

INTRODUCTION

The issue of air quality in Romanian cities is a topical one. Accidental pollution problems are reported daily in large cities. They occur against the background of a negative evolution of the background pollution of the urban atmosphere. In Suceava, major pollution problems due to PM10 were reported in the years 2008-2010. Then in Suceava the major water distribution network was replaced and the main streets were re-asphalted. This period with more accentuated pollution was studied by the relation of PM10 with the meteorological factors by Lazurca in 2015. The concentration of tropospheric ozone and its evolution over time was investigated for Suceava by Mihăilă et al. in 2018.

Otherwise, apart from the daily, monthly and annual reports on air quality prepared by the County Agency for Environmental Protection, air quality, synthetic and long-term studies are missing for this municipality. Our study comes to cover this deficiency.

STUDY AREA

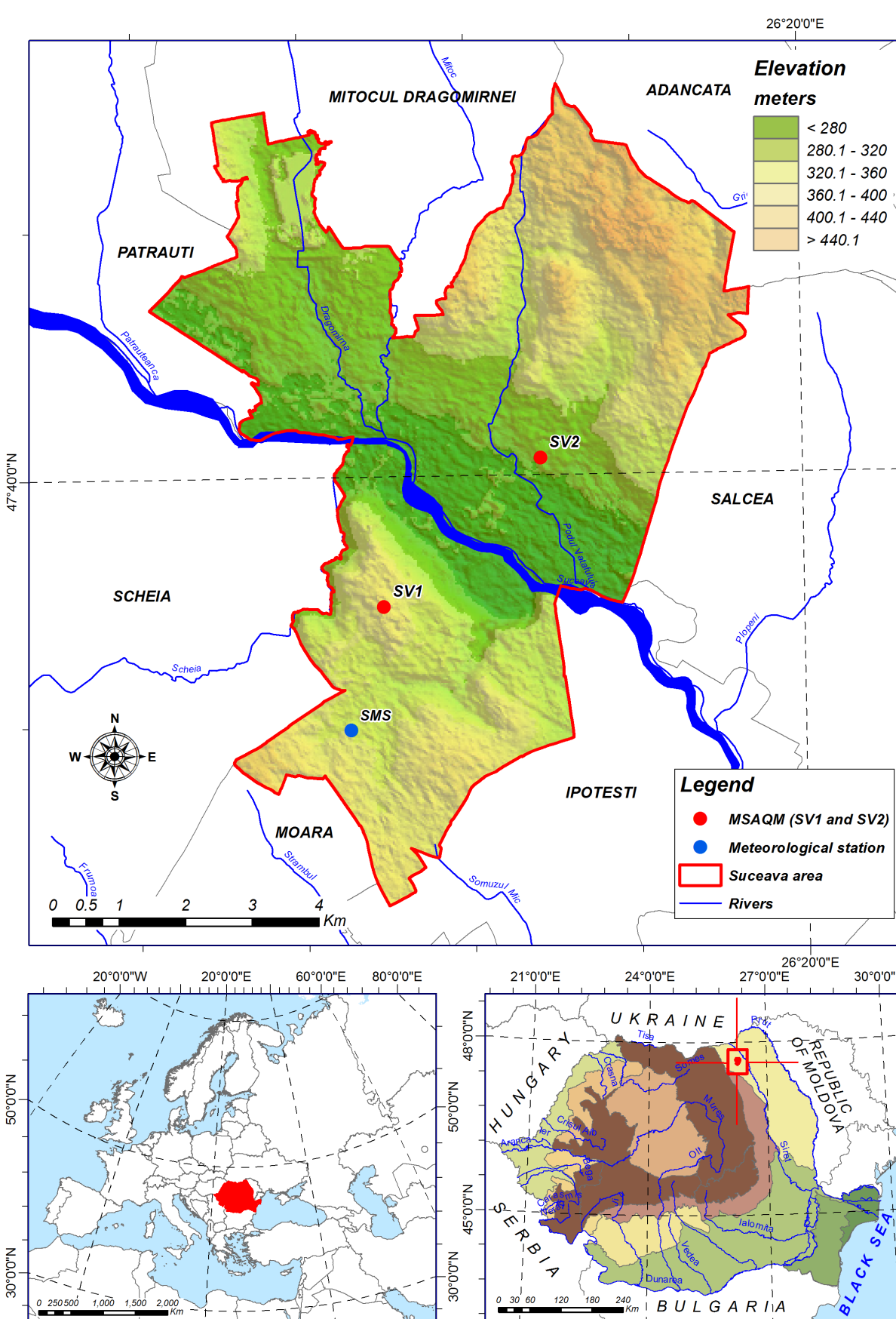


Figure 1 Geographic and mathematical location of meteorological and medical observation points in Suceava urban area - top, Romania - bottom right and Europe - bottom left

In Suceava the chemical parameters of the urban atmosphere are being influenced, mainly negatively, by the daily human activities.

The urban agglomeration of Suceava (from the NE of Romania—**Figure 1**) amounted to 116404 inhabitants as per the census from 2011.

Their quality of life depends directly on the quality of the air inhaled, and this is being affected by the variable emissions of the transport and industrial sectors and by the house hold activities.

The Municipality of Suceava is an important commercial center and, at the same time, a tourist city.

Currently, the industrial activity is carried out at minimum parameters (the only relevant industrial economic agent in affecting the air quality on the industrial platform of the municipality remains the AMBRO factory).

Instead, Suceava is a city suffocated for most of the day by a very heavy car traffic, especially given that the city did not have a bypass during the study.

MATERIALS AND METHODS

