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Interactive comment on "Variations of China's emission estimates response to uncertainties in energy statistics" *by* Chaopeng Hong et al.

Anonymous Referee #2

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I have read the paper "Variations of China's emission estimates response to uncertainties in energy statistics" by Hong et al. This is a well structured study that addresses an important issue. The paper will be a solid addition to the literature. The paper should have a bit more background material along with some additional methodological details, as discussed below.

The sectoral resolution of the different datasets should be briefly discussed. First, is the sectoral resolution similar across all the datasets? I assume these data all distinguish between key sectors that have quite different emission factors - if so this should be stated? (e.g. iron and steel, vs boilers in industry; agricultural machinery vs road vehicles, etc.). If the sectoral resolution of the different datasets is not the same, then how this was treated in the data processing needs to be discussed (at least for sectors that are a signifiant portion of total emissions of one of the targeted species).

More details on the processing of the energy data are needed. All the text says now is "five emission inventories based on different sets of energy statistics (i.e., CT-CESY-Ori, CT-CESY-1C, CT-CESY-2C, CT-CESY-3C and PBP-CESY) were established.". In general, energy data sets do not contain all the information needed for an inventory, so additional assumptions (such as technology splits over time and technology retirements) would likely need to be made. Some assumptions likely had to be applied at some point, and these need to be described. Basically, the process of going from the energy datasets to the data needed in MEIC needs to be described. Then how this methodology might impact the results should be discussed. (If there are differences in the sectoral resolution of the different datasets, this could be an additional source of uncertainty, for example.)

Also, where fuel consumption differs between the datasets, how was this mapped to the technology detail in the inventory? For example, were the same emission factors applied for fuel consumption in a given sector in each year (even though different fuel consumption data would imply different rates of new purchases and/or retirements). Greater growth in coal consumption in one dataset as compared to another would tend to imply a greater amount of new equipment, which could have different emission factors as compared to older equipment. Note also that these assumptions would likely add additional uncertainty.

My understanding is the MEIC has province level detail. Were these calculations performed with province-specific emission factors, or national average emission factors. If the former, how were differences in national data allocated to provinces?

It would be useful to see a bit of a discussion of how these apparent uncertainties might extend back further in time. One point in particular, it should be noted that the narrowing of the uncertainty toward 1995 is due, in part, due to fewer different datasets. Can it be presumed that the methodologies for data collection did not evolve as much during this earlier period as compared to the latter statistical surveys (in which methodologies apparently became more consistent between provincial and national statistics)?

For this reason, I like the author's choice of terminology of "apparent uncertainty", but this possible bias in the results – e.g., actual uncertainty earlier in the series shown is likely be underestimated due to lack of multiple datasets – should be more explicitly discussed in the paper.

It would be useful if the authors could discuss a bit more possible reasons why the provincial and national statistics agree during earlier time periods. Was this because both of these statistics contained similar biases? Or were there some potential sources of bias that increased over this time period. The authors have substantial experience with these datasets and their insights (although likely no firm answers!) into these issues, and a more complete discussion would greatly strength and add to the value of this paper.

SPECIFIC COMMENTS In Table 1" is described as "The energy statistics for China used in this work." and IEA data are included in this table. However, the text states that "The IEA energy statistics were excluded from the emission calculations because they are based on NBS's national Energy Balance Sheets". Please clarify (I believe it is useful to have IEA data in Table 1, since it gives context for this widely used dataset, but perhaps add a footnote that these data are not used in the current work, or re-title the table.)

Page 6, line 31 "contributions (approximately 70%) from industrial process emissions". It would be useful to clarify by adding (I assume this is the case) "contributions (approximately 70%) from industrial process emissions. Note that non-combustion emission uncertainty was not addressed in this study."

This brings up an additional point. Were all fuel consumption differences assumed to be applied to combustion sectors? Or was some portion of these differences assumed to be feedstocks? This should be clarified in the paper.

Page 7, line 7 "The contributions of gas and other fuels are negligible because their emissions are relatively small." This is not necessarily true for biomass (which often

contributes substantially to CO emissions in particular). I assume that uncertainty in biomass consumption was not included in this study? If uncertainty in biomass consumption was not considered this would be useful to state here (and also needs to be mentioned earlier in the methodology section).

Page 8, line 23 "Third, although there is no ample evidence of such activity" ample is not quite the correct word to use here (is ambiguous). Depending on what the authors mean, a clearer words should be used.

Page 11, line 11 "Top-down estimates of the CO2-to-NOx emission ratios". Give the reader a short definition of how top-down differs from bottom up. Presumably this is observationally based?

Page 11, line 14. "The MEIC inventory reports a larger CO2 trend in China (10.4% yr-1) " it looks like this is not larger, it is well within the uncertainty of the top-down estimate.

page 11, conclusion section Re-define "apparent uncertainty" here so that the conclusion is more easily understood on its own.

Figure 5 is a bit difficult to interpret due to the many different parings of inventories. The authors might want to experiment to see if a consistent set of differences (e.g. showing the difference between each dataset vs one dataset that spans all years (if available) would communicate the points they wish to make, so that there is a consistent reference over the entire period). This might be more straightforward for the readers to interpret.

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