СЕКЦІЯ 3
ЕКОЛОГІЧНА БЕЗПЕКА СІЛЬСЬКОГО ГОСПОДАРСТВА, ТЕРИТОРІЙ ТА АКВАТОРІЙ

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CARBON MONOXIDE CONCENTRATION ASSESSMENT IN THE ATMOSPHERE BASED ON REMOTE SENSING DATA (KIROVOHRAD OBLAST CASE STUDY)

Summary. *The paper monitored the average concentrations of carbon monoxide in the atmosphere of the Kirovohrad oblast for 2019 and 2024 and determined the difference in concentrations between 2024 and 2019. The results showed small increases in average concentrations of +0.00187226 (mol/m^2) and minimal decreases of -0.000840043 (mol/m^2). Although the changes are very insignificant, they can affect human health by increasing chronic respiratory diseases.*

Key words: Carbon monoxide, environmental monitoring, remote sensing, Google Earth Engine, ArcGIS.

In recent years, the trend of using remote sensing methods to monitor atmospheric air pollutants has been actualized [1]. Such monitoring is important because it has an impact on public health. CO can provoke, in particular, respiratory diseases, leading to asthma, allergic manifestations, etc. [2, 3].

The Kirovograd oblast was chosen as the research area. The oblast is located in the central part of Ukraine, in the forest-steppe zone, has a temperate continental climate, and is rich in natural resources. Part of the territory of the Kirovograd oblast is located on the territory of the Ukrainian Crystalline Shield [4].

The purpose of the work: To monitor the average concentrations of carbon monoxide in the atmosphere of the Kirovohrad oblast for 2019 and 2024, as well as to determine the difference in concentrations between 2024 and 2019.

The work used the Google Earth Engine (GEE) [5] cloud-based geospatial analysis platform and ArcGIS geographic information system software. In the GEE platform, the Sentinel-5P NRTI CO: Near Real-Time Carbon Monoxide satellite database collection was selected. Band CO_column_number_density–Vertically integrated CO column density was selected. Pixel size 1113.2 meters. System unit mol/m^2, from the minimum (-279) value to the maximum (4.64) [6].

Images were generated in GEE and mapped in ArcGIS of the average concentration of carbon monoxide in the atmosphere of the Kirovohrad oblast for 2019 and 2024, as well as the difference between 2024 and 2019.

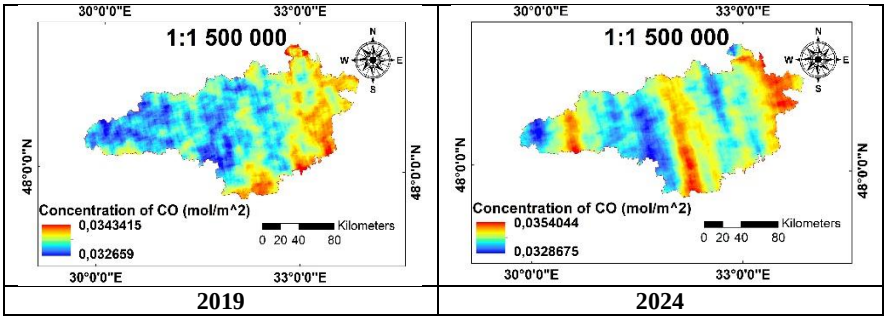

Fig. 1. Average CO concentrations in the atmosphere of Kirovohrad oblast for 2019 and 2024

In 2019 (Fig. 1), the maximum values of average concentrations in the atmosphere of the Kirovograd oblast were 0.0343415 (mol/m^2) and the minimum 0.032659 (mol/m^2). The maximum concentrations prevailed along the borders of the oblast, namely in the southern, eastern, and northeastern parts of the Kirovograd oblast. The minimum concentrations were observed in the western and central parts of the Kirovograd oblast. The average concentrations were observed throughout the territory of the oblast.

In 2024 (Fig. 1.), the maximum values of average concentrations in the atmosphere of the Kirovograd oblast were 0.0354044 (mol/m^2), the minimum 0.0328675 (mol/m^2). The maximum concentrations prevailed mainly in vertical bands in the western, central, and northeastern parts of the Kirovograd oblast. Minimum concentrations were also dominated by vertical bands in the western, central, and northern parts of the oblast. Average concentrations prevailed throughout the oblast.

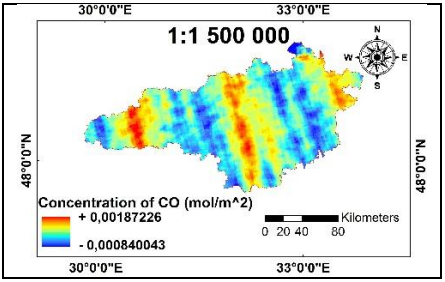

Fig. 2. The difference in average carbon monoxide concentrations in the atmosphere of Kirovohrad oblast between 2024 and 2019

According to the map of the difference in average carbon monoxide concentrations in the atmosphere of Kirovohrad oblast between 2024 and 2019 (Fig. 2.), it follows that there are certain increases in concentrations of +0.00187226 (mol/m^2) and certain decreases of -0.000840043 (mol/m^2). Maximum concentrations were observed in vertical stripes in the western, central, and locally in the northeastern parts of the oblast. Minimum concentrations were observed locally in stripes in the western and central parts of the oblast. Average concentrations were observed almost throughout the entire territory of the oblast.

Conclusions: So, according to the map of the difference between 2024 and 2019 of the average carbon monoxide concentrations in the Kirovohrad oblast, we can observe that there are some small increases in the average concentrations of +0.00187226 (mol/m^2) and very minimal decreases of -0.000840043 (mol/m^2). It can be assumed that the changes are present, although very insignificant, but this can affect human health in different ways. One example is that if the carbon monoxide concentration is constantly maintained at the same level, it can cause chronic respiratory diseases. The oblasts of Ukraine need to monitor the concentrations of greenhouse gases, one of which is carbon monoxide, in every detail to achieve the goals of sustainable development in ensuring the well-being and health of the population, as well as in eliminating risks to public health.

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