



Urban air quality in Mongolia: concentrations, sources and future needs of studies



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INTRODUCTION

Ulaanbaatar, the capital city of Mongolia:

- Situated in a dome valley located at a high altitude of ~1300 m above sea level
- The coldest capital and one of the most polluted city in the world
- 1.5 million people live (around 46% of the population of the country) ~60% live in *ger* areas, which constitutes ~80% of air pollution.

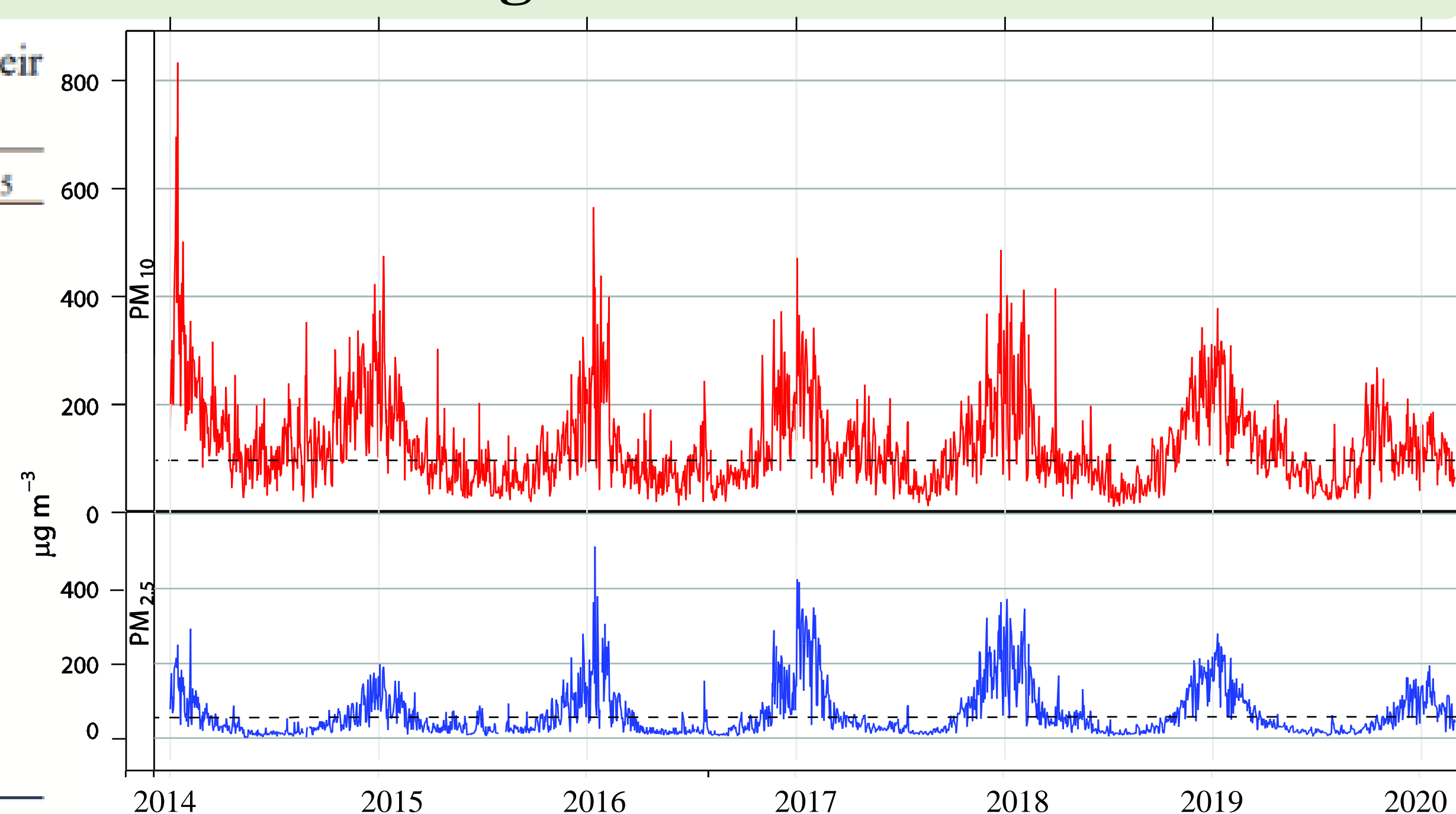


AIR QUALITY DATA

PM concentrations from 12 automated monitoring stations

Table 2. Air quality monitoring sites in Ulaanbaatar, their location classification, and monitor devices.

