Aerosol and Air Quality Research

Supplemental Material

Big Data Analysis for Effects of the COVID-19 Outbreak on Ambient $PM_{2.5}$ in Areas That Were Not Locked Down

Tai-Yi Yu[1], How-Ran Chao[2,3,4,5]*, Ming-Hsien Tsai[6], Chih-Chung Lin[2], I-Cheng Lu[2], Wei-Hsiang Chang[7], Chih-Cheng Chen[8], Liang-Jen Wang [9],En-Tzu Lin[2], Ching-Tzu Chang[3], Chunneng Chen[10], Cheng-Chih Kao[11], Wan Nurdiyana Wan Mansor[12,13], Kwong-Leung J. Yu[11,14]

[1] *Department of Risk Management and Insurance, Ming Chuan University, Shilin District, Taipei City111, Taiwan*

[2] *Department of Environmental Science and Engineering, College of Engineering, National Pingtung University of Science and Technology, Pingtung County 912, Taiwan*

[3] *Institute of Food Safety Management, College of Agriculture, National Pingtung University of Science and Technology, Pingtung County 912, Taiwan*

[4] *Emerging Compounds Research Center, General Research Service Center, National Pingtung University of Science and Technology, Pingtung County 912, Taiwan*

[5] *School of Dentistry, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung City 80708, Taiwan*

[6] *Department of Child Care, College of Humanities and Social Sciences, National Pingtung University of Science and Technology, Pingtung County 912, Taiwan*

[7] *Department of Food Safety/Hygiene and Risk Management, National Cheng Kung University, Tainan 70101, Taiwan*

[8] *Section of Neonatology, Department of Pediatrics, Kaohsiung Chang-Gung Memorial Hospital and Chang Gung University College of Medicine, Kaohsiung 83347, Taiwan*

[9] *Department of Child and Adolescent Psychiatry, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University College of Medicine, Kaohsiung, Taiwan*

[10] *JS Environmental Technology and Energy Saving Co. Ltd., Kaohsiung City 806, Taiwan*

[11] Superintendent Office, Pingtung Christian Hospital, Pingtung 90053, Taiwan
[12] Faculty of Ocean Engineering Technology & Informatics, Universiti Malaysia Terengganu, 21300, Malaysia
[13]Air Quality and Environment Research Group, Universiti Malaysia Terengganu, 21300, K. Nerus, Malaysia

[14] Department of Anesthesiology, College of Medicine, Kaohsiung Medical University,

Kaohsiung City 80708, Taiwan

Corresponding author: Dr. How-Ran Chao

Department of Environmental Science and Engineering

National Pingtung University of Science and Technology

Address: No. 1, Hseuh Fu Road, Neipu, Pingtung County 91207, TAIWAN

E-mail: hrchao@mail.npust.edu.tw

Telephone number: +886-8-770-3202 ext 7514; Fax number: +886-8-7740256

Figure legends

Figure S1 Levels of $PM_{2.5}$ and their precursor, NO_2 and SO_2, in the Fugui Cape air pollution monitoring site (not air sensors) from October to March between 2018 and 2020 (Liang and Tsai, 2020)

Figure S2 The differences in levels of $PM_{2.5}$, NO_2, and SO_2 between October 2018-March 2019 and October 2019- March 2020 (2019-2020 minus 2018-2019) from air pollution monitoring sites in Taiwan (not air sensors) (Liang and Tsai, 2020)

Figure S3 Levels of $PM_{2.5}$, PM_{10}, NO_2, and SO_2 collected from the air pollution monitoring sites by TEPA between January and March in 2019 and 2020 from south and north Taiwan

We listed several data collected from the air pollution monitoring sites (not from air sensors) by TEPA. The results were shown as the below.

