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Corrigendum to

"Microphysical Process Rates and Global Aerosol-Cloud Interactions" published in Atmos. Chem. Phys., 13, 9855–9867, 2013

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Abstract. A mistake swapped process rates between autoconversion and accretion in global model solutions. Revised figures are presented. The accretion to autoconversion ratio in the model does increase with Liquid Water Path (LWP) as in the steady state model but biases remain. Simulated autoconversion rates are too high. Adjusting process rates following the steady state model ideas leads to an improvement in process rates. The main conclusion is unaffected.

1 Introduction

The analysis of autoconversion (A_u) and accretion (A_c) process rates were inadvertently switched in the analysis of global model results in Gettelman et al. (2013). This affects several of the figures. It does not affect analysis not considering the rates, and does not affect the steady state model. The revised figures are presented. The underlying conclusion is unchanged; diagnostic precipitation may result in autoconversion that is too high, and this can be corrected by altering the relative balance of the autoconversion and accretion rates, which lowers the radiative effect of Aerosol Cloud Interactions (ACI).

2 Revised figures

Revised Fig. 4 illustrates that autoconversion occurs higher in the cloud (Fig. 4a). There is more accretion near surface (Fig. 4c). Vertical averages are similar between autoconversion and accretion (Fig. 44b and d). Because the ratio is now correctly inverted (Fig. 4e and f), it is higher near the surface (more accretion) and decreases upward (Fig. 4e). The ratio of accretion to autoconversion (A_c / A_u) in the column is lower. The ratio of vertically averaged accretion to autoconversion (Fig. 4f) is often less than one.

In revised Fig. 5 the biggest change is an increase in the ratio with increasing LWP as the steady state model suggests (Fig. 5a). The slope looks similar to the analysis of VOCALS observations, but the magnitude of autoconversion is too large (Fig. 5b). Accretion with respect to LWP is similar to that estimated from observations (Fig. 5c). Results with AOD are mixed, which reflects different LWP regimes occurring for a given AOD. Globally there are increases in the A_c / A_u ratio (Fig. 5d). Autoconversion decreases with AOD (Fig. 5e), while accretion does not (Fig. 5f).

In revised Fig. 6 the ratio of vertically averaged autoconversion to rain rate (A_u / R) flattens out (Fig. 6a), whereas the vertically averaged accretion to rain rate ratio (A_c / R) continues to increase with LWP (Fig. 6b). This makes more sense from the formulation: A_c is dependent on $Q_r^{1.15}$, so it is expected to increase. As before, there is not a strong relationship with AOD (Fig. 6c, d).

Susceptiblity is unchanged in the simulations. In revised Fig. 8 the sensitivity tests are a clear improvement: QrScl and Increased Accretion increase the A_c / A_u ratio substantially (Fig. 8). In the QrScl simulation this is mainly by reducing autoconversion (Fig. 8b) and in the A_c*10 simulation by boosting accretion as well as reducing autoconversion. A_u / 10 also decreases accretion and autoconversion. QrScl has the largest effect, and is the best fit with susceptibility (Fig. 9).

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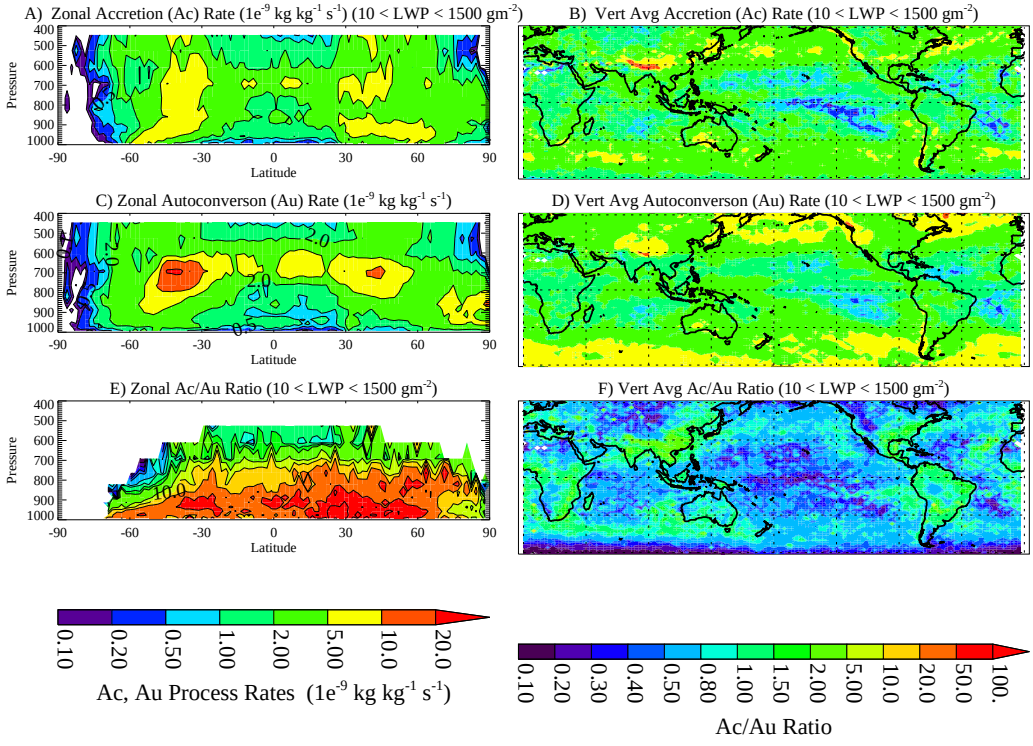