Our study is based on the processing of data on the hourly concentrations of NO₂, SO₂, CO, O₃ and PM10 from the air quality monitoring stations SV1 (urban background station) and SV2 (industrial background station) from 2009—2019. The hourly data served to outline the diurnal regime of the investigated noxious substances. The daily concentrations of these pollutants were calculated from them. They continued to be used to shape the annual regime of pollutants based on daily values. From the average daily concentrations were extracted for each station, month, day and pollutant extremes and they have calculated their monthly average concentration. These average monthly and extreme diurnal concentrations per month were used to outline the pollution variability for each month and also the annual noxious concentration regime for SV1 and SV2 points.

The general objective of the study consists in the evaluation of the air quality of Suceava Municipality, on the basis of the hourly data from the stations SV1 (urban background) and SV2 (industrial background) from the interval January 2009 - October 2019, on the basis of five chemical indicators: NO₂, SO₂, CO, O₃ and PM10. The main objectives are: i) the identification of the fluctuations in time of the daily or hourly average concentrations of these emissions with the outlining of their daily or annual regime; ii) the comparison of the air quality in the neighbourhoods with residential function from the central and central-southern areas (Zamca, Marasesti, George Enescu, Areni, Obcini and so on) with the one from the industrial platform vicinity, and iii) the releasing of some accurate evaluations based on data from monitoring, which to classify in different levels of quality the air breathed in by humans.

RESULTS AND DISCUSSIONS

In Suceava the concentrations of NO₂ (with hourly indices of quality evaluated as being excellent in 96,51 % of cases at SV1 and 93,51 % of cases at SV2), SO₂ (with hourly indices of quality evaluated as being excellent in 99,79 % of cases at SV1 and 99,03 % of cases at SV2) and CO (with indices of excellent quality of the air in 99,78 % of the hours of observations at SV1 and 97,32 % at SV2) are not capable to raise real problems from the perspective of their impact on human health. At the level of detail, we can capture in the case of daytime running NO₂ concentrations (Figure 2), two maxima and two minima whose genesis is attributed to the intensification / diminution of social activities and in the field of transport in the morning and evening, respectively at night and in the afternoon, but also the specific weather conditions at these times of the day. Annual NO₂ concentration regime (**Figure 3** and **4**) indicates a slight increase in pollution in the days and months of the cold season without exceeding the hourly limit values (200 µg/m³) set by national and European directives.

