TTL with subsequent slow ascent. The model convection is evaluated with PDFs of OLR against observations from satellite and compared to the models convective mass fluxes. The authors present seasonal cycles of both diagnostics as vertical cross sections for the tropics. They show that the region of strongest convective impact on the upper TTL particular from Nov to Feb is situated over the Pacific warm pool. They conclude that this constitutes the preferential gateway of short-lived bromine species to the TTL and thus a source for short-lived stratospheric bromine.

The paper adresses an important problem of current atmospheric sciences and uses

statistical analyses to investigate the relation between model and observed OLR in addition to mass flux diagnostics. The results highlight the importance of the Maritime continent for convection and the TTL region and differences to the African and American tropics in their role feeding the TTL. The evaluation on the basis of OLR is sound and the results are presented adequately, however, possible limitations and error sources should be discussed more in detail. I think the paper is suitable for publication with minor changes.

Specific: What can be stated about the dependency of the results to the used setup: How important is e.g. the vertical resolution of the model, when diagnosing vertical transport above Q=0 ? How sensitive are the results to the cloud scheme?

The plots of Figure 7 show interesting regional variations and suggest a strong impact of convection on the TTL particular in February. However, Figure 7 only shows the mean states of e.g. Q=0 and the relation of OLR and mass fluxes to these quantities. Is it possible to plot PDF's of the instantaneous differences of cloud top relative to the instantenous Q=0 , LRT, ...? This would strengthen the results. Alternatively the variability of Q=0 on Figure 7 would be an interesting information with regard to a potential overlap.

p.20285, l.11-13: The autors find a lower tropopause height for the region of convection reaching the upper TTL and suggest a higher probability for air reaching the stratosphere due to the lower tropopause. This is speculative since a low tropopause and a region of convective outflow slightly below are not necessarily connected. Air parcels may travel within the TTL over large distances, thus injection high into the TTL does not necessarily mean rapid local tropopause crossing.

p. 20271, l. 17/18. What are the boundaries for the mass flux integration, 14 - 14.5 km?

p.20279, l. 8: represent instead of represents

p.20279, l.25-28: It is difficult to follow the pattern matching argument here to link regional impact of convection. Is it possible to add the relevant contours of Fig. 1 on Fig.6? To me the link seems very weak.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 20267, 2010.