Figure 4. Zonal mean latitude height **(A, C, E)** and vertically averaged maps **(B, D, F)** of accretion rate (A_c: **A, B**), autoconversion rate (A_u: **C, D**), and the ratio of accretion to autoconversion rate (A_c/A_u: **E, F**) for all Liquid Water Paths.

3 Conclusions

In summary, the big difference in these corrected plots is that the simulated ratio of accretion to autoconversion increases with LWP as with observations. That is different than the conclusions in the uncorrected manuscript. However, the main conclusion of the paper is unchanged. Autoconversion rates are too high, and modifying the process rates as suggested by the simple model improves the relative balance of the process rates and can alter ACI significantly.

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Gettelman, A., Morrison, H., Terai, C. R., and Wood, R.: Microphysical process rates and global aerosol-cloud interactions, Atmos. Chem. Phys. Discuss., 13, 11789–11825, doi:10.5194/acpd-13-11789-2013, 2013.

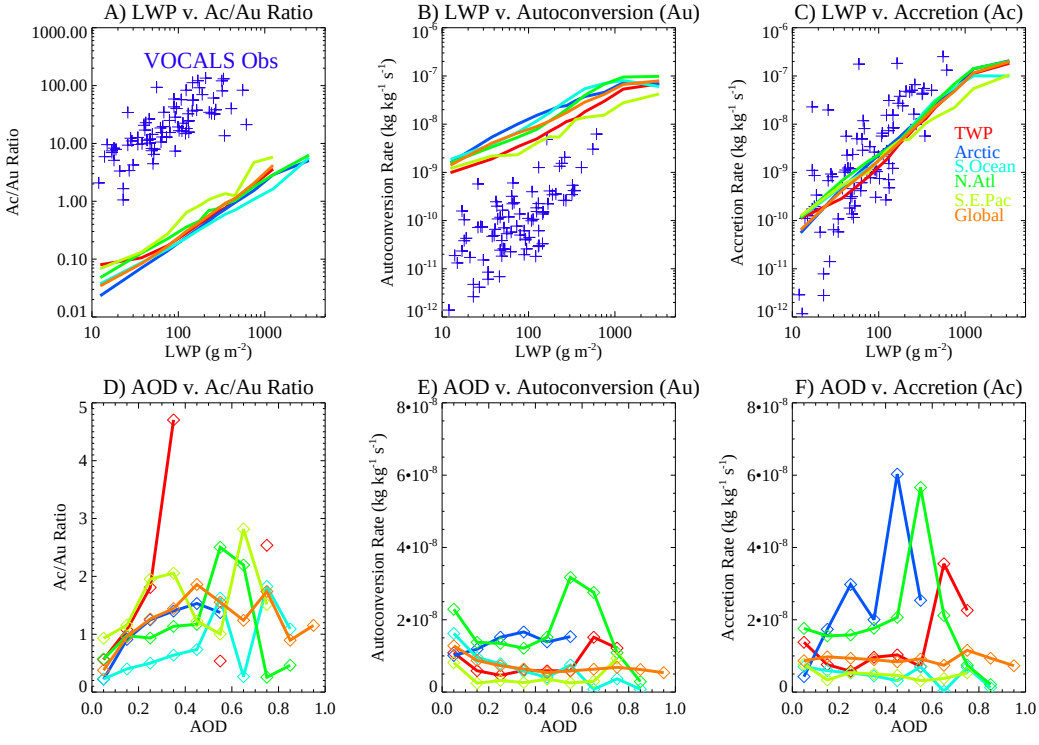

Figure 5. GCM Regional and global averages of vertically averaged **(A)** Accretion/Autoconversion (A_c/A_u) ratio v. LWP, **(B)** Autoconversion (A_u) rate v. LWP and **(C)** Accretion (A_c) rate v. LWP. Also shown are **(D)** A_c/A_u ratio, **(E)** A_u and **(F)** A_c v. AOD. Regions correspond to: Tropical Western Pacific (TWP: 20° S–20° N, 120–160° E), Arctic (65–80° N, all longitudes), S. Ocean (65–60° S, all longitudes), N. Atlantic (40–60° N, 300–360° E), S. E. Pacific (30–10° S, 260–295° E), and Global.

