

## **Reply to RC1: 'Comment on essd-2021-62', Anonymous Referee #1, 15 Jun 2021**

Qiaofeng Xue et al.

---

Author comment on "The dataset of walled cities and urban extent in late imperial China in the 15th–19th centuries" by Qiaofeng Xue et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-62-AC1>, 2021

---

### **Dear anonymous referee (RC1):**

Thank you for the insightful and professional comments concerning our preprint entitled "An urban extent dataset in late imperial China in 15th–19th centuries" (essd-2021-62). Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches.

We have studied comments carefully and have made correction. Below we repeat the comments of RC1 and explain how we have addressed them in the revised manuscript.

- **a) The Authors write that 'most cities in late imperial China built city walls, and these walls were usually built around the urban built-up area (Yannis et al., 2017).' The paper cited here, by Yannis et al., 2017, goes much further starting with (maybe too strong – I think you can clarify that, as the specialists) quote of Osvald Sirén (1924), that 'There is no real city in Northern China without a surrounding wall, a condition which, indeed, is expressed by the fact that the Chinese use the same word ch'eng for a city and a city-wall: for there is no such thing as a city without a wall. It is just as inconceivable as a house without a roof.'**

**I think better clarification and support of the thesis on city walls' importance in China is needed in your paper. You state that city walls in China are the only reliable data on the urbanization processes (e.g. due to lack of other data, as stated in the paper). But it needs to be clarified because the role of city walls in China differed in the past when compared to the role of the city walls in other parts of the world at the time. Otherwise, one can assume that the dataset presented here has limited value for the scientific community.**

**Response:** Thank you for your comments. Whether city walls in China were the reliable data on the urbanization process is one of the key issues of our study. We think your opinions are critical. Our discussion on this issue is not adequate and the references are not appropriate. We will enrich the discussion of this issue in the revised manuscript and add more appropriate references. Here we give a brief explanation of our supplementary points. In fact, imperial Chinese cities were not always walled. For example, during the Mongolian-ruled Yuan Dynasty (13-14<sup>th</sup> centuries), the city walls were deliberately torn

down. In addition, during the 3<sup>rd</sup> to 10<sup>th</sup> centuries, many regional capital cities in China only built small city walls called *Zicheng* (*Zi* means small and *Cheng* means city wall). The *Zi-cheng* was built around government and military barracks, similar to castles in medieval Europe. Residential areas, markets, schools and religious buildings were all outside the *Zi-cheng*. Only in the Ming and the Qing Dynasties (14-19<sup>th</sup> centuries), cities generally built large-scale city walls to protect governments, temples, granaries, residences, and certain natural resources against invasion, tribal uprising, and peasant rebellion. According to many previous studies (Chang, 1970; Kostof, 1992; Knapp, 2000; Lu, 2011), the walls of this period were usually slightly larger than the built-up area of the city, and as the suburban areas grew, new and larger city walls were often built. Thus, the city wall in the Ming and Qing periods could be seen as the urban fixation line, reflecting the size of the city. On the other hand, the Ming period and the first century of the Qing witnessed the extensive construction of city walls. As we state in lines 260-261 of the preprint, 80% of cities had walls in the 15<sup>th</sup> century, and 95% of cities in the 16<sup>th</sup> century had city walls. Based on the above brief review of the history of Chinese city walls, we believe that during the Ming and Qing Dynasties, the city wall could be regarded as a reliable data for the process of urbanization.

Supplementary References:

Chang, S., Some observations on the morphology of Chinese walled cities, *Ann. Assoc. Am. Geogr.*, 60: 63-91, 1970.

Knapp, R., *China's walled cities*, Oxford University Press, Oxford, 2000.

Kostof, S., *The city assembled: the elements of urban form through history*, Thames & Hudson Ltd, London, 1992.

Lu, X., *Inside and outside the city wall: urban form and spatial structure in ancient Han River basin*, Zhonghua Press, Beijing, 2011. (in Chinese).

