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Interactive comment on "Effect of regional precursor emission controls on long-range ozone transport – Part 1: short-term changes in ozone air quality" *by* J. Jason West et al.

Anonymous Referee #2

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The paper presents an extremely thorough and comprehensive analysis of the impacts of small (10%) reductions in precursor emissions (the primary focus is NOx but CO and NMVOC are examined also) from each of 9 world regions on surface ozone in that specific region and all the other regions. The motivation is to understand the relative importance of long-range transport between all source-receptor pairs for direct short-term ozone changes, similar to the emphasis of the recent Task Force on Horizontal Transport of Air Pollution (HTAP) initiative (e.g. Fiore et al., 2009). The paper is in general very good and the results are useful in terms of understanding long range transport of pollution and identifying air pollution control strategies that have benefits for both air quality and climate. The study is an extension of HTAP since it considers many

more regions and it also uses a policy-relevant metric 'population-weighted' ozone. My major concern is that the results are based on only ONE YEAR of model output (using meteorological fields generated from a climate model). Therefore no measure of uncertainty or significance relative to climate model interannual variability has been provided.

Specific comments are outlined below:

1. The results are based on an emissions inventory for the early 1990s, about 15-20 years ago. Emissions of ozone precursors in the present day are likely to be different, especially in the United States and Europe where control policies have been implemented, and East Asia where there has been recent intense economic development. This issue is mentioned on Page 7039 and loosely in the conclusion section but it needs to be qualified with how it will affect the major conclusions of the study.

2. A major weakness in the study is that all the results are based on only one year of model simulation using meteorological fields from the MACCM3 Community Climate Model. Anything can happen in a particular year in the climate model! It could have been a particularly dry, wet, cold, hot etc. year. The ozone simulation is very susceptible to meteorology. The maximum changes in the polluted regions (for NOx reductions within that region) are about 1ppbv. Interannual climate variability could be larger than this signal for some regions. The smaller inter-region differences at the pptv level could even be a different sign year to year. Further model years are needed to be run and averaged to yield viable results that can be used by the scientific and policy communities. Typically, chemistry-climate models are run for 10 years to remove the influence of interannual variability in the climate model. Measures of uncertainty / standard deviation need to be included in Tables 2-9.

3. The model seems to over-predict surface ozone with large discrepancies in the U.S. No evaluation is provided for 7 of the 9 regions. The model-observation discrepancies are orders of magnitude larger than the changes imposed via the NOx perturbations

applied within the regions. How useful are the results for developing regulatory controls when the current ozone simulation does not match observations convincingly?

4. Are aerosols and more importantly gas-aerosol interactions (full coupling) included in the model simulations? These effects could impact the results significantly, for example, in the case of nitrate aerosol formation.

5. Figure 5 is difficult to see clearly and the y-axes all have different scales, which makes it difficult to compare the panels.

6. NOx (and CO and NMVOC) emissions reductions applied are homogeneous spatially within a region and across all source types. In reality, emissions controls would address specific source types (e.g power plants or motor vehicles etc.) that operate in distinctly different regions. How does the assumption of homogenous emissions perturbations affect the results?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 7033, 2009.