

We sincerely thank you for the valuable feedback that we have used to improve the quality of our manuscript. According to the comments from you and another reviewer, we re-estimated daily provincial CO<sub>2</sub> emissions use more proxies: 1) For power sector, we added yearly provincial thermal power generation data to existing monthly provincial thermal power generation; 2) for industry sector, we re-collected monthly provincial productions of 35 industrial products to replace the previous monthly cement productions (Table 1); 3) for ground transport sector, except for existing yearly vehicles ownership, we added 3 monthly proxies, one seasonal proxy, and additional 7 yearly proxies. In addition, we added the comparison with the other two additional dependent China provincial carbon emissions datasets except for existing CEADs. Moreover, we re-estimate our uncertainties. I think these improvements could address your concern about using only cement production to estimate emissions from industry sector. Below you will find out point-by-point responses to the reviewers' comments/questions.

*Q1: Line 49: Need to expand and provide citations for EDGAR, CDIAC and CEADs here in the introduction.*

**Response:** Thanks for your comments. The reference of EDGAR (Crippa et al., 2019), CDIAC (Boden et al., 2016), and CEADs (Shan et al., 2018) are as follows:

Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., Vignati, E., Fossil CO<sub>2</sub> and GHG emissions of all world countries - 2019 Report, EUR 29849 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-11100-9, doi:10.2760/687800, JRC117610.

Boden, T.A., G. Marland, and R.J. Andres. 2016. Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001\_V2016

Shan Y, Guan D, Zheng H, et al. China CO<sub>2</sub> emission accounts 1997–2015[J]. Scientific Data, 2018, 5:170201.

*Q2: What is China ' s mitigation target, by what date and according to what baseline year?*

**Response:** In 2015 China committed to improving the carbon intensity by 40% - 45% relative to 2005 levels by 2020, and the peak of total emission by 2030 (Government, 2015). In 2020, China's government announced the ahead achievement of the carbon intensity target by decreasing 48.1% in 2019 relative to 2005 levels, and the share of renewables achieved 15.3% in the energy mix (Office, 2020). In September 2020, Chinese President Xi Jinping announced China's new climate target to peak its CO<sub>2</sub> emissions before 2030 and to achieve carbon neutrality before 2060 (Jinping, 2020).

Government, T.C. (2015) Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions.

Office, C.s.S.C.I. (2020) Energy in China's New Era.

Jinping, X. (2020) Statement by H.E. Xi Jinping President of the People's Republic of China At the General Debate of the 75th Session of The United Nations General Assembly.

*Q3: Line 76: Do the authors mean “by acknowledging the uncertainties more than just the total emissions” ?*

**Response:** Thanks for your comments. We replaced the “inventory” in the last manuscript with total emissions.

*Q4: Line 152: by “totally” do the authors mean “combined”? If so changing to combined would be clearer.*

**Response:** Thanks for your comments. We replaced the “totally” in the last manuscript with “combined”.

*Q5: Line 170: remove “were”*

**Response:** Thanks for your comments. But we re-write this sector, the “were” has been removed. The re-write sector is as follows:

For the industry sector, we collected monthly provincial production of 35 industrial products related to emissions sectors to construct the provincial weight factor of industrial CO<sub>2</sub> emissions. By reviewing the subsectors of the industrial sector at the national level of China as presented in the EDGAR2019 and CEADs dataset, we found that the emission in manufacturing sector accounts for almost 90% of the manufacturing industries and construction sector (Table 3). We have also had the industrial sector in China subdivided into 10 subsectors in accordance with the EDGAR classification standard and also collected the provincial monthly data of 35 types of products relevant to emission (Table. 3). Only 9 industrial subsectors are covered, considering that the 35 types of products are irrelevant to the subsector of wood and wood products. According to the results of EDGAR (2019), the emission of the subsector of wood and wood products only accounts for 0.11% of the total emission of the handicraft industry. Therefore, it is believed that the 35 types of industrial products cover nearly 90% of the industrial emission nevertheless, and can reflect the overall situation of industrial emission. The provincial daily emissions of the industrial sector in China were estimated on the basis of those data and the following equation:

$$E_{pl} = \sum_m (E_{NI} \times R_m \times (\sum_n \frac{p_{p,n}}{p_{t,n}}) * 1/n)$$

where  $E_{pl}$  is the provincial emission of industrial sector;  $E_{NI}$  is the national emission of industrial sector;  $m$  is the subsector of the industrial sector, where  $m=9$ ;  $R_m$  corresponds to the contribution rate of the subsector of the industrial sector to the total emission of handicraft industry;  $n$  is the number of the relevant product in the subsector;  $P_{p,n}$  represents the provincial production of the product; and  $P_{t,n}$  represents the total production of the product. It is reckoned that the estimation made in this method can cover nearly 90% of the nationwide emission.

*Q6: Line 217: Should refer to Figure 1 regarding the “valley shape” which needs a few months to illustrate the shape. Table 1 lists the minimum and maximum only.*

**Response:** Thanks for your comments. For more clear representation, we used Table 1 lists the average monthly emissions at the provincial level.

*Q7: For most readers who will have a limited knowledge of Chinese provinces, the lists of province abbreviations is tedious to read and not useful, even with the Table 1 legend. I acknowledge that perhaps this comment is unwarranted and just my own bias, since I would not feel the same if it were my own country’s sub-national regions or those of the US, which are more commonly known. My suggestion is to just state the number of provinces in the text, rather than provide long lists, since the tables and figures give that detail anyway. A compromise to improve readability may be to just state the number and list them in parentheses. I will leave this to the authors and editor to decide on what is best.*

**Response:** Thanks for your comments. We added the number column in Table 1, and in provincial figures, we used numbers instead of letters in figure titles (like new Figure 1). The provinces in all provincial figures use the same numerical order. Therefore, we could use numbers to represent the long name of provinces.

