Responses to Referee's Comments

We appreciate careful reading and lots of valuable comments.

We wrote referee's comments in black, our responses to comments in blue and italics, and the revised manuscript in red.

Referee #1:

My only major suggestion is for the authors to consider the use of monthly mean "hourly" AMF, e.g. monthly mean AMFs for 9AM, 10AM, 11AM local time ... The only reason for using monthly mean AMFs would be to reduce computation such that operational VCD products can be delivered quickly. It seems the use of "monthly mean hourly" AMFs would not only be quick, but also address a lot of the aerosol temporal effects, since for each month, the main diurnal variability of AMFs is driven by the vertical profile of aerosols (which in turn is driven by the development of the PBL). This seems like something the authors can address without too much additional computation.

Following the reviewer's suggestion, we calculated monthly mean "hourly AMF" (AMF_{mh}) and included our discussion on the results using AMF_{mh} in Fig. 3-4 in the revised manuscript as follows:

Here, we use three AMF specifications associated with the temporal variation of input data for AMF calculations. Input data include HCHO profiles, aerosol optical properties and profiles, temperatures, pressures, and other interfering gases (O_3, NO_2, and SO_2) from GEOS-Chem simulations. We use monthly, hourly, and monthly-averaged hourly input data at each model grid to compute AMF_m, AMF_h, and AMF_{mh}, respectively, for June 2009.

…

Figure 4 shows scatterplot comparisons of retrieved VCDs versus model simulations at 9, 12, and 18 LST of Seoul over China (105-120°E, 15-45°N). We find some biases in the retrieved products using AMF_m and AMF_{mh} compared with the true values and the results with AMF_h. Regression slopes are close to one for the results using

AMF_h (0.96-1.08) but higher than one for the results using AMF_m (1.14-1.31) and AMF_{mh} (1.08-1.24). The coefficients of determination (R^2) between the retrieved versus true VCDs differ significantly and are 0.73, 0.83, and 0.99 for the retrieved VCDs with AMF_m, AMF_{mh}, and AMF_h at 12 LST, respectively, indicating the best performance of the retrieval using AMF_h relative to those with the other AMFs.

We find that both the regression slope and R^2 for the results using AMF_{mh} suggest a better performance than those with AMF_m, particularly at 12 LST, but do not show any significant improvement at 9 and 18 LST. We infer from this that the temporal variability of species, caused by the diurnal variation of the planetary boundary layer (PBL), mostly explains the difference between the retrievals using AMF_m and AMF_{mh}. Accounting for this diurnal variability appears to be important for the retrieval when the PBL is fully developed and the active chemical processes typically occur. Therefore, we think that the use of AMF_{mh} could be an alternative and more efficient way to improve HCHO VCD retrievals for geostationary satellites with less computation required relative to the use of AMF_h.

