

## Response to the Editor and the Reviewer 2

We thank the editor and reviewers for the constructive comments and suggestions which have helped us improve the manuscript. Our response is in **blue**, to differentiate from the comment, which is in black. Furthermore, we include any new text added in the manuscript in **red**, to facilitate this second revision.

### Editor comment:

Notification to the authors:

1. Regarding the figure 1: with the next revision, please add the copyright icon as follows: © Google Earth. 2. Please remove the placeholder text from page 2 of the manuscript. 3. Please ensure that the colour schemes used in your maps and charts allow readers with colour vision deficiencies to correctly interpret your findings. Please check your figures using the Coblis – Color Blindness Simulator (<https://www.color-blindness.com/coblis-color-blindness-simulator/>) and revise the colour schemes accordingly.

**Response:** We thank the editor for his/her comments. The following changes have been done:

1. The copyright icon © has been added to Figure 1. Now, the caption from Figure 1 is: a) Location and b) main topographic features of the study area. Base maps in Panel a were taken from © Google Earth. The locations of air pollution monitoring stations (Xarxa de Vigilància i Previsió de la Contaminació Atmosfèrica, XVPCA) along the S–N axis (Barcelona-Vic Plain-Pyrenean range) are shown in Panel a (right).
2. The placeholder “TEXT” from page 2 has been removed.
3. All figures in the manuscript and the supplement has been checked using the Cobis - Color Blindness Simulator.

### Reviewer comment:

"In their response to section, Section 5.1, lines 313-317, I find no mention in Sillman et al. 2003 of the values of the NOX:VOC ratios that they say are in there. If the authors can clarify where these numbers come from, that is to say why \*precisely\* the values of 4, 8 and 15 pertain, or give a reference in which these exact values are specified, I would be prepared to accept publication..."

**Response:** We thank the reviewer for this comment. The values of 4, 8 and 15 are not from Sillman et al. 2003, these values are from National Research Council (1991). In addition, in our study we follow other studies (e.g. Yang et al. 2021 and Ren et al. 2022) that establish a

relationship between surface VOC:NO<sub>x</sub> and O<sub>3</sub> concentrations, and, subsequently, derive the line separating the two different photochemical regimes by the local O<sub>3</sub> maximum. The local O<sub>3</sub> maximum occurs when VOC:NO<sub>x</sub>  $\approx$  8, coinciding with the ratio defined in National Research Council (1991). Now it is clarified on the text:

Section 5.1, lines 307-314: In this study, we establish a relationship between surface VOC:NO<sub>x</sub> and O<sub>3</sub> concentrations, and, subsequently, derive the line separating the two different photochemical regimes by the local O<sub>3</sub> maximum (see Figure S7 in the Supplement). The local O<sub>3</sub> maximum occurs when VOC:NO<sub>x</sub>  $\approx$  8, coinciding with the ratio defined in National Research Council (1991). In Figure 4-6, we indicate the NO<sub>x</sub>-limited regime with a dark solid line separating VOC:NO<sub>x</sub> >8, which is typical for locations located downwind of urban and suburban areas, and the VOC-limited regime (VOC:NO<sub>x</sub> <8) which is typical for highly polluted urban areas (National Research Council, 1991). We also indicate the transitional regime with two dotted lines (VOC:NO<sub>x</sub> >4/1 and VOC:NO<sub>x</sub> <15/1) showing where ozone becomes less sensitive to NO<sub>x</sub> changes and increases with increasing VOC levels, as identified in National Research Council (1991).

#### References:

National Research Council (NRC), 1991. Rethinking the Ozone Problem in Urban and Regional Air Pollution. Washington, DC: The National Academies Press. <https://doi.org/10.17226/1889>.