- **b) The Authors cite the works by Skinner, but do not refer broadly to the fact that Skinner produced his own database of more than 150 attributes for all cities including information on the city walls. Although in Chinese scientific literature there has been a discussion with Skinner approach (Cao 2001), I think it would be good to discuss it briefly here and refer to the main differences between the datasets, so that it is clear for the readers what is new and why it was changed, regarding previous works.**

**Response:** Thank you for your comments. We will enrich the discussion of this subject in the revised manuscript. William Skinner used population as the key indicator to measure the urbanization of China in the 19<sup>th</sup> century (Skinner, 1977, page 220~221). However, since China did not have reliable urban population data until 1953, Skinner had to work backward in time, extrapolating better, more recent data to somewhat earlier dates, and building up a consistent time series culminating with the fairly hard data for 1953. He chose 1893 as the representative year, and created a comprehensive file of over 2,500 data cards designed to cover every city and town. Based on this database of more than 150 attributes (mainly including administrative level, circumference of city wall, postal status, population estimates, trade statistics and steamship or rail traffic), cities were classified. Then, he defined the urban population class intervals that the upper boundary of each class is twice the lower boundary, the following series was used: 1,000, 2,000, 4,000, 8,000, 16,000, 32,000, and so on. And finally, Skinner estimated the urbanization process of China in the 19<sup>th</sup> century. The statistical data collected by Skinner have nothing to do with urban spatial morphology. In addition, it is acceptable to use data of the 1950s to study urbanization in the 19<sup>th</sup> century; but for longer-term research, the credibility and operability of this approach will be greatly reduced.

- c) Please clarify if the city walls extent was understood as administrative boundaries or where there some exceptions?

**Response:** Thank you for your comments. During the Ming and Qing periods, in capital cities such as Beijing, Nanjing and Shenyang, the public security and civil affairs were managed by some special government agencies, and the city walls could be regarded as administrative boundaries. The walls of the Eight Banner cities of Manchu in the Qing Dynasty could also be regarded as administrative boundaries. But in most cases, the walls of ordinary cities generally have no administrative significance, but were only functional buildings.

- **d) In the title you have the 15th-19th centuries, although many cities from the 14th century can be also found in the database. Could you clarify that?**

**Response:** Thank you for your comments. The title refers to the China Urban Extent Dataset (CUED), which contains data from only six representative years (i.e., 1400, 1537, 1648, 1708, 1878, and 1866), so it is the 15<sup>th</sup> -19<sup>th</sup> centuries. The 14<sup>th</sup> century cities you found are in the China City Wall Areas Dataset (CCWAD). Since CCWAD includes cities from the Ming and Qing periods, and the Ming Dynasty was founded in 1368, there are many 14<sup>th</sup> century cities in the CCWAD.

#### **Comments regarding datasets:**

- **a) Paragraph 6 on the data accuracy is very general and mostly based on the 'accuracy ranking', but in my opinion, it is not fully clear how did you rank the accuracy in detail? Much more information (incl. examples) is needed here since this is now the only uncertainty attribute in your dataset. Please explain the ranking rules, so that the readers have no doubts about how it was exactly done.**

**Response:** Thank you for your comments. As you pointed out, the 'accuracy ranking' is an uncertainty attribute in our dataset. The accuracy ranking is based on the reliability of restoration. It is divided into three accuracy levels, A, B, and C, and two special case marks, D and BW. These mainly depend on the richness of the city's historical documents and the integrity of the ground remains. But to be honest, these are basically subjective decisions of the authors, and it is difficult to find objective criteria. Thus, in this case, the accuracy ranking A indicates that the authors are quite certain about the restoration, the B indicates that part of the restoration is speculative, and the C means that the restoration is based entirely on supposition. Accuracy rankings for all data are determined by discussion among all authors. In addition, the D indicates that the city has never been walled, so its urban extent is entirely speculative. The estimates were based on the combination of the administrative level of the city and the size of the nearby cities. The BW expresses the speculation on the urban extent before the city built its original city wall.

In summary, the accuracy rankings A and B are more credible, accounting for 90% of the data of CUED, and 69% of CCWAD. The C and D together account for 5% of CUED and 17% of CCWAD. Limited by objective conditions, the extent of some cities may be difficult to restore, but it may not be appropriate to exclude these cities directly. Therefore, we designed the accuracy rankings so that users with different needs can decide how to use these speculative data. We will improve the discussion in Section 6 of the revised manuscript.

- **b) Also, there is not much on the geometric accuracy of your data (I assume this is because it was done on recent detailed remote sensing data), but there might happened that some cities from the database were completely**

**destroyed and are not detectable on the current remote sensing data – how was the extent of the walls assessed then? Are those cities present in the database or not?**

**Response:** Thank you for your comments. The situation you pointed out does exist. These cities' restoration was based entirely on speculation, and we marked them with 'C' in the 'accuracy ranking' attribute. The basis of the speculation is mainly the administrative level of the city and the size of the nearby cities. These are 269 of these data in CUED, accounting for 3%; and 140 in CCWAD, accounting for 4%.