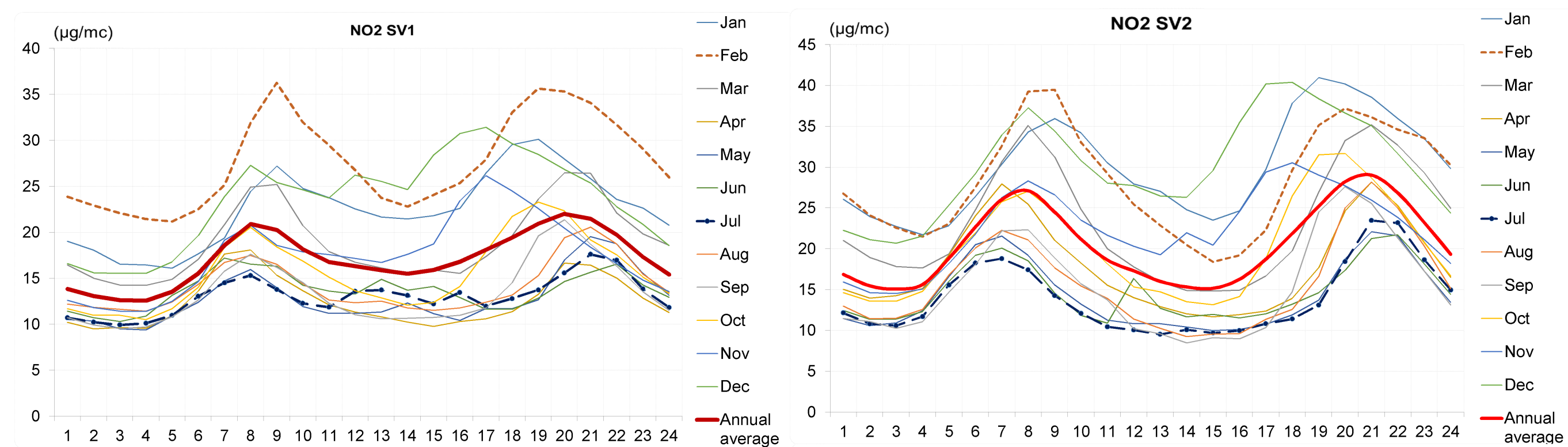


Figure 2 Difference in flow of NO₂ concentration at SV1 and SV2 (2009-2019)

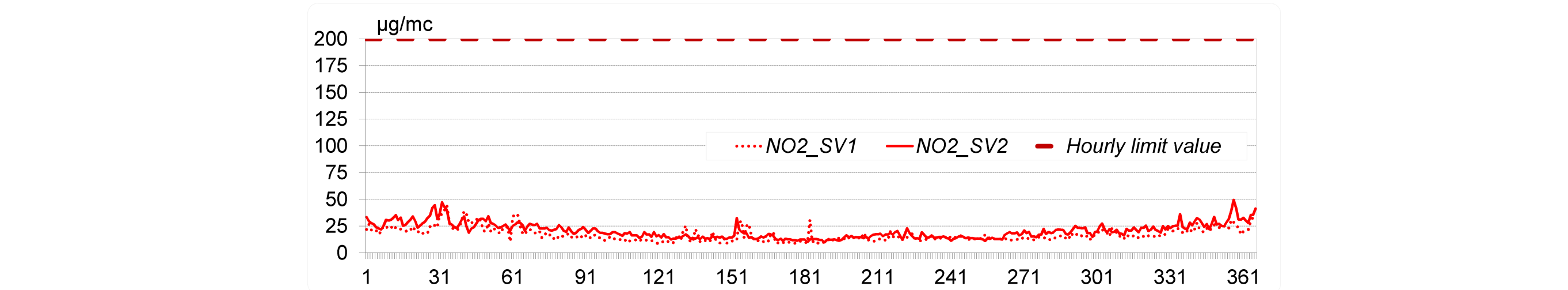


Figure 3 Interdiurnal flow of NO₂ concentration at SV1 and SV2 (2009-2019)