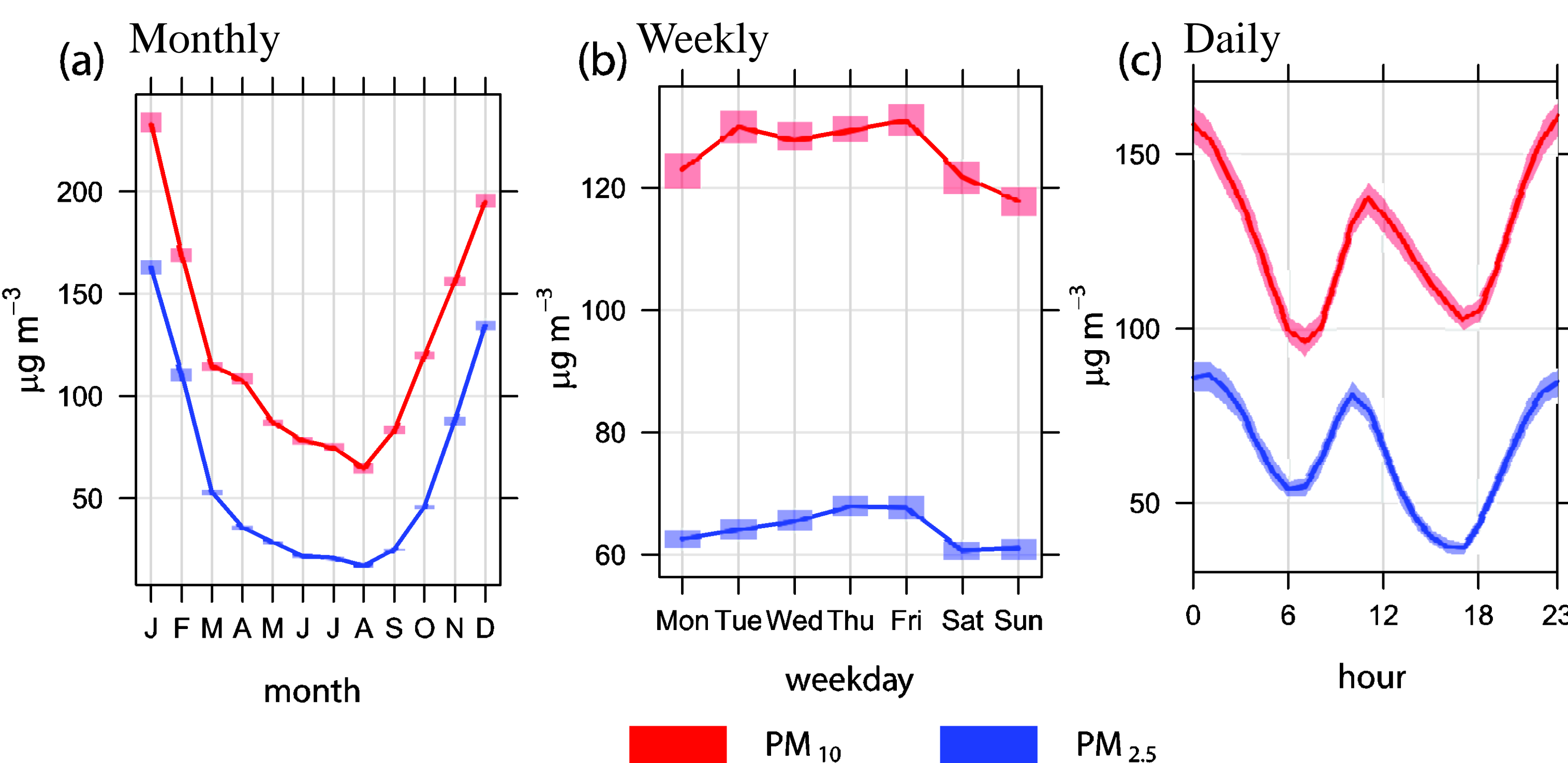
Site name, ID	Location	PM ₁₀	PM _{2.5}
Misheel, UB1	Industrial	+	–
Baruun 4 zam, UB2	Traffic	+	+
1-r horoolol, UB3	Ger area	+	+
Buhiin urguu, UB4	Residential	+	+
100 ail, UB5	Ger area	+	–
Mongol gazar, UB7	Industrial	+	–
Urgakh naran, UB8	Remote	+	–
Tolgoit, APRD1	Ger area	+	+
Zuragt, APRD2	Ger area	+	+
Amgalan, APRD3	Traffic	+	+
Nisekh, APRD4	Ger area	+	+
Bayankhoshuu, APRD6	Ger area	+	+



