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Dependence of the air composition in the atmospheric surface layer on the variability of meteorological quantities

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Global warming seen in recent decades is mainly determined by changes in the atmospheric composition due to increasing anthropogenic emissions. Since this also leads to the changes in dynamics of basic meteorological quantities and of the atmosphere itself, it is interesting to see how these changes affect the air composition.

To identify possible cause-and-effect relationships, we performed a comparison of the long-term variations of the trace gas concentrations with dynamics of meteorological quantities based on the observational data obtained at the so-called TOR-station (56˚28'41"N, 85˚03'15"E, West Siberia). We used a dataset of monthly mean concentrations of O_3, CO, CO_2, CH_4, NO_2, and SO_2 to analyze their possible relationships with atmospheric pressure, air temperature, humidity, wind velocity, and global solar radiation.

The results of the comparison showed that there are both positive and negative correlations between them, as well as cases of complete absence of one. For example, long-term variations of CO_2 concentration correlate well with atmospheric pressure. The ground-level ozone that is formed in the lower troposphere by in situ photochemistry from precursors has a strong correlation with almost all basic meteorological quantities. Concentrations of gases such as SO_2 and NO_x practically do not correlate with principal weather parameters.

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