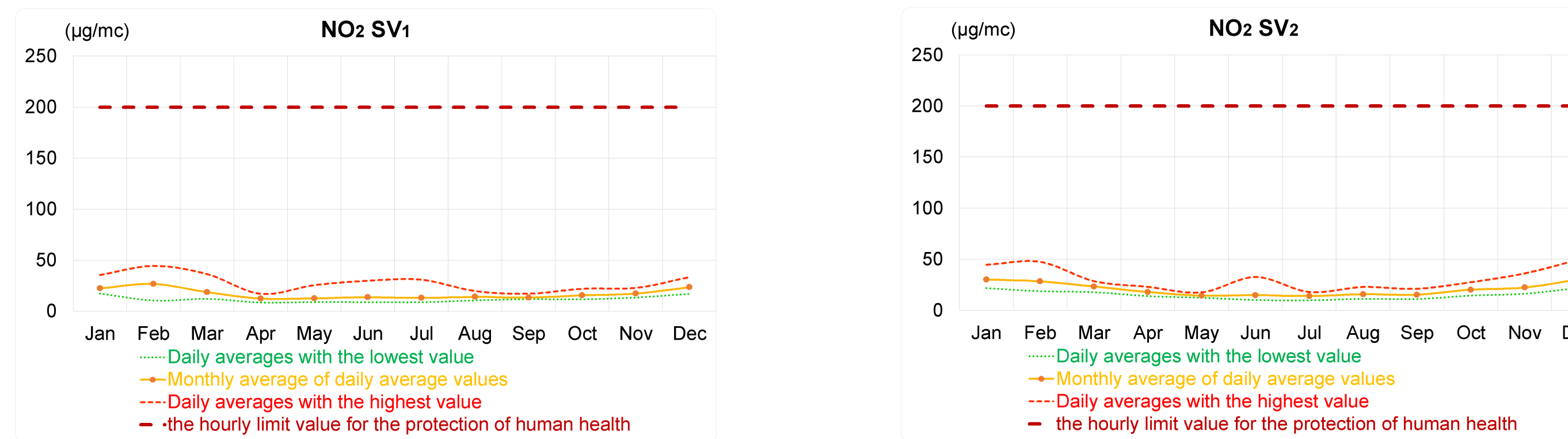


Figure 4 Interlunar flow of NO₂ concentration at SV1 and SV2 (2009-2019)

SO₂ from the atmosphere of Suceava comes mainly from the pulp and paper industry (AMBRO)—therefore in SV2 located near AMBRO the concentration of this gas is higher, from diesel engines and from power plants or heating stoves that use wood and coal. If in diurnal regime we can outline a slightly pronounced diurnal maximum in the noon hours (Figure 5 - due to the intensification of economic activities and specific meteorological conditions at this time of day), in the annual regime we can only notice days and months with slight increases compared to the average SO₂ concentration without outlining a clearly defined regime (Figure 6). The daily limit for the protection of human health (125 µg / m³) was far from exceeded.

