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Interactive comment

Interactive comment on "Novel index to comprehensively evaluate air cleanness: the "Clean aIr Index"" *by* Tomohiro O. Sato et al.

Anonymous Referee #1

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A. General comments:

In this manuscript, authors focused on their original index to evaluate air cleanness, named as CII. CII is defined as the difference from unity of the sum of relative cleanness of each pollutant (NO_2, SO_2, SPM and O_3) normalized by each standard. This study is positioned as a basic research of their novel index and a demonstration for indicating reasonability and utility of the index. Such an index may be useful for capturing and understanding simply the air cleanness. Thus, the reviewer believes that this work has an important implication and is significant enough to be published in this journal. However, the present manuscript leaves several points to be improved, clarified, modified, and/or reconstructed, in order for readers to understand descriptions and to recognize the significance of this study clearly. Especially, it is necessary to

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[Discussion paper]

indicate more information and explanations with some arguments and/or references, and to clarify the story of discussion.

B. Important specific comments:

B1) Overall: uncertain and unclear points The referee thinks that the story which authors want to explain may be as follows: (1) validation of the model calculation (WRF/CMAQ) by comparison with observation data (AEROS), (2) explanation and interpretation of the novel cleanness index, CII, estimated for all the municipalities in Japan from the results of WRF/CMAQ, and (3) demonstration of the utility of the index, top 100 clean air cities in Japan. Would you please confirm that the referee's understanding is correct? Such a self-doubt of the referee is due to ambiguity and uncertainness in this study's aim, position, and significance, as follows, especially: (a) What are the differences among the indices? What are advantages to CII? Why CII, not AQI, for example? (b) What is the aim and significance of the top 100 clean air cities in Japan? (c) Descriptions and explanations on the methods and results are unclear. The major data in this study are based on the model calculation, aren't they? However, such critical points are not clearly found in the manuscript.

B2) Shallow descriptions without arguments and/or references: Some descriptions are without any arguments and/or references. The referee feels that authors say these descriptions definitively, without explanations.

Eg. Line 65: . . . , because more than 90 - 95 % of Ox is composed of O3.

Eg. Line 136 (similar to Line 65)

Eg. Lines 176-: . . ., because polluted air was transported from East Asia and . . .

Eg. Lines 187-: (similar to Lines 176-)

Eg. Line 188-: typical lifetime of NO2

Eg. Line 251: There are many industrial areas in western Japan, . . .

For example, are these the results of model calculation, or cited from references?

B3) Table 6 and Lines 225-228 Descriptions are only qualitative on the top 100 cities. What is the scientific implication?

B4) Line 239: Would you please indicate authors' opinion why 'except for Osaka' ? What is the situations in Osaka?

C. Other comments and Technical corrections:

C1) Explanations on model and method are insufficient. Essential parts of the model descriptions are not enough, the referee feels. For example: What is CMAQ? What reactions are considered? How to consider, for example, emission, deposition, secondary formation, transportation and diffusion, for SPM, O3, NO2, and SO2?

C2) The referee thinks that readers want to compare CII with other indices. Thus, please add explanations on other indices. For example, what is AQI? If possible, as a demonstration, please calculate AQI and compare some data and figures based on CII with those based on AQI.

C3) Line 137: What is 'Fig.3(a)' ?

C4) Line 165 and others: '1.2 times', for example, is not proper because CII is defined as '1 − (ratio of pollution)' in Eq.(1). In addition, the 'times' description is also not proper because the CII can be less than zero when the pollution is severe. Meanwhile, for the 'ratio of pollution', the 'multiple' description (like '1.2 times') is proper, because such 'ratio of pollution' is proportional to the quantities of pollutants. However, for the difference from unity in Eq.(1), such 'multiple' description cannot be explained to be proportional to some values.

C5) Line 165: Please indicate the sources of data and information on the pollutions in Seoul and Beijing.

C6) Figure 4: Would you please add the histogram of CII determined from AEROS data

C3

and compare them with CII from CMAQ? Such additional comparisons can support the reasonability of CII from the model calculation.

C7) Overall: Would you please add the figures of CII determined from AEROS data (similar to Figs. 5, 6 and/or 7) and compare them with those from CMAQ? Such comparisons can support the advantages of CII from the model calculation. For example, 'figures acquired from AEROS data are insufficient but those from CMAQ are fine enough to discuss the spatial distributions and temporal variations of CIIs over Japan.'

C8) Overall: Geographical descriptions of Japan (eg. cities, prefectures, and islands) are insufficient. Readers unfamiliar with Japan cannot understand the information in this paper.

End of Comments.

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