

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

Anonymous Referee #3

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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

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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 NO_x and BC), and it may also work for some secondary pollutants (perhaps SO₄); but it might not entirely applicable to O₃ since ozone production changes non-linearly with an increase (or a decrease) of NO_x. A stronger evidence is needed before a conclusion on the origin of ozone is given in the manuscript.

Specific comments:

Line 12 and Line 49-53: During the SF, the power plants are generally not shutdown in the megacities of China. Are there any power plants in Shenzhen? Where the industrial area of Shenzhen located in reference to the measurement site? Are the wind roses of various pollutants in the SF different from those in the non-SF period?

Line 19-21: Here it might not be suitable to say “decreasing of regional pollutants” since there is an increase of O₃ by 6%.

Line 47: It might not be fully suitable to say so. The reported emission reductions could be verified by comparisons of different approaches, e.g., ground measurements, satellite observations, and model simulations with different emission inventories.

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Line 77-79: Figure S1 provides only geographical position of measurement site. How far away from the main traffic roads the site is? How about regional distributions of pollutants' emissions?

Line 135: Figures S3-S5 provide more detailed information and can be moved into the formal part of the manuscript.

L174: CO is NOT a typical SECONDARY regional air pollutant as most of CO in the urban and polluted areas are mostly probably to be primarily emitted.

L183-184, L252-253, L261-267, L309-312 and L337-340: According to the study, isoprene and DMS measured in Shenzhen have anthropogenic sources. But they are repeatedly described as "natural" gases; on the other hand, sometimes they are classified as "pollutants". These vague expressions should be corrected.

Line 191-192: It should be noted that there is an increase of O₃ to a small extent.

L195-202: Are there any power plants in Shenzhen and nearby areas? A plot of the regional emission distributions of SO₂ would be helpful for the reader to follow the discussion here. It would also be great if the wind rose or trajectory analysis result could be given.

L212-215 and L300-301: The sentence "meteorology has only a small impact on their concentrations" is misleading. Note that only for the period average values are the results consistent.

L231, Figure 2: Ticks for 10 nm and 1000 nm could be given.

L288-289: In-depth analysis should be performed if you insist that the lack of NO_x at noon during the SF period hinders the generation of O₃. Figure 3B shows that the levels of NO_x in the SF and NSF_M at noon are comparable. It seems that the difference in VOCs might play an important role.

L300: What do the wind fields look like? It might be more appropriate to say the wind

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field patterns are the same.

L368-370: The concept of regional air pollutants is unclear. How are they defined? Even for NO_x, it can also result in regional pollution.

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