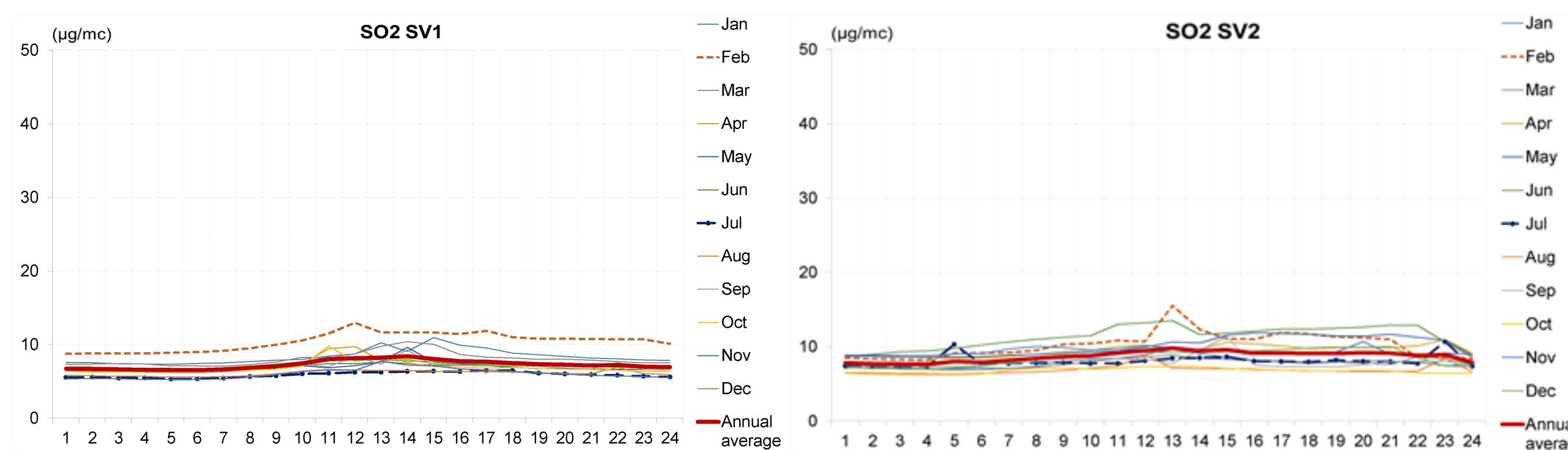


Figure 5 Daytime flow of SO₂ concentration at SV1 and SV2 (2009-2019)

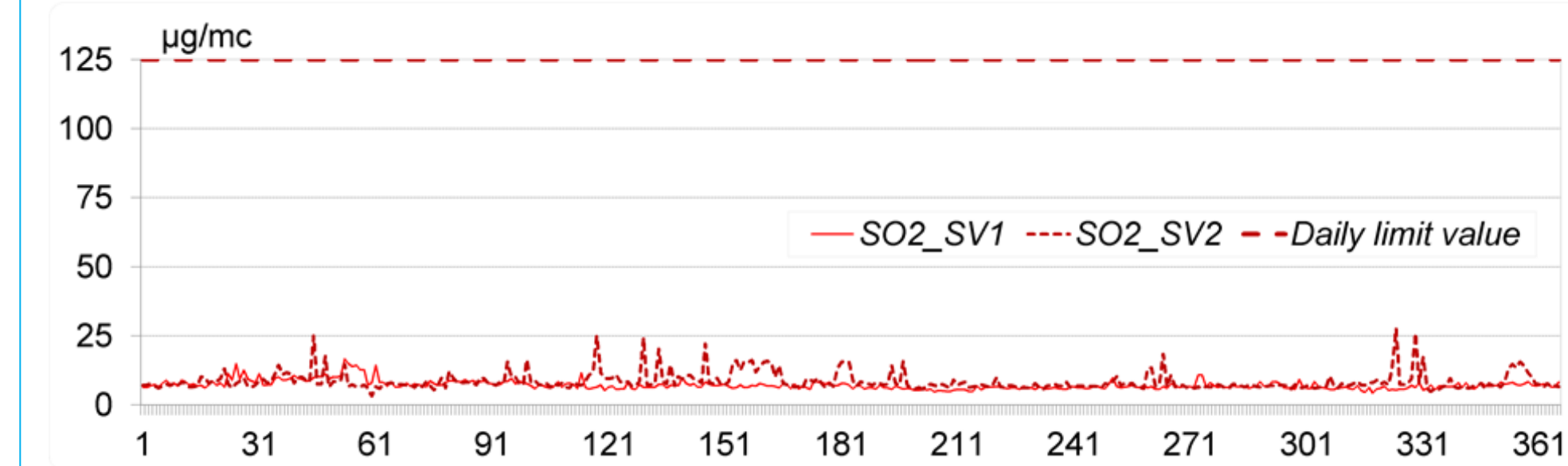


Figure 6 Interdiurnal flow of SO₂ concentration at SV1 and SV2 (2009-2019)