*Q8: It should be stated that “1 ton = 1000 kg”. In some usage, like in the US, “ton” is 2000 pounds, while “tonne” or “metric ton” is 1000 kg.*

**Response:** Thanks for your comments. We replaced tonne with “metric tons”, please see Figure 1.

*Q9: Line 386: “which fell during the COVID-19 pandemic” should be replaced with “which fell during a period of national restrictions due to the COVID-19 pandemic”, since the pandemic is still going on.*

**Response:** Thanks for your comments. We replaced “which fell during the COVID-19 pandemic” with “which fell during a period of national restrictions due to the COVID-19 pandemic”.

*Q10: Figure 1-6. Clearer and larger x-axis labels would be an improvement.*

**Response:** Thanks for your comments. We have improved larger x-axis like new Figure 1.

*Q11: Figures 1-11. Listing the provincial abbreviations in the figure captions is not helpful and they should be removed.*

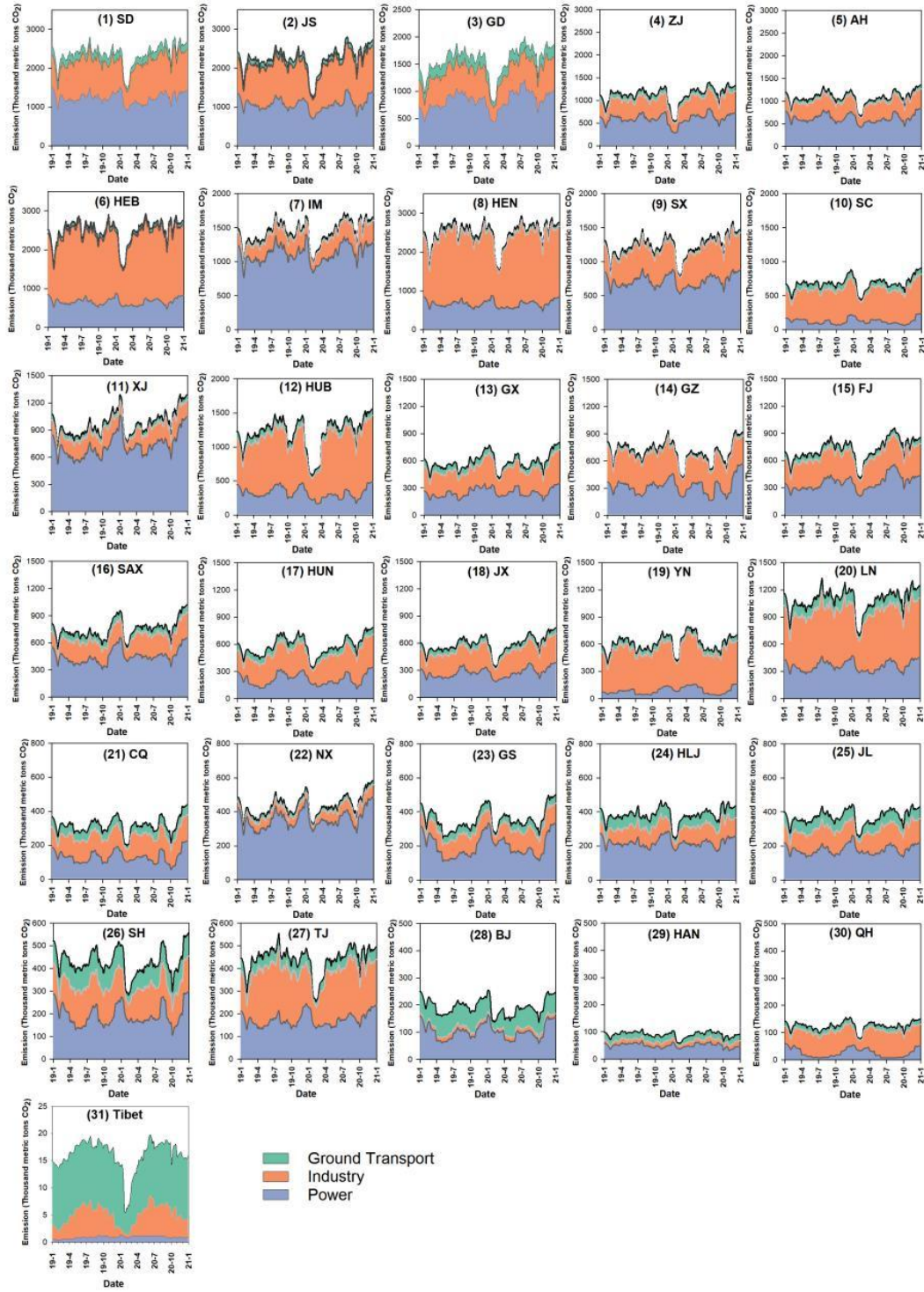
**Response:** Thanks for your comments. We deleted all provincial abbreviations in the figure captions.

*Q12: Figure 5 says southern China, but it is actually all 31 provinces.*

**Response:** Thanks for your comments. We deleted “southern” in the Figure 5 captions

*Q13: Table 3 and 4. It might be helpful to note that the sum of each column or month is 100%.*

**Response:** Thanks for your comments. We added 100% under the month title in each column.



**Figure 1.** Total daily CO<sub>2</sub> emissions from the Chinese mainland's 31 provinces from 2019 to 2020. Total emissions cover 3 sectors: electricity (green), industry (orange) and ground transport (blue).