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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropical convective transport and the Walker circulation" *by* J. S. Hosking et al.

Anonymous Referee #2

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Overview

In this paper, the authors study the transport of tracers in the tropical tropopause layer (TTL) in the tropics. Their work is based on modelling results using the Met Office UM model. The authors show the link between the efficiency of tracer transport in different tropical regions and the Walker circulation. The work presented in the paper is certainly of interest. It provides additional material compared to previous studies, in particular to the work by Levine et al. (2007). The paper is well written and clearly organised. My main concerns on this paper are firstly the validation of the simulations before possible interpretation and secondly the sensitivity of the model results to various model parameters which could be of importance and should be discussed. This is why several major comments (detailed below) need to be addressed before acceptance for publication.

Major comments

The validity of the meteorological simulation is briefly discussed in sections 2 and 3.1. Since the conclusions presented in the paper only rely on UM simulations there should be a dedicated section/subsection explaining why the authors are confident in their model simulations for the study of tracer transport.

The tracer transport is very dependent on the convection parameterization used as shown in previous studies. How confident are the authors on the vertical transport of tracers by convection in their model ? This issue needs to be discussed.

From the literature, we know that the top altitude of convection and the associated tracer transport can vary with the vertical levels used, if too coarse. Moreover, the TTL being a transition region with large gradients, these gradients can only be captured with a sufficiently fine vertical grid spacing (500-800 m). The information on the vertical grid spacing is not given in the paper. This should be added. The vertical grid being an important parameter, it should be discussed in the paper.

Three pertinent levels are chosen for the interpretation of the tracer transport in the TTL : 12.5 km, 14.6 km and 16.9 km which correspond, respectively, to the lapse rate minimum (LRM), the level of clear-sky net-zero radiative heating (Q clear) and the cold point tropopause (CPT). Are the height of these levels derived from the model simulation ? If yes, how ? In any case, the altitudes of LRM, Qclear and CPT levels vary with the tropical region and with the season considered. To make a fair interpretation of the efficiency of the tracer transport between the different tropical regions at differents seasons, this variability should be taken into account. In practice, the variability of these levels could be determined from the model outputs and discussed. If there are significant variations (which may be expected), I would recommend to use the mean LRM, Qclear and CPT calculated from the model results for each region and for each season to make figure 4 and associated discussion.

Minor comments

The interpretation presented in this paper is based on the UM model. The description of the model is too short. In particular, it would be necessary to have details at least on the vertical resolution of the model in the TTL, on the diffusion and convection parameterizations used.

It would be useful to have an illustration of the Walker circulation provided by the model for a better understanding of the discussion.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 12229, 2012.