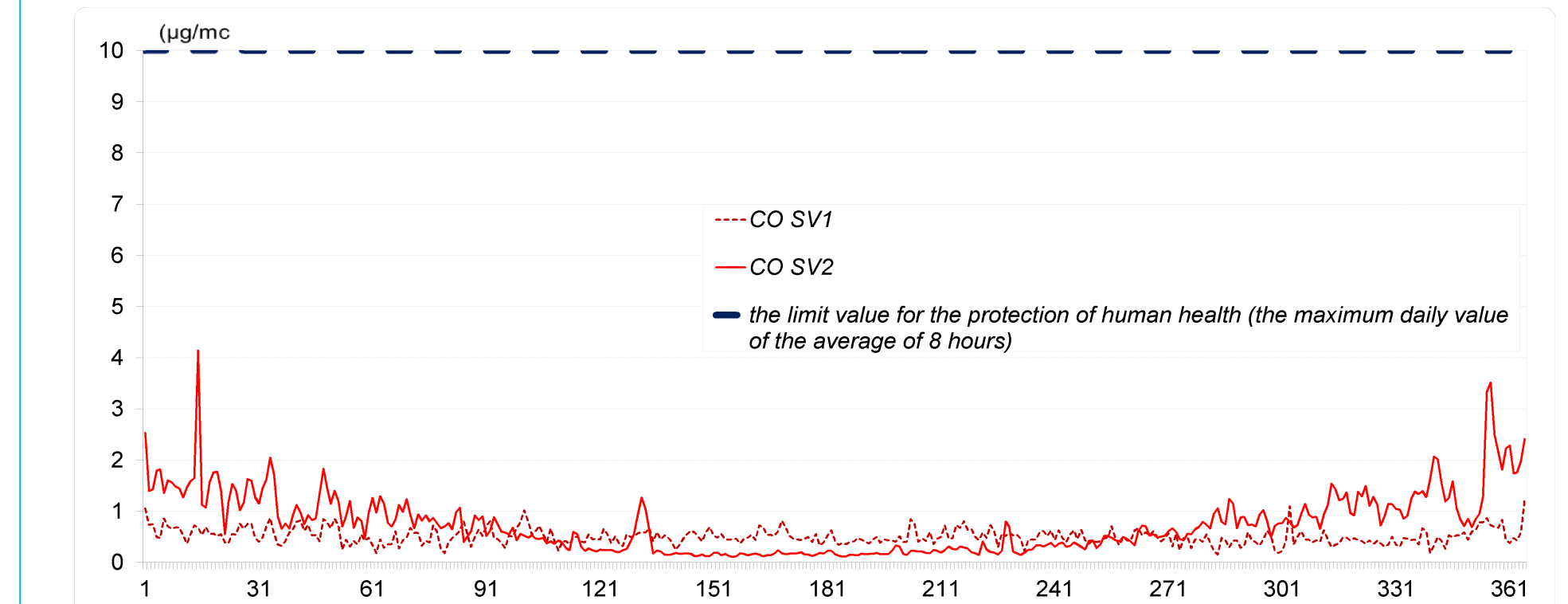


Figure 7 Interdiurnal flow of CO concentration at SV1 and SV2 (2009-2019)

Daily concentrations (Figure 7) and the monthly average of CO in the atmosphere are reduced in Suceava and were far below the limit value for the protection of human health (the maximum daily value of the average of 8 hours -10 µg/m³). In the case of O₃, in 1,67 % of the hours of observations from SV1 the concentration of this gas exceeded the target value for the protection of human health (120 µg/mc). The situation is not alarming due to the reduce percentage held by these situations and to the limitation of the areal to a single monitoring point. The maximum ozone concentration is reached annually in April-May (**Figure 8**), when atmospheric transparency is maximum for UV radiation. Target value for the protection of human health (max. daily value of 8-hour averages) it was not exceeded in any case if we take into account the daily averages of O₃.