- **c) The datasets' attributes are explained in the Data Records files, but there are discrepancies between the attributes presented there and in the shapefiles. E.g. in CEUD dataset, we can find the attribute 'TYPE' which is not explained in the Data Records file. Similarly, in CCWAD attributes we can find 'area', but Data Records do not clarify the unit it is presented in. Attribute 'References' should be fully explained – e.g. in the form of the full list of options which can be found there. Preferably the list of attributes should be explained both in the Data Descriptor (e.g. in the Data availability section or in the form of a respective table) and in the Data repository.**

**Response:** Thank you very much for your reminding. These are mistakes in our work. We will correct these problems in the revised dataset and add corresponding content in the Data Descriptor. The attribute 'References' were simplified when converting from excels to shapefiles. So we will develop a glossary of abbreviations of these References and add it as an Appendix in the revised manuscript.

- **d) It is not clear why in some cases there are differences among the databases and cities covered. For instance, in the CCWAD there is a city of Yijinai which is attributed by the end year 1372, while in CUED it is covered only for the representative year 1400, but as Weiyuan. None of the later periods cover it. Is it because it changed the name, the extent, and did not survive till the next, 1537 (or any later) representative years?**

**Response:** Thank you for your comments. Basically, yes. According to Guo and Jin (2007), the city Yijinai was built before the Ming period. The Ming army occupied the city in 1370 and abolished the administrative agencies of the city in 1372. Around 1384, a garrison was set up in this city, and its name was changed to Weiyuan. And around 1403, the garrison was abolished and the city was abandoned. So in CUED, there was this city in 1400, but it didn't exist in 1537 or any later.

See also: Guo, H., Jin, R.: General history of administrative regions in China (the volume of Ming Dynasty), Fudan University Press, Shanghai, 2007, page 87, 393~399, and 410~411.

- **e) The above-mentioned example shows an important issue of the database – in the Data Records CCWAD file you write: 'Due to the ancient Chinese cities often have several names at the same time and they are always change, here we provide the most common name for them.' -it is not clear what 'most common' mean. I would recommend reconsidering that issue – would it be possible to either present all the names as the attributes (I suppose you have it for representative years) or use e.g. clear rule like, the last name, the name which was used for the longest period. You can also explain better 'most common', as now it is not fully clear.**

**Response:** Thank you for your comments. The names of ancient Chinese cities were always changing, and some cities had several names at the same time. However, city

names are not the focus of this research, and the China Historical Geographic System (CHGIS) developed by Harvard University and Fudan University has provided an excellent database of city names. So we simplified the issue of city names when making our database. However, as you pointed out, 'most common' is really not an appropriate naming rule. So we decided to unify the city names as the longest used names in the Ming and Qing period. We will revise the city names in the revised datasets according to this rule.

- **f) The Authors write that: 'In addition, we also need some remote sensing images for auxiliary work. The 1970s China remote sensing image from the U.S. Geological Survey (USGS) website (<https://earthexplorer.usgs.gov/>) was the most important'. It is not explained in the text or in Figure 3b (or I. 200), which sensors exactly were used here? We assume it was not Landsat, so please state clearly which images were used and add respective details. This is important because actually, remote sensing data are the main source of the extent of the walls in your work.**

**Response:** Thank you for your comments. We used CORONA photographs here. CORONA is the satellite deployed by the United States in 1958, and it took remote sensing images covering the world from 1960 to 1972. Now the CORONA photographs have been decrypted and can be downloaded from the USGS website. We will add relevant content in the revised manuscript.

- **g) Is there a possibility to verify somehow, e.g. for selected cities, if your extent is assessed correctly, e.g. by comparing the area to the reliable statistical records from the respective period?**

**Response:** Thank you for your comments. We are sorry that we could not find a proper verification method. We made the accuracy ranking to make up for the lack of verification.

