

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

**Anonymous Referee #3**

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It is of great significance to develop the local and global air quality index for providing informative information to policy maker and citizen. The authors propose a simple index for qualifying air cleanness, “Clean air Index (CII)” and evaluate the air quality in Japan by using the CII. This work is challenging but the CII has critical problems for applying globally and locally. Additionally, the evaluation of CMAQ is too insufficient to analyze the air cleanness in Japan. This reviewer would recommend the publication of this manuscript after major revisions responding to following comments.

Major comments 1. The authors mentioned that “the purpose of the CII is to estimate the level of air cleanness that is not a health risk” (line 66). What is the “air cleanness” in this study? It should be explained the meaning of “air cleanness”. The authors referred the WHO (2015) when they selected the pollutants in the CII. However, WHO (2015)

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focused on the health effects of air pollution. As a result, the author’s idea/concept about “air cleanness” is ambiguous.

2. The authors mentioned that “The CII can be used globally and locally by optimizing the numerical criteria”. The author should explain how to set the value of numerical criteria when the CII is used globally. The air quality standards in each country are different due to the current status of air quality, health effects, socioeconomic and political aspects and other factors. Hence, the authors should propose the methodology for optimization of these differences.

3. As show in Table1, the averaging time of air quality standard for Ox (hourly) and other pollutants (SPM, SO<sub>2</sub> and NO<sub>2</sub>; daily average) are different. How do the authors harmonize these differences?

4. The authors analyzed air cleanness in whole Japan by using the simulated results of CMAQ. However, the model evaluation is limited in only six cities. The CMAQ should be evaluated in all stations including remote sites. In particular, the municipalities in Hokkaido and Okinawa which are selected as those with highest CII value in Chapter 4 should be included in the model evaluation.

5. The authors mentioned that “The model underestimates the amount of O<sub>3</sub> and overestimates that of NO<sub>2</sub> in case of large contribution of the reaction (R3), i.e., NO titration effect.” (lines 149-150). Is this correct? If the model can reproduce well the NO titration effect, there are less discrepancies between model and observation. In general, the regional chemical transport model such as CMAQ tends to be underestimate the NO titration in urban area because the model cannot reflect the effects of local emissions. Additionally, the CMAQ tends to overestimate the O<sub>3</sub> concentration in Tokyo (For example, see Akimoto et al., 2019) . (Ref.) Akimoto et al., Atmos. Chem. Phys., 19, 603–615, 2019 <https://doi.org/10.5194/acp-19-603-2019>

Minor comments 1. Line 67: “The amount of SPM was simply assumed as [SPM] = ([PM<sub>10</sub>] + [PM<sub>2.5</sub>])/2 in this study” should be moved to section 3.2 because this

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assumption may be applied in the conversion of PM10 and PM2.5 of CMAQ to SPM.

2. Lines 163-166: Is it appropriate to analyze the air quality in Seoul and Beijing by using the CII based on the Japanese's standards?

3. Lines 249-251: In "The (delta)CII value reflects the transport of air pollutants from around the municipality rather than the CII value", what is the meaning of negative value of (delta)CII?

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