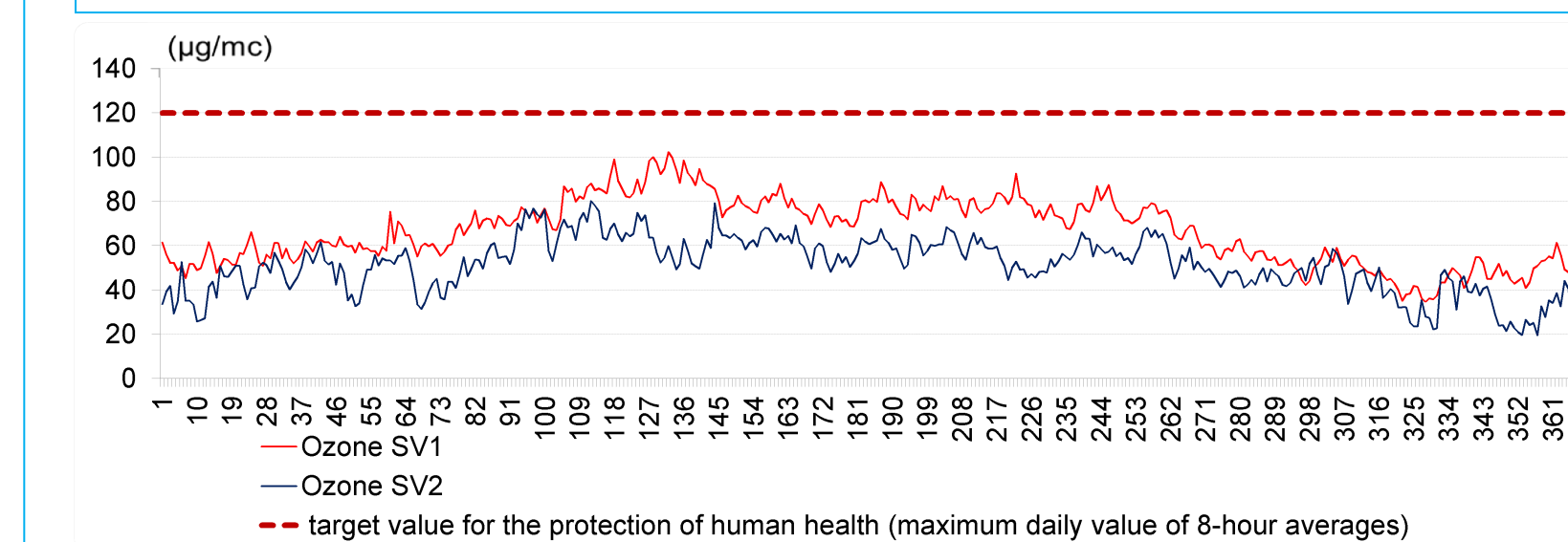


Figure 8 Interdiurnal walk of O₃ concentration at SV1 and SV2 (2009-2019)

