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Interactive comment on "Differentiating local and regional sources of Chinese urban air pollution based on effect of Spring Festival" *by* Chuan Wang et al.

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General comments: The paper presents an assessment of the effect of the Chinese Spring Festival on urban air quality in a southern China city. Various trace gases and aerosols were measured over three consecutive winters (2014-2016), including both the Spring Festival (SF) and non-Spring Festival (non-SF) periods, at an urban site of Shenzhen city. By comparing the concentrations of these pollutants in different periods, the authors show that the decreases for some pollutants are significant (by 50%-80%) in the SF with respect to the non-SF while the decreases of others pollutants are smaller. They suggest that such differences in the reduction extent of pollutant

concentrations be used to judge their sources, i.e., predominantly from local emissions or from regional transport. This study, together with a valuable dataset, should be a welcome addition to the literatures on the holiday effects on air quality. The manuscript can be accepted for publication after the following issues have been well addressed.

As the main purpose of the study is to distinguish the sources of urban pollution between the local emissions and regional transport, the local and regional pollution sources should have been clearly defined. It would be great if the authors could provide a map showing the geographical distributions of emissions rates of major air pollutants in Shenzhen city and its surrounding areas during wintertime. It is also suggested that if possible, the geographical extent of pollution reduction during the SF in relative to the non-SF period be identified, perhaps by using population density or satellite product.

The study identifies the primary source of each pollutant, i.e. the local or regional origin, using the reduction extent of a pollutant (in relative percent) from the non-SF to SF period. This methodology is fine for primary pollutants (such as NOx and BC), and it may also work for some secondary pollutants (perhaps SO42-); but it might not entirely applicable to O3 since ozone production changes non-linearly with an increase (or a decrease) of NOx. A stronger evidence is needed before a conclusion on the origin of ozone is given in the manuscript.

REPLY: As to the definition of the local and regional pollution sources, please see our reply to your specific comment #14. In the revised manuscript, we have tried to define them as below: "Apparently, the dominant sources for most of these pollutants are primarily local emissions in the urban scale, such as combustion sources for BC, m/z 57, and NOx. . ."; "The species in this group are either typical regional air pollutants mostly from beyond the urban scale, such as CO, which has a long lifetime. . ."

As to a map showing the geographical distributions of emissions rates of major air pollutants and the geographical extent of pollution reduction during the SF, they need a lot of supporting data sources, which are not easily available, and such work could be

much beyond the scope of this paper. Alternatively, we have cited a paper of emission inventory in PRD (Zheng et al., 2009b) in section 2.1 to describe the relative location of the sampling site in terms of pollutant emissions in PRD, as below: “A highly resolved temporal and spatial emission inventory for PRD indicates that the sampling area is characterized by lower SO2 emissions but higher NOx and VOCs emissions in comparison with other areas in PRD (Zheng et al., 2009b).”

As to the conclusion on the origin of ozone, we agree on your specific comment #12 that based on limited VOCs measurements, it is not reasonable to get the conclusions that whether the O3 formation is NOx-sensitive or VOCs-sensitive. Therefore, in the revised manuscript, we only state as below: “As a result, although the reduction in emissions of urban anthropogenic sources leads to a significant decline of NOx and VOCs, this reduction does not mitigate the average ambient O3 concentration, which implies that the concentration ratio VOC/NOx plays an important role in controlling O3 concentration.”

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