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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of the variation in inflow to East Asia on surface ozone over Japan during 1996–2005" *by* S. Chatani and K. Sudo

Anonymous Referee #2

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Using a regional chemical transport model (WRF-Chem) driven with chemical boundary conditions (BC) from a global model (CHASER), this study intends to explore the inter-annual variability in pollution inflow to East Asia and subsequent impacts on surface ozone trends in Japan. Quantifying global and regional transport is extremely important to further our understanding on the variability and long-term changes of baseline ozone at northern mid-latitudes. The present study is valuable in this context, however, the applied methods and experiment set-up are NOT valid to address the variability of pollution "inflow" to East Asia and its contribution to long-term trends in surface ozone in Japan, as described below in my major comments.

Major comments:

1) The authors use the difference between two sets of regional WRF-Chem simulations

with inter-annual varying BC and fixed BC for the year 2000 from the global CHASER model, to estimate the variability in pollution inflow to East Asia. Since Asian emissions are included in the global model simulations, the variability in ozone BCs can be affected by the export of Asian pollutants. These Asian-influenced pollutants at the regional domain boundaries can also be recirculated into East Asia when driving WRF-Chem with CHASER BCs. Therefore, the inter-annual variability in CHASER BCs can NOT be considered as "inflow" to East Asia. Results from this experiment set-up can NOT be used to draw any conclusions that the authors stated in the manuscript about the influence of inflow to East Asia on the variability or long-term trends of surface ozone in Japan. The variability can be simply caused by the amount of ozone produced in East Asia and its recirculation at the regional model domain boundaries.

2) The simulated ozone are biased high as much as 30 ppbv (Figs.4-6). Nevertheless, the authors are talking about less than 4 ppbv of inter-annual variability in Figs.7-11. Wouldn't the variability in the model be simply driven by the variability of model biases? Is there a positive relationship between the model biases and the inter-annual variability of ozone? A scatter plot may help to address this issue.

3) The ozone anomaly shown in Figures 7 and 8 are very scattered, and looks more like inter-annual variability to me instead of a robust trend. The p value and the range of slopes in the 95% confidence limit should be calculated to explore if the trends are statistically significant. The model also fails to capture much of the variability in the fall and winter seasons.

Specific comments:

1) The abstract needs to be a concise and complete summary of the manuscript. Please describe briefly what models you are using and be quantitative about the model biases. The inadequate intrusion of low-ozone marine air masses and errors in monsoonal clouds/rainfall during the East Asia monsoon season are probably dominating factors causing the ozone overestimate in the model (Lin et al., 2009). The last few

sentences in the abstract do not stand (see the major comment 1).

2) P30826, L4-25: Some other studies employing a global to regional coupled model system to study ozone inflow to Asia also need be referenced and discussed here, e.g. Lin et al., Atmos. Chem. Phys., 10, 4221-4239, 2010

3) P30827, L20-25: Need to describe the model vertical resolution in the lowest 2 km and near tropopause, which can partly contribute to the model overestimate.

4) P30829, L1-5: Please clarify temporal resolution of BCs? Daily? Monthly mean?

5) P30829, 1.045 monitoring stations –> 1045 monitoring stations

6) P30828, L8-9, Why not include biomass burning emissions? Biomass burning emissions modulated by ENSO should be an important factor for driving the inter-annual variability of tropospheric ozone and other tracers.

7) Table 1: Gunther –> Guenther. Why not use MEGAN to calculate biogenic emissions? Some studies have suggested that the simple biogenic emission scheme (bio_emiss_opt = 1) in WRF-Chem tends to underestimate isoprene emissions.

8) Does CHACER have similar biases (up to 30 ppbv) at mid-latitudes sites in the other continents? If so, wouldn't the model overestimate the contribution of ozone produced in other continents to East Asian ozone?

9) Section 4-5 and associated figures: all discussions and conclusions about inflow need to be rephrased. The current experiment set-up in this study does not support the conclusions (see major comment 1)

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 30823, 2010.