$PM_{2.5}$, NO_2, and SO_2 in Fugui Cape air monitoring station (from October to March)

Fugui Cape is located at the most northern tip of Taiwan. An air monitoring station in Fugui Cape is established by TEPA to investigate transboundary transportation of air pollutants from Mainland China especially for northeast monsoon. Compared with $PM_{2.5}$, NO_2, SO_2 in 2019-2020, these air pollutants are slightly lower magnitudes in 2018-2019 based on the previous Taiwanese study in Figure S1 (Liang and Tsai, 2020). The reduction of $PM_{2.5}$, NO_2, SO_2 from transboundary transportation during the COVID-19 situation was not obvious.

Nationwide investigation of $PM_{2.5}$, NO_2, and SO_2 in air monitoring stations (from October to March)

Figure S2 showed the differences of $PM_{2.5}$, NO_2, and SO_2 between 2018-2019 and 2019-2020. $PM_{2.5}$ was increased by 0.6 μg m^{-3} and NO_2, and SO_2 was decreased by 0.5 and 0.6 ppb, respectively, from October 2019 to March 2020 compared with those in the corresponding periods in 2018-2019 in north Taiwan (Figure S2). For south Taiwan, the reduction of $PM_{2.5}$ (-4.8 μg m^{-3}), NO_2 (-1.6 ppb), and SO_2 (-0.6 ppb) was obvious

in 2019-2020 compared with those in 2019-2020.

Levels of $PM_{2.5}$, PM_{10}, NO_2, and SO_2 in air pollution monitoring sites established by TEPA near our sampling areas from January to March between 2019 and 2020

Levels of $PM_{2.5}$, PM_{10}, NO_2, and SO_2 from TEPA's air pollution monitoring sites near our sampling areas from January to March between 2019 and 2020 were shown in Figure S3. Air pollutants of $PM_{2.5}$, PM_{10}, NO_2, and SO_2 in 2019 had the higher magnitudes than those did from north and south Taiwan in 2020, except for NO_2 in north Taiwan.

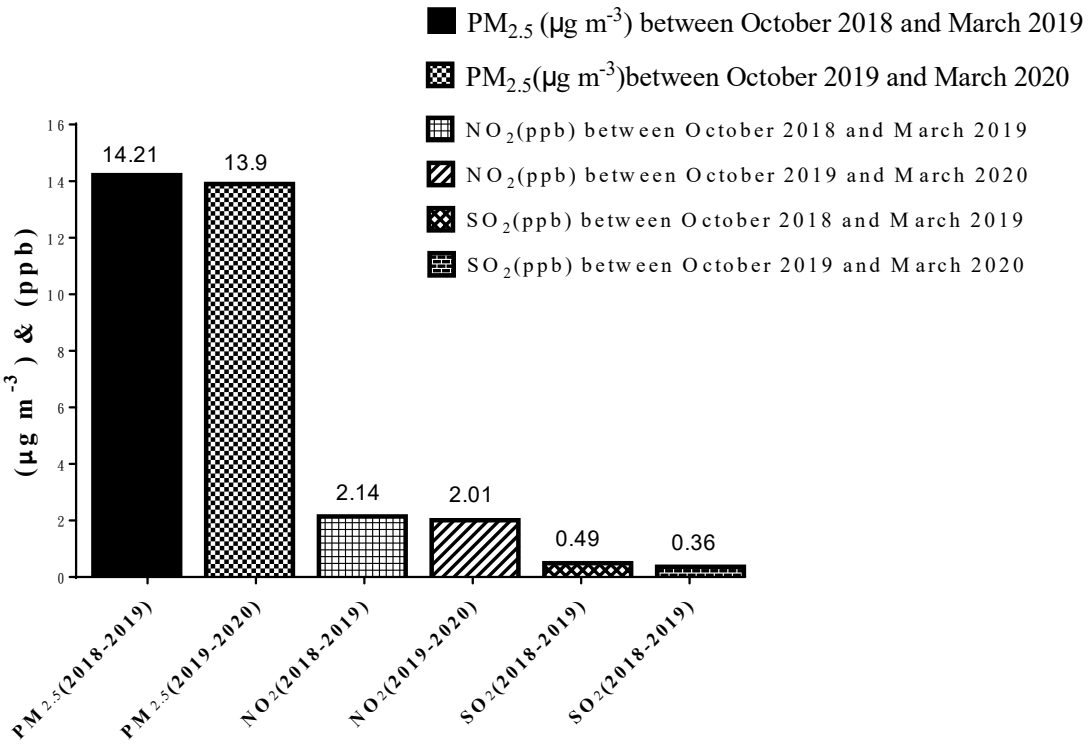

Figure S1 Levels of $PM_{2.5}$ and their precursor, NO_2 and SO_2, in the Fugui Cape air pollution monitoring site (not low-cost air sensor) from October to March between 2018 and 2020 (Liang and Tsai, 2020)

