

**Review of:** Evaluating the effects of China's pollution controls on inter-annual trends and uncertainties of atmospheric mercury emissions.

**Athors:** Zhao et al.

### **Overall**

This study is of great value to the scientific field of mercury emissions inventories. It uses a detailed, novel approach, to better constrain the anthropogenic emissions of mercury from China; one of the largest emitters of mercury from a global perspective. Hence, an improved emissions inventory is therefore very important. The work is very thorough and covers the most important industrial sectors. The focus on uncertainties, temporal and spatial variability (due to pollution controls) makes the updated inventory more reliable and applicable. However, there are a few areas that require some additional attention from the authors to make this work ready for publication. These are detailed below.

### **Questions and Comments**

In section 2.3 "Uncertainty analysis", line 208—210, it is described that "Generally, normal distributions, are assumed..." However, some industrial sectors do not have normally distributed data; and it is wondered if the data is not normal, how is the data then treated? Please describe in the text.

Section 3.1 "Other industrial sources": why is the data for this sector assumed to be "log normally distributed", whereas other sectors are normally distributed? The authors may want to explain this in the ms.

Section 3.1 "Non-ferrous metal smelting": why are the 10<sup>th</sup> and 90<sup>th</sup> percentiles used? The authors do not provide a rational. Thus, one can ask "why not use 2-standard deviations instead?" The authors may want to explain this in the ms.

Section 3.2, line 447 states that the **increasing** Hg emissions from China (679t in 2005, to 750t in 2012, with a peak of 771t in 2011) can help explain the observed **decrease** in atmospheric Hg concentrations worldwide. This is of course an incorrect conclusion because both are 180 degrees counter each other. China's mercury emissions only changed relative to energy usage, not in absolute terms; the emissions grew less than China's economic growth, but increased nonetheless. Hence, the authors' results do not support the observed global trend, quite the contrary. The reviewer suggests the authors delete this section to avoid confusion. A discussion of this discrepancy is outside the scope of this paper.

## **Recommended edits.**

### **Abstract.**

Line 20: change “have been” to “are”; otherwise it appears the emissions will not be further constrained in the future.

Line 21: start sentence with “In this study, improved methods,…”

Line 33: define Hg<sup>0</sup>, Hg<sup>2+</sup> and Hg<sup>p</sup>

Line 35: delete “, but middle to... inter-annual emission trends”. This is a recommendation and not a result of your study.

Line 38: change “expected in the most optimistic scenarios” to “expected at the most.”, because these scenarios are not defined in the abstract.

Line 42: delete the word “swiftly” (subjective word)

## **Introduction**

Line 52: change to "...and control the emissions of mercury (Hg)..."

Line 68: change to "...to emissions, and instead apply global..."

Line 72: change to "...and limit carbon emissions), ..."

Line 76: change "ones" to "units"

Line 86: delete "by capturing some Hg in fly ash and gypsum byproducts" (it is not necessary to explain how these controls work).

Line 107-115: delete "Section 2 briefly... summarizes the study.". In the reviewers opinion it is not necessary to describe the contents of the paper (in such detail). The paper can do very well without this entire section. In addition, given that the ms is already long, omitting this section will improve readability.

### **Chapter 3. Evolution of emission factors, section 3.1**

Line 252: change “that” with “through”, and delete “have”

Line 276: Delete “As the foremost.... Chine since 2005”. Start paragraph instead with “Deployment of advanced... has increased since 2005”. Also delete the word “swiftly”.

Line 337: Suggest changing “Based on these..” to “Due to these...”

Line 366: delete “sharply” (objective language)

Line 367: change to “...other than precalciners are expected to be closed by 2020 in the S1 and S2 scenarios, and by 2030 in S0.”

Line 379: change to “... et al. 2004), and are lower than those of...”

Line 396: change to “In this work, biomass combustion takes into account crop residues...”

Line 398: change to “...are adopted from Huang et al., 2011; Zhang et al., 2013.”

### **Chapter 3. Evolution of emission factors, section 3.2**

Line 411: Change to the first sentence simple to “The speciation of Hg plays a crucial role in its atmospheric fate and transport, and chemical cycling.”