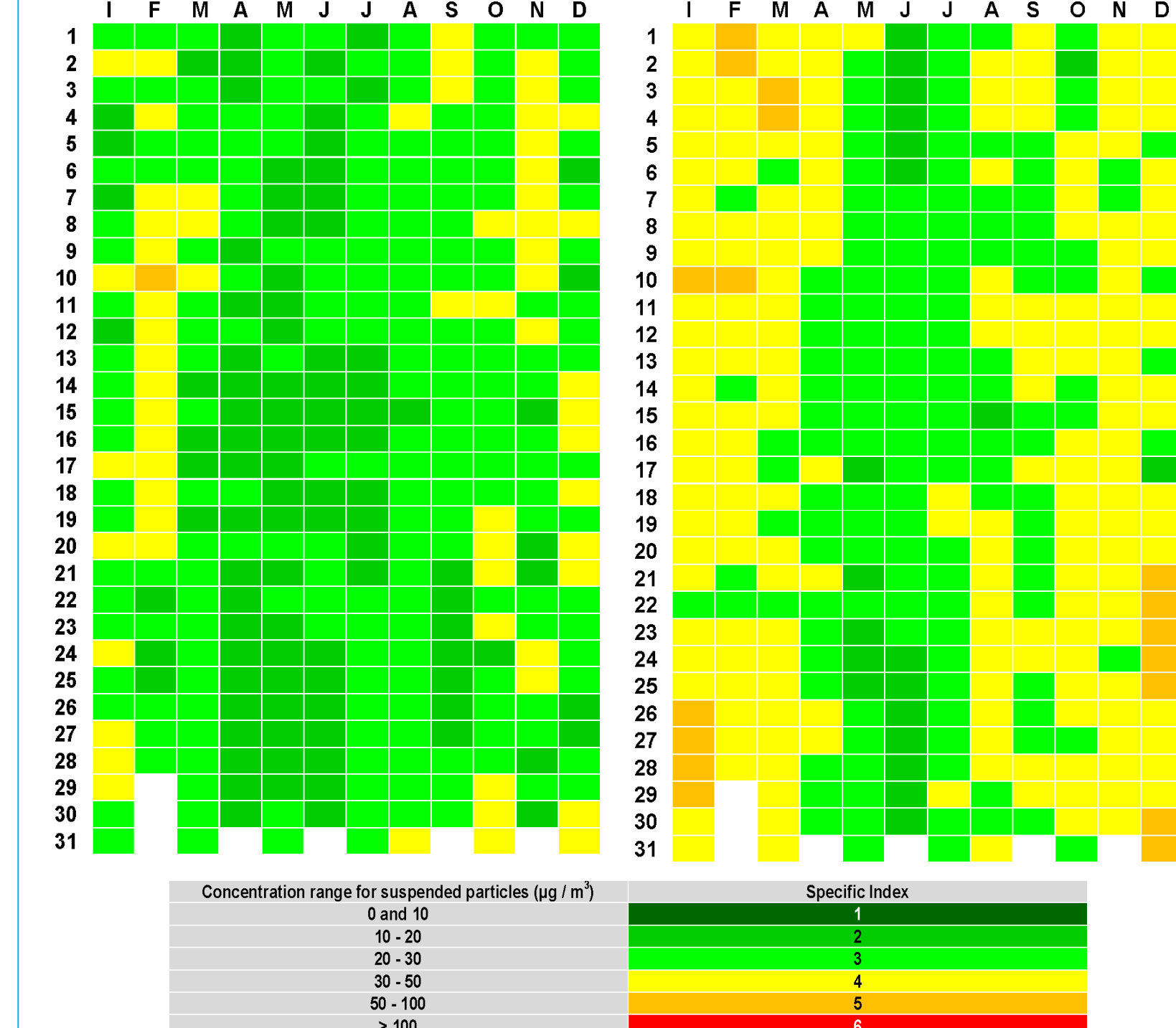


Figure 9 Mean diurnal PM10 concentrations at SV1 and SV2 (2009-2019)

CONCLUSIONS

On the background of the industrial decline after 1989, the air quality in the Suceava atmosphere increased. However, the problem of dust in the area of the industrial platform and of the Burdujeni neighborhood remains a topical one.

REFERENCES

- Lazurca L. G. (2015). The influence of meteorological conditions on PM10 concentrations in Suceava City (North - Eastern Romania), Georeview, Vol 25, 1, 103-116
Mihăilă D., Briciu A.E., Ursul G. (2018) The evaluation of the tropospheric ozone variability in the municipality of Suceava from the meteorological perspective, PESD, VOL. 12, no. 2, 195 – 213