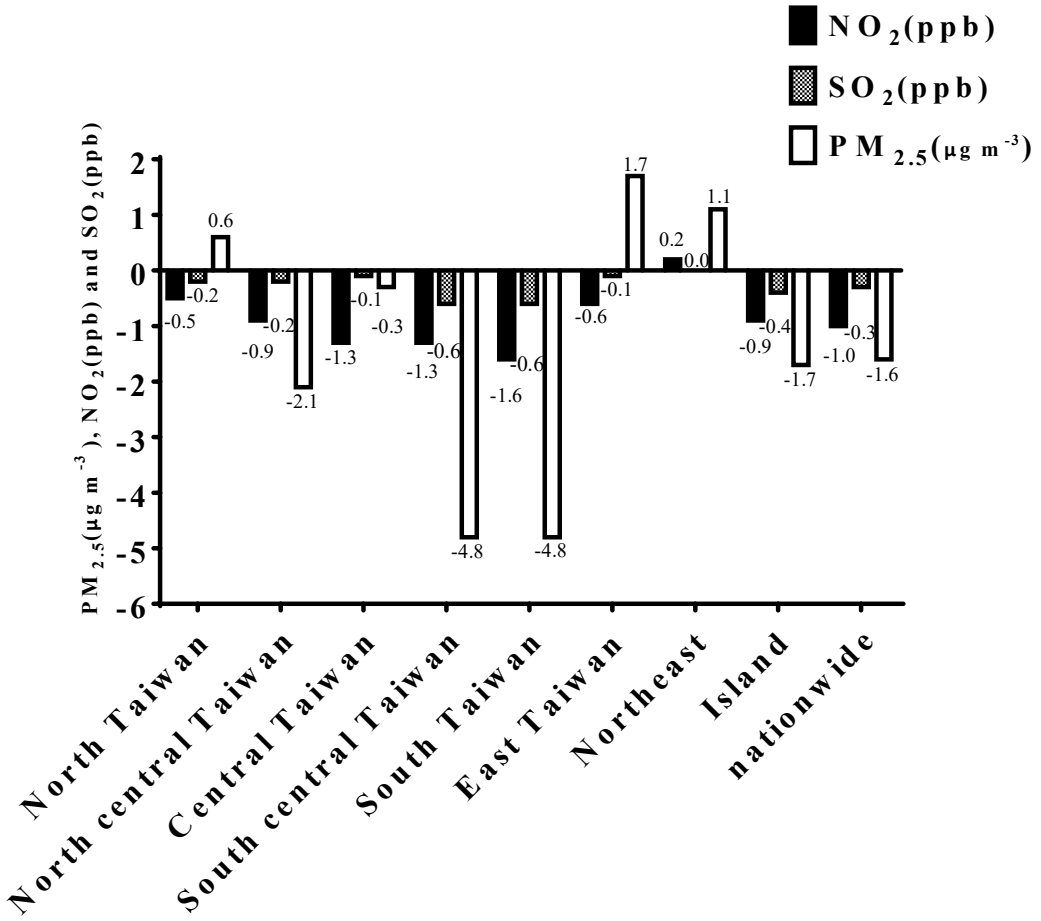

Figure S2 The differences in levels of $PM_{2.5}$, NO_2, and SO_2 between October 2018-March 2019 and October 2019- March 2020 (2019-2020 minus 2018-2019) from air pollution monitoring sites in Taiwan (not air sensors) (Liang and Tsai, 2020)