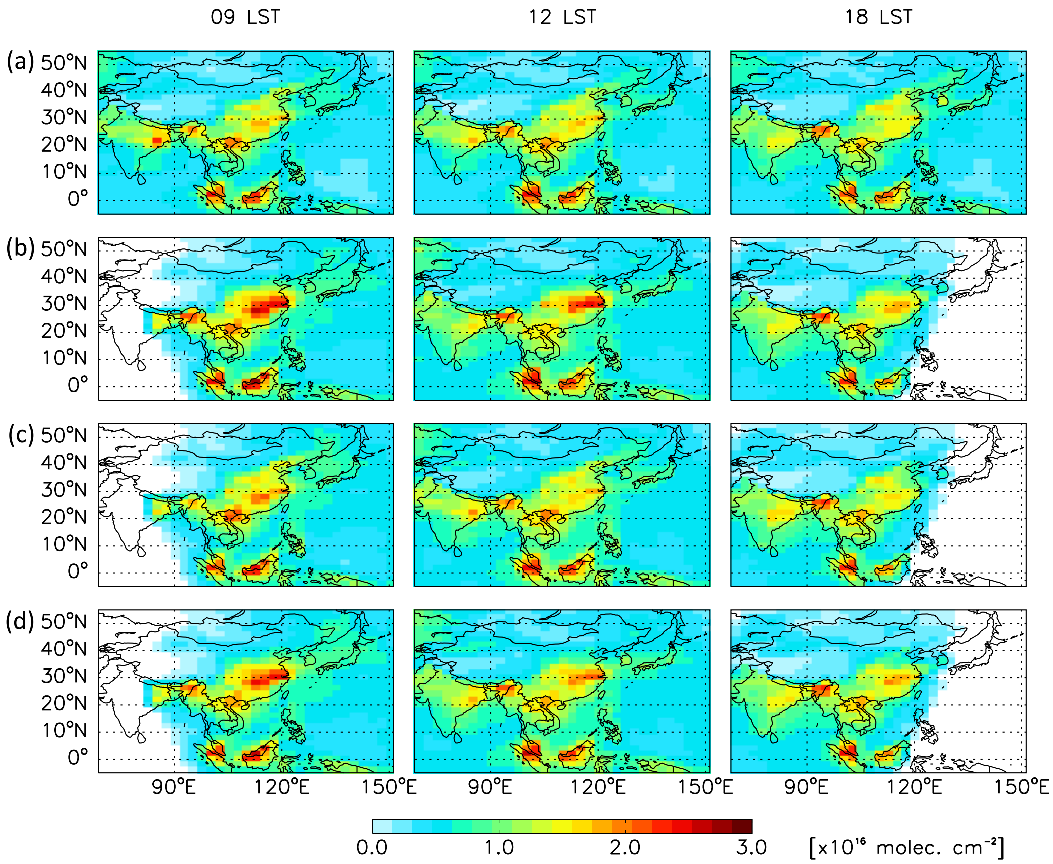

Figure 3. (a) HCHO VCDs simulated by GEOS-Chem at 9, 12, and 18 local standard time (LST) of Seoul on 21 June 2009. (b) Retrieved HCHO VCDs with AMF_m. (c) Retrieved HCHO VCDs with AMF_h. (d) Retrieved HCHO VCDs with AMF_{mh}.

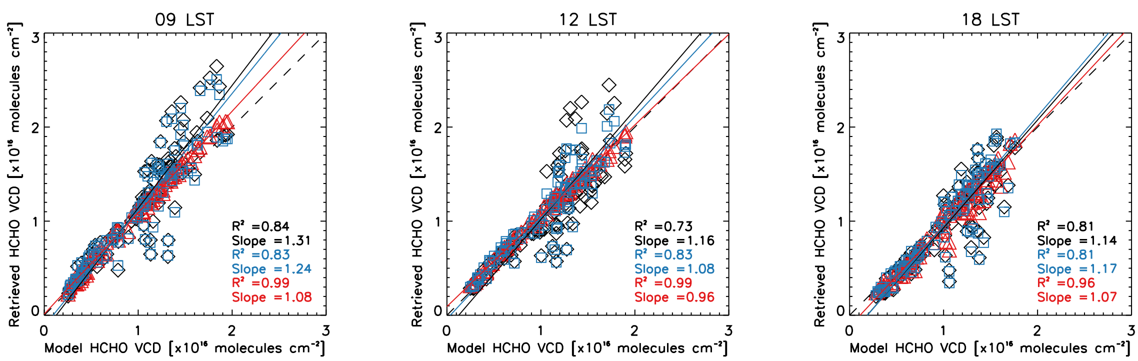

Figure 4. Comparison of the retrieved versus simulated VCDs shown in Fig. 3 over China (105-120°E, 15-45°N). Black diamonds, red triangles, and blue squares denote the retrieved VCDs using AMF_m, AMF_h, and AMF_{mh}, respectively. Statistics are shown as insets.

Minor comment: Page 8, lines 20-21: "In biogenic emission regions, the effects of biogenic aerosols on AMF are negligible . . .”This may be true, but it would be nice to have some quantification. How large is the contribution of biogenic aerosols to total AOD?

We clarified the sentences as follows:

In biogenic emission regions, AOD at 300 nm is low (<0.1) and thus its effect of AMF is relatively minor except for biomass burning cases occurring over Indonesia (100-120°E, 4°S-5°N) in September and Indochina (100-120°E, 10-20°N) in March.