Reviewer #2:

Comments:

The authors investigated the key trends and drivers of China's anthropogenic emissions for the period of 2010–2017 for the first time. They used a bottom-up emission inventory to quantify emissions for each source sector in each Chinese province, and then combined the estimated emissions data with the Index Decomposition Analysis approach to analyze the drivers of emission trends. The results suggest that China reduced its anthropogenic emissions by a large extent between 2010 and 2017, and emission control measures are the main drivers of this reduction, especially since 2013 when China's Clean Air Action was successfully implemented. The trends in China's emissions are evaluated with both satellite- and ground-based measurement of SO_2 and NO_2 concentrations, which confirm the certainty of the estimated emissions trends. This work is absolutely within the scope of the ACP journal. Overall, I think the paper reads well, provides valuable results, and could be published after the following issues are addressed.

Response:

We thank the reviewer #2 for the comments and our point-by-point response is given below.

1. The article makes heavy use of data sets that appear to be confidential or have restricted access, such as the technology penetration data achieved from China's Ministry of Environmental Protection (line 13, page 5). It would be helpful to other researchers if the authors describe these data a bit more clearly, such as which data are used, how these data sources are compiled, and the role these data play in the calculation of emissions in this paper.

Response:

We obtained the firm-level statistics for electric generators, cement factories, iron- and steel-making furnaces, and glass kilns from China's Ministration of Environmental Protection (MEP). These data are collected from each plant by local agencies, and then managed and verified by MEP. The information adopted in this study include pollution control technologies, penetrations, and efficiencies for different industries in each province, which are used to calibrate emission control levels (i.e., C and η in Eq. (1)) in the bottom-up inventory. We clarify this in Sect. 3.1.

2. The emissions trends estimated in this paper are built upon a variety of input data, including official statistics, government reports (not peer reviewed if I understand it correctly), and peer reviewed literatures. I understand the effort made by the authors that update emission inventories to the latest year using a mix of data sources. However, the audience may want to know the certainty of these data and how they affect the certainty of the estimated emissions trends, even if in qualitative terms would be very helpful. For example, care must be taken to confirm that targeted goals/progress from government reports may not be taken as actual emission reductions, although I believe China's emissions are decreasing fast in the last several years after reading this paper.

Response:

We add a discussion on the uncertainties of emission trend estimates in qualitative terms as the reviewer suggested. Please refer to Sect. 4.3 for more details.

3. According to the emissions results, China's emissions decreased fast since 2013 mainly due to China's Clean Air Action. I suggest the authors add a bit more description of China's Clean Air Action in the introduction part. Besides, since reducing ambient $PM_{2.5}$ pollution is the primary objective that stimulate emission control actions, the discussions on $PM_{2.5}$ concentration trends and the possible linkage to the estimated emission trends may be added in the Sect. 4.3.

Response:

We add the following sentences in the introduction part to describe China's Clean Air Action.

"The Clean Air Action is China's first five year plan (2013–2017) that radically tightened air pollution targets for particulate matter pollution reduction. The three metropolitan regions mentioned above were required to reduce $PM_{2.5}$ concentrations by 15–25% by the year 2017 compared with the 2013 levels, and all other provinces in China were required to reduce PM_{10} concentrations by 10%. The Clean Air Action launched stringent measures to achieve these air quality targets, including the adjustment of energy mix and industrial structure, reduction of air pollutant emissions, establishment of monitoring and early-warning systems for air pollution, and other supportive policies. With the successful policy implementation, China met the 2017 air pollution target set under 2013 Clean Air Action, and the annual average $PM_{2.5}$ concentrations were reduced by 28–40% from 2013–2017 in the three metropolitan regions (China, 2018)."

We add a general discussion on $PM_{2.5}$ concentration trends and the relation to the estimated emissions in the first paragraph of Sect. 4.3.

4. The authors should be more specific to what they refer in the main text. For example, in line 13 page 3, "to fulfill the air quality target", not clear what the air quality target is. In line 2 page 4, what do the "emission-intensive industries" include? In line 24 page 10, what's the definition of "Eastern China"?

Response:

The air quality targets refer to those set under 2013 Clean Air Action, which are described in detail in the introduction part now. We change the sentence to "To fulfill the air quality target set under 2013 Clean Air Action".

The emission-intensive industries mainly include iron and steel making, cement, brick, coke, glass, and chemical industries. We clarify this in the main text.

The Eastern China discussed in this paper includes the provinces of Beijing, Tianjin, Hebei, Shanxi, Shaanxi, Shandong, Henan, Hubei, Anhui, Jiangsu, Shanghai, and Zhejiang. The definition of Eastern China is given in the caption of Fig. 8.