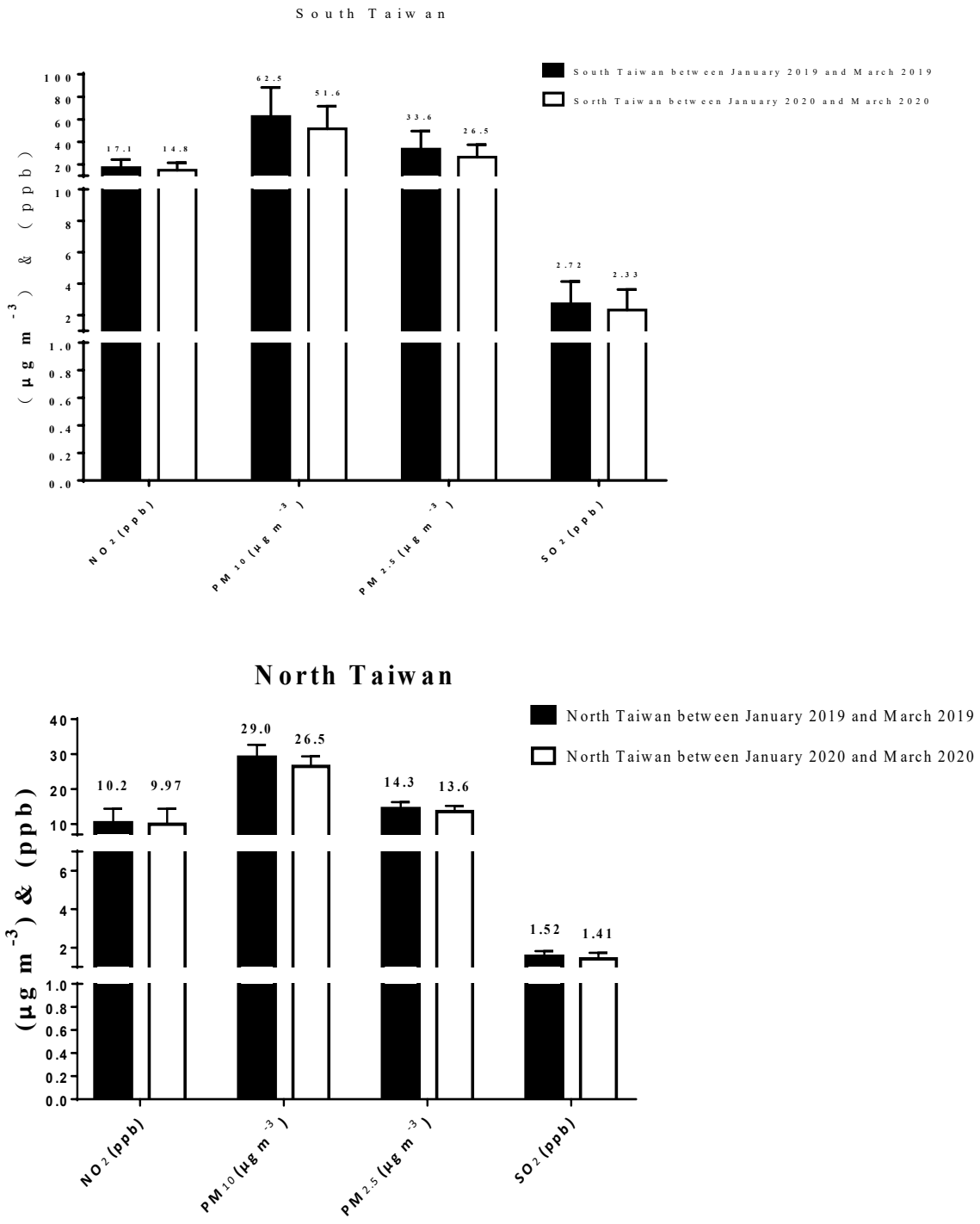

Figure S3 Levels of $PM_{2.5}$, PM_{10}, NO_2, and SO_2 collected from the air pollution monitoring sites by TEPA between January and March in 2019 and 2020 from south and north Taiwan