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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Increasing synoptic scale variability in atmospheric CO_2 at Hateruma Island associated with increasing East Asian emissions" *by* Y. Tohjima et al.

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Thank you very much for your comments and suggestions on our paper, which are very useful for revising the manuscript.

Reply to Specific Comments

We agree with the reviewer that the CO2 emission from biofuel consumption is not so significant compared to the fossil fuel component. Please note that the main aim of this paper is not inter-annual variability (just between the adjacent years), but more sustained increase over several years. The fossil-fuel emission change due to anthropogenic activity does not vary significantly from one year to another, but a gradual

change (increase or decrease) is expected. We attribute the major interannual variations to changes in regional meteorology or non-fossil emissions.

P15728, L24: The modeling period is from January 1990 to December 2006, and first six years are treated as spin-up period, during which the inter-hemispheric gradient and stratosphere-troposphere exchange like long-term transport mechanisms are equilibrated in the model. Thus model results for the period 1996-present are used in this analysis. We will state this in the revised manuscript.

P15729, L5: As for the fossil fuel emissions, firstly spatial distribution of anthropogenic CO2 emission are constructed for the period of 1990-2000 by interpolating the emissions maps for the years 1990, 1995 and 2000 based on EDGAR3.2 and EDGAR3.2FT2000. For the years after 2000, EDGAR3.2FT2000 map is used. Then we used the national total emission inventories from the CDIAC database corresponding to each year for the period of our simulation to scale the emission maps. We will add this description on the fossil fuel emission in the revised manuscript.

P15729, L22 and P15734 L5: Actually, the percentages of the trajectories occurring in the specific origins for individual years show significant inter-annual variations. So, we will add the uncertainties (standard deviations of the annual percentages) for the percentages in the revised manuscript. These percentages are 21$\pm$4% for Beijing, 17$\pm$4% for Shanghai, 12$\pm$3% for Korea, 12$\pm$4% for Japan, 38$\pm$5% for CH, 24$\pm$5% for JK, 9$\pm$4% for ST, and 29$\pm$4% for PO. The annual percentages do not show any exceptional changes in 2006.

P15734, L14: As the referee #2 suggested, the longer backward trajectory calculations reveal that the air masses of which origin is categorized as PO are also often influenced by the continental emissions during the winter season. We will add the statement in the revised manuscript.

P15735, first paragraph: Carefully investigating the inter-annual variability in the backward trajectories, we have not found any exceptional changes in 2006. The sharp dip

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in 2006 is still puzzling. However, please note that the sigma_CO2 alone did not dip in 2006, but significant increase in sigma_CH4 resulted the ratio to decrease. It is possible that anthropogenically produced CH4 emission increased significantly in 2006 and also continued in 2007. We still do not have an ideal tracer for normalizing the transport and/or natural emission variabilities in atmospheric CO2 (CH4 is only a close approximation in terms of lifetime and emission pattern).

P15735, L5: The values of the sigma_CO2/sigma_CH4 ratio only for the air masses of JK and ST are usually lower than those for all air masses, and the discrepancy is largest in 2007 (see attached Figure 1). Therefore, the values of the sigma_CO2/sigma_CH4 ratio for the air masses without JK and ST are largest in 2007. We will add the values for the air masses of JK and ST in Fig. 4.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 15725, 2009.

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Interactive Comment

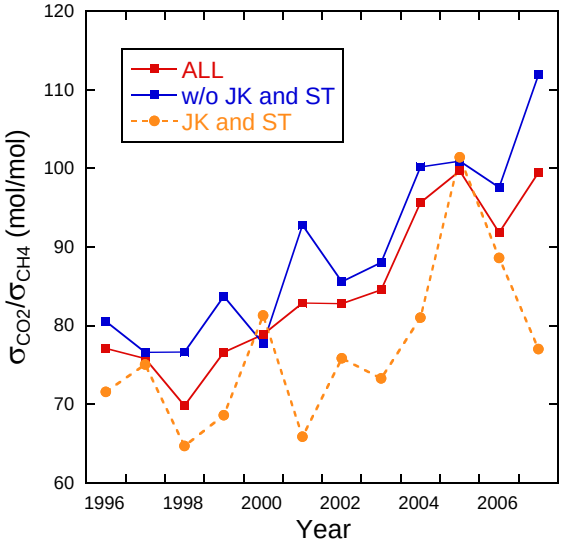

Fig. 1. Temporal changes in the sigma_CO2/sigma_CH4 ratio for all observation data (closed red squares), selected data without JK and ST origins (closed blue squares), and selected data only including JK and

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