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Variation of the surface ozone concentration during precipitation

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In the review compiled by Monks et al. (2015), it is noted that the main variations in the tropospheric ozone are determined by the exchange between the troposphere and the stratosphere, in-situ photochemical production from gaseous precursors depending on their composition and concentration, solar radiation income, and meteorological conditions. The impact of precipitation on the surface ozone concentration is a less well-studied factor.

The process of ozone interaction with precipitation was studied theoretically (Heicklen, 1982). Two ways of the above process were analyzed: adsorption of gas molecules on the surface of a particle and a chemical reaction with its surface. There are no direct data on the verification of these findings in the literature. At the same time, there is some evidence of a possible link between precipitation and ozone.

This study is aimed to analyze the presence or absence of changes in the ozone concentration during precipitation. Variations of the surface ozone concentration (SOC) in the presence of precipitation were analyzed using the long-term data obtained at the TOR-station established in 1992 for ozone monitoring in Tomsk. It was revealed that these changes can be both positive (increase in concentration) and negative. The sharp changes in the SOC are observed when frontal precipitation takes place. In the presence of air-mass precipitation, the sign and magnitude of the change is determined by the diurnal variation of ozone concentration.

The analysis showed a coincidence of the SOC growth during precipitation with its increase in diurnal variation in 59% of cases. The coincidence in the wave of the concentration decline in the diurnal variation with decreasing precipitation rate is even higher and amounts to 85%.

Airborne sounding carried out in the vicinity of the TOR-station shown that in a number of cases the ozone deposition from the boundary layer is observed upon the transition of thermal stratification during the precipitation to neutral.

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