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Simulation of Long-term Changes in the Surface Ozone and Aerosol Concentrations Based on the Solar Activity Data

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Based on the long-term data obtained during previous studies we have found an interrelationship