#### **Other comments:**

- **a) 40-42 – how this work can help in Chinese sustainable urbanisation currently? It is somehow unclear (similarly the reference to sustainable development goals in the Abstract).**

**Response:** Thank you for your comments. We mainly consider that the cores of current Chinese cities are mostly developed on the basis of ancient times. These old city areas, dating back to the late imperial period, form the core of today's Chinese cities. These areas are generally located in the center of cities, and most of them are still densely populated and flourishing businesses. And the old cities concentrate a large number of cultural heritages and landscape. So the preservation and renewal of old cities is a hot issue in urban development in China. Our database provides basic data on the evolution of the old cities during the Ming and Qing dynasties, and may be helpful to researchers who are interested in the sustainable development of old cities. Of course, that's not the subject of our study, and we don't mind deleting these expressions.

- **b) 125-126 – the same title appears twice – was it a different publication or edition? Please clarify.**

**Response:** Thank you very much for your reminding. I think it's a clerical error. It should be 'the *Book Integration of Ancient and Modern Times and Unified Records of the Qing Dynasty*'. And 118-120 should be 'the *Book Integration of Ancient and Modern Times* (edited in 1701-1728), *Unified Records of the Qing Dynasty* (edited in 1842)'. We will correct them in the revised manuscript.

- **c) There are some minor English spelling and grammar issues (e.g. line 100 – ‘lat’ instead of ‘late’) and repetitions (line 110-114 – word ‘region’ is repeated 5 times).**

**Response:** Thank you very much for your reminding. We will correct them in the revised manuscript.

- **d) Style should also be corrected – e.g. lines 240-241, l. 251 – ‘It should to analysis the time series...’, l. 339-340**

**Response:** Thank you very much for your reminding. We will correct it in the revised manuscript.

- **e) The Authors use the names of the regions as Region I, II, etc – did you consider replacing it with proper geonames?**

**Response:** Thank you for your comments. We consider replacing Region I to V with Northeast China, Inner Mongolia, traditional agricultural area, Xinjiang, and Qinghai-Tibet Plateau. We will label them in Figure 1 in the revised manuscript.

- **f) In the Conclusion the Authors explain a very interesting relation between city walls and war – could you elaborate it? It might be very important in terms of your dataset usage.**

**Response:** Thank you for your comments. Like most ancient civilizations, city walls in China were primarily defensive military structures. In peacetime, the city walls were useless and often hindered the expansion of cities. During these periods, suburbs grew outside the city gates, and the walls were often neglected or even vandalized. But during the war, the walls became necessary facilities to defend the cities. At this time, if the suburbs outside the city gates had grown large, new suburban walls were built to protect them. As can be seen from Figure 7b, the peak periods of city walls construction almost without exception corresponded to all the important wars in China in the 14<sup>th</sup> to 18<sup>th</sup> centuries: (1) from 1368 to the early 15<sup>th</sup> century, it corresponded to the wars that the Ming destroyed the Yuan Dynasty and civil war of the Ming Dynasty; (2) from the middle of the 15<sup>th</sup> century to the middle of the 16<sup>th</sup> century corresponded to the protracted wars between the Ming Dynasty and Mongols and Japanese pirates; (3) the first half of the 17<sup>th</sup> century corresponded to the late Ming peasant uprising and the wars with the Qing Dynasty; (4) and the first half of the 18<sup>th</sup> century corresponded to the wars in Xinjiang. It can be seen that the construction of city wall was closely related to the stimulation of war. The development of cities generally required peaceful social environment, but city walls were often built during wartime. To some extent, the city wall can be seen as a sign and confirmation of the urban development before wars. We will add relevant discussion in the Conclusion.

- **g) In point 3 (l. 379) of the Conclusions the Authors mention the cities without the walls – could you explain, how common the phenomena was? When and why it happened?**

**Response:** Thank you for your comments. We use D to represent the cities without walls in the accuracy ranking attribute in CUED and CCWAD. In CCWAD, there are 436 such kind of cities, accounting for 13%. In CUED, there are 83 such cities in the representative year 1400, 48 in representative year 1537, 43 in the representative year 1648, 31 in the representative year 1708, 37 in the representative year 1787, and 42 in the representative year 1866; and the proportions are between 2% and 5%. It can be seen that there were not many cities without the walls. Cities without the walls could be roughly divided into three categories. One was the less important cities located in the inland areas

with better security. The other was the cities established at the end of the 19<sup>th</sup> century. At that time, with the advancement of weapons, the defensive significance of city walls were greatly reduced. Third, cities established by Europeans. We will add relevant discussions in the Conclusion.