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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Methane plume over South Asia during the monsoon season: satellite observation and model simulation" *by* X. Xiong et al.

X. Xiong et al.

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First, we thank the reviewer for their detailed and constructive comments on our paper. We have revised the paper following all the comments/suggestion given by the reviewer.

We appreciate the suggestion to analyze the data from five stations of the NOAA network at the periphery of the region under investigation, i.e. Mt Waliguan, China; Ulaan Uul, Mongolia; Bukit Koto Tabang, Indonesia, and the station in Kazakhstan. However, as the most sensitive region of AIRS measurements to methane (CH4) is in the middle to upper troposphere, direct comparison of AIRS CH4 product with the measurements at NOAA flask network is sub-optimal. Instead, the comparison of seasonal cycle is

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promising. We found the CH4 seasonal cycle in the free troposphere, using the observations at Mt Waliguan, China (3810m) and Plateau Assy, Kazakhstan (2519m), is quite different from the cycle near the marine boundary layer (MBL), using data from other three sites. Similar to AIRS measurements in the middle to upper troposphere, the CH4 in the free atmosphere also increases in the summer. Table 1 is added to include the latitude, longitude, elevation and the period of data used, and Figure 5 is added to show the seasonal cycles in these five sites.

Page 13464 Lines 11-16: There is a consistency of the occurring time of the maxima of CO and CH4. The reviewer is right that the dominant sources for CO and CH4 are different. So, this consistency indicates that the transport is likely the main driver for the enhancement of CH4 in the summer. We examined the data published in literacy but have not found the total amount of CH4 emissions from Asian rice paddies in different months. We think it is hard to say exactly that the maximum of CH4 in the upper troposphere coincides with the maximum of CH4 emissions from rice. These discussions have been added in the paper.

Page 13465 Line 11: As suggested, we changed the source pathway to EMISSION pathway in the whole paper.

Page 13466 Line 5: I think there exists a misunderstanding for the use of background CH4. For clarification we revised this paragraph. What we used is the difference of mean mixing ratio between 1st run and 2nd run over the ocean in southern hemisphere in order to account for the imbalance of sources and sinks in 2nd run, and this difference is removed from the 2nd model run. Since the most sensitive region of AIRS measurements to CH4 is in the middle to upper troposphere, using the ground-based measurements from NOAA flask network as the background in the middle to upper troposphere is obviously inappropriate and biased. A comparison of the seasonal cycle between AIRS measurements and ground-based measurements had been added.

Page 13466 Line 10: As suggested, in the context we added the value of change

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in ppbv in addition the change in percentage. The corresponding change of 4-5% is about 70-80 ppbv, and 8-9% is about 140-150 ppbv. The paragraph beyond this point has been revised as recommended.

Figure 3: as suggested we added a box at 150-300 hpa in Figure 3 to highlight the pressure layer where AIRS has the most sensitivity to CH4.

Figure 4: Right, this figure could also be plotted with the oceanic or continental background removed. This plot looks similar to the current figure, so we have not included it in the paper. Also we think the information included in such a plot can be found from Figure 1. It is hard to identify the months of maximum emissions as impacts of both the transport and the emissions can not be separated. The following context is added:

Figure 4 could also be plotted with the oceanic or continental background removed, which may give us some information of the months of maximum emissions, rather than a cycle heavily influenced by OH activity. However, while we removed the CH4 over the ocean or the zonal average from the CH4 over the South Asia, the plot is similar to Figure 4. This analysis further confirms the formation of CH4 plume begins in early July and peaks around the end of August to early September in South Asia, and the this enhancement is associated with both the transport processes and the local surface emissions. However it is hard to identify the months of maximum emissions as the impact of emission coexists with the impact of transport. The dependence of the CH4 plume on the emission can be found from the sensitivity study using the model in Section 3.3.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13453, 2008.

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