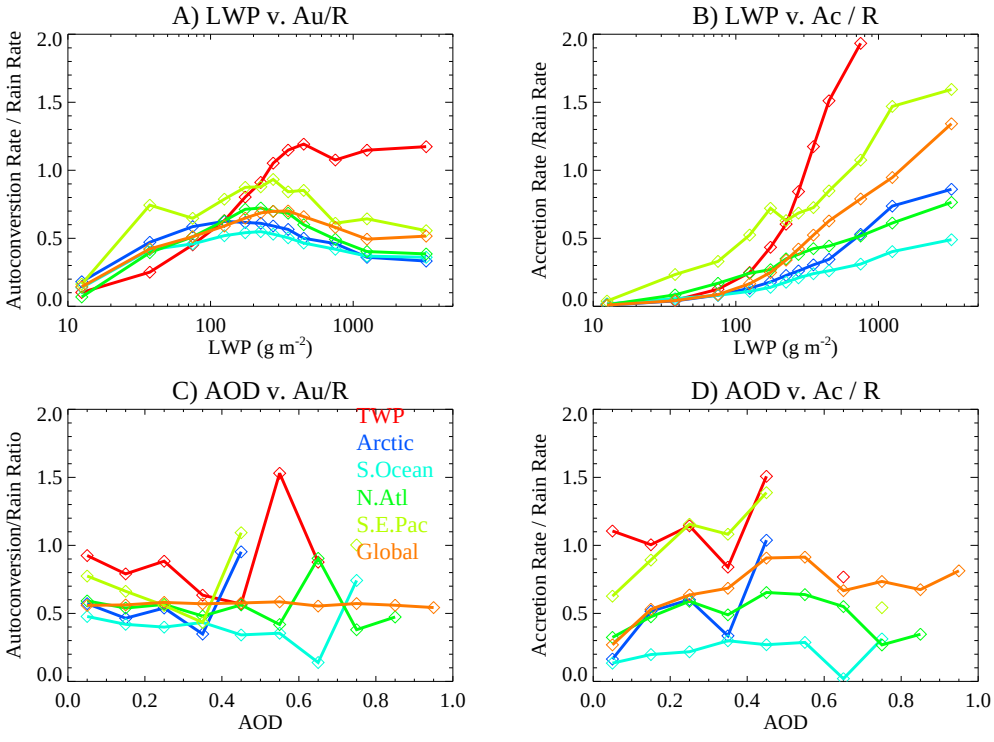

Figure 6. Regional averages of the ratio of vertically averaged **(A, C)** autoconversion and **(B, D)** accretion to surface precipitation rate for different regions (colors, see Fig. 5 for description) binned by **(A, B)** LWP and **(C, D)** AOD.

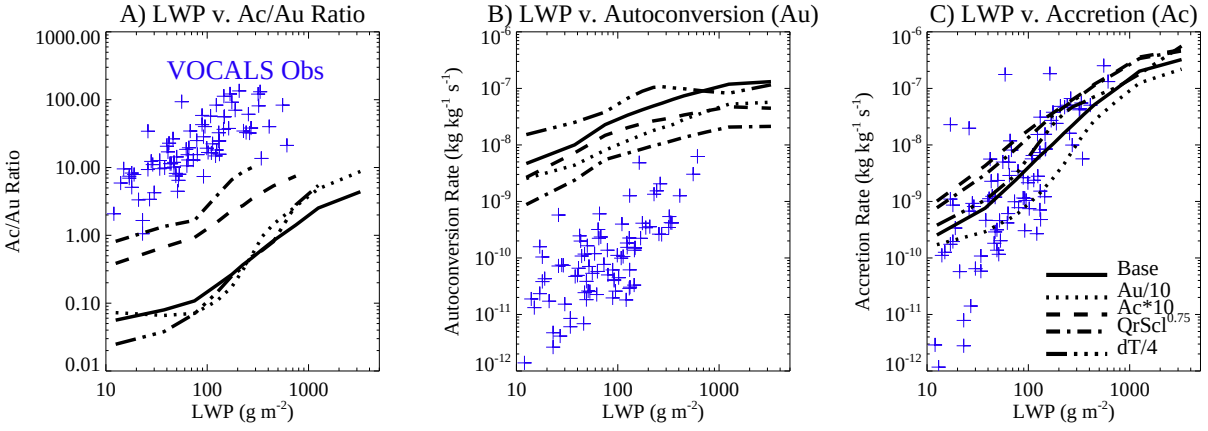

Figure 8. Global averages of vertically averaged **(A)** Accretion/Autoconversion (A_c/A_u) ratio v. LWP, **(B)** Autoconversion (A_u) rate v. LWP and **(C)** Accretion (A_c) rate v. LWP. Simulations are described in Table 2. Base CAM5 (solid), A_u / 10 (dotted), A_c * 10: (dashed), QrScl$^{0.75}$ (Dot Dashed) and dT/4 (triple dot-dash). Also shown are observational estimates (blue crosses) from VOCALS aircraft flights as described in the text.