Line 415: delete “thus” (no conclusion is drawn)

Line 427: delete “tentatively” (The reviewer wonders if –by using this word- it is applied, not applied, or applied a little?... however, either it is applied or it is not. Hence, it is better to delete the word)

#### **Chapter 4 Results and Discussion. Section 4.1**

Line 447: Delete “The result reflects... Hg concentrations worldwide.” (Please see the Questions and comments section above for reasoning).

Line 470: Delete “unsurprisingly” (subjective language)

Line 514-516: Reviewer wonders if it is maybe better to apply these abbreviations for the first time in each respective section of chapter 3!?

#### **Chapter 4 Results and Discussion. Section 4.2**

Line 493-494: Change first sentence of section 4.2 simple to “China’s anthropogenic Hg emissions have not increased as rapidly compared to the country’s economic growth. “ Namely, the original first sentence is not true, since actual (absolute) mercury emissions have increased and did not slow since 2005 (See previous comments). In addition, the original sentence is not objective.

Line 496: delete the word “thus” (not a conclusion)

Line 499: change “biggest” to “largest”

Line 502: change “divide” to “divided”.

Line 543: change “confirms” to “shows”, and delete the word “greatly” (subjective language)

#### **Chapter 4 Results and Discussion. Section 4.3**

Line 522: delete the word “main”

Line 553: change the word “dramatic” to “large” (subjective language)

Line 554: delete the word “concerned” (redundant)

Line 555: change sentence to “...in different inventories across studies.”

Line 557-559: delete the sentence “The comparison thus...and energy use”. (Subjective language and redundant)

Line 569: change sentence to “our higher estimate is supported by limited...” (More neutral)

Line 579, 581, 583, 595, etc.: the phrase “in this study” has been used 38 times (!) throughout the manuscript. Obviously making it repetitive. The reviewer suggests careful rewording of at least half of those sentences in order to delete that particular phrase and making the ms less repetitive.

Line 621: add the word “while” between “...applied ignoring...”

Line 633: delete the word “plainly” (subjective language)

#### **Chapter 4 Results and Discussion. Section 4.4**

Line 658: The reviewer thinks the abbreviations BIO and SWI etc should better and already be defined in the appropriate paragraphs under section 3.1 instead of here.

Line 660: change “It is nevertheless...” to “However, ...”

Line 661: delete the word “that”. The word “greater” implies “greater than something”, but instead the reviewer believes the authors mean “better”. Please change to “better” if so.

Line 662-663: change sentence to “Those sources include CCP for Hg<sub>0</sub>, NMS and gold mining for Hg<sub>0</sub> and Hg<sub>2+</sub>, and...”, since these 3 abbreviations have already been defined prior in the ms.

Line 665: change “most significant” to “important” (no statistical tests were used, hence the word significant is inappropriate in the current context)

Line 668: change “...increasingly dominates the sector...” to “...usage increases...”

#### **Chapter 4 Results and Discussion. Section 4.5**

Line 709: delete the word “far”

Line 712-714: delete the entire sentence “These policies will.... numerous economic sectors”. (Discussing policy outcomes and implications is outside the scope of this ms)

Line 714: delete the word “clearly” (subjective language)

Line 715: change the word “simply” to “only” (subjective language)

Line 727: change “...the sector...”, to “...that sector...”.

**Chapter 5 Conclusions.**

Line 734: delete "...are judged to..."

**Acknowledgement.**

Line 763: change first sentence to "...of Chine (41205110), and by the Natural Science Foundation..."

## **Tables and Figures**

### **Table 2**

Please explain what “triangular” and “Weibull” data distributions are, as most likely many readers will not have knowledge of these type of data types (reviewer included)

### **Table 4**

Please check if the 2012 emissions for RES are rounded 79 or 80, since Table 3 gives “79.5”, but it could be due to the 2<sup>nd</sup> decimal; e.g.  $79.49 = 79.5$ , but  $79.49 = 79$

### **Figure 5.**

The y-axis has to start at 0, not at 0.8. All other data-figures have the y-axis start at 0, so must figure 5.