- Concentrations of air pollutants in Ulaanbaatar are notably high. For example, before 2019, the hourly maximum PM_{2.5} and PM₁₀ concentrations were recorded as 1413 µg m⁻³ (at Buhiin urguu site at 1 am 16 January 2018) and 2505 µg m⁻³ (at 1-r horoolol site at 3 am 6 February 2018), respectively.
- During the 2019–2020 winter, a clear decrease in both PM_{2.5} and PM₁₀ concentrations was observed.
- In recent years, since the tendency of air pollution problem in Ulaanbaatar worsens due to raw coal consumption, beginning 15 May 2019, the consumption of raw coal in Ulaanbaatar has been replaced by the consumption of briquette fuel.

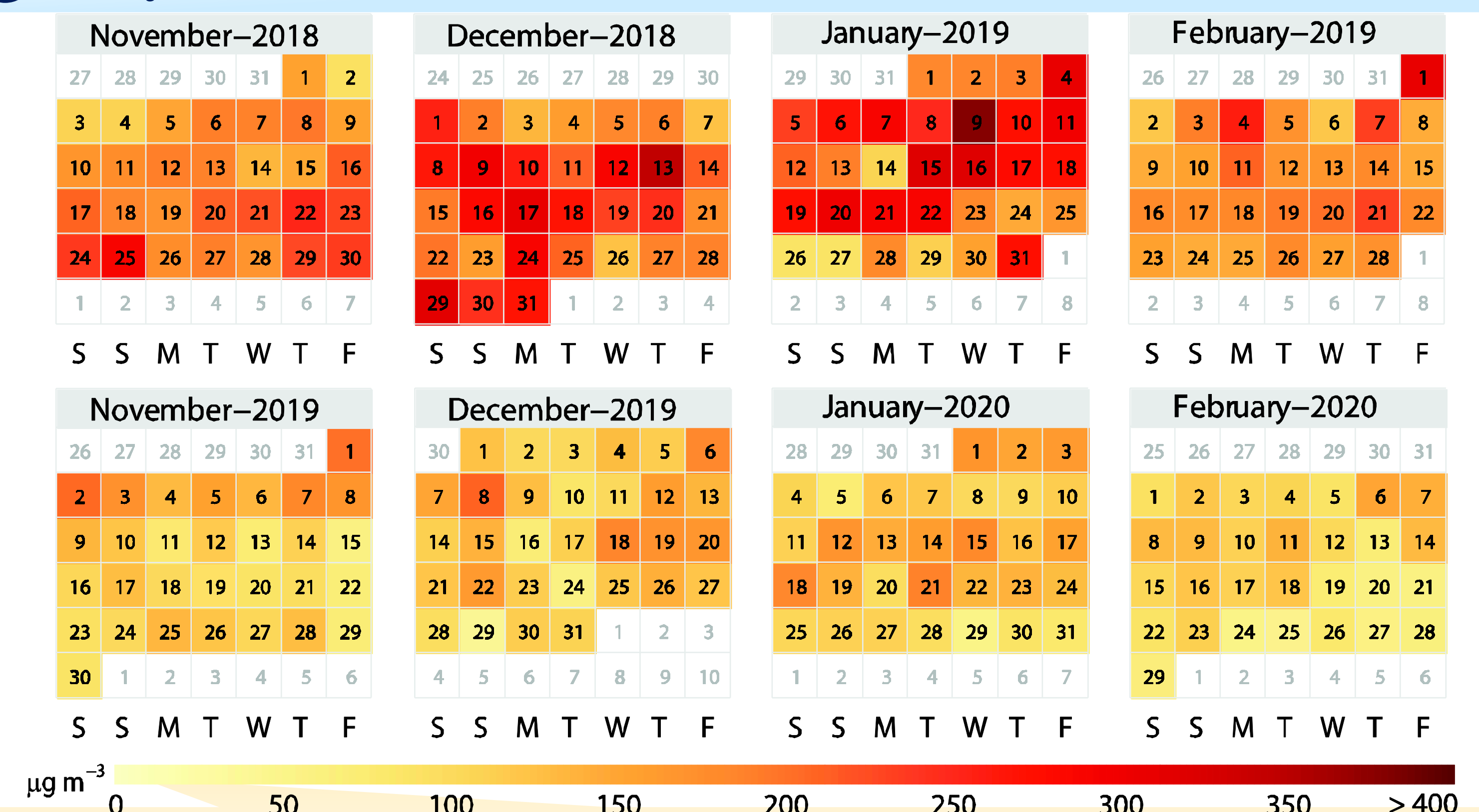
RESULTS and DISCUSSION

1 Variations in PM_{2.5} (blue) and PM₁₀ (red) concentrations



PM levels are far above the national standard daily maximum values reaching 834 µg m⁻³ (PM₁₀) and 511 µg m⁻³ (PM_{2.5}).

3 Daily mean concentrations of PM₁₀



Since transition to briquette fuel, the mean November–February PM_{2.5} and PM₁₀ concentrations were reduced by 37% and 40% compared to the mean November–February concentrations of the previous 5 years, respectively.

2 National standard levels vs. PM₁₀, PM_{2.5}, SO₂, and NO₂

Days with average concentrations exceeding the national air quality standard levels of air pollutants.

Concentration, (µg m ⁻³)	Nov 2016- Feb 2017	Nov 2017- Feb 2018	Nov 2018-Feb 2019	Nov 2019- Feb 2020	Nov 2020- Feb 2021
PM ₁₀ >100	103	99	112	73	64
PM _{2.5} >50	116	112	113	83	88
NO ₂ >50	42	63	65	79	51
SO ₂ >50	50	52	54	95	100

In heating season, the number of days exceeding the national standards decreased for PM₁₀, PM_{2.5}, and NO₂, but not for SO₂ because of introduction of briquette fuel (with high sulfur content) in *ger* areas in Ulaanbaatar since 2019 winter.

4 Present study and further needs

Despite the worse air pollution situation, the research gap in this area necessitates investigations in numerous fields, which could have great importance in developing mitigating strategies and minimizing the adverse impact of air pollution on local, regional, and larger scales.

Since high concentrations of air pollutants have been lasting decades in Ulaanbaatar, the effects of air pollution on ecosystem should be investigated further.

CONCLUSION

Based on past situations and current condition of urban air quality in Ulaanbaatar, the current study proposes several directions for further research.

- Pollution source apportionment and emission inventories will hopefully change in accordance with the replacement of raw coal by briquette fuel.
- The modified emission inventory can be used in future forecasting and modeling works.
- Additionally, high-resolution spatial variations in air pollution should be investigated.
- The effects of air pollution on ecosystem should be investigated further.

ACKNOWLEDGEMENT

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Reference:

Ganbat, G., Soyol-Erdene, T.O. and Jadamba, B. (2020). Recent Improvement in Particulate Matter (PM) Pollution in Ulaanbaatar, Mongolia. *Aerosol Air Qual. Res.* 20: 2280–2288. <https://doi.org/10.4209/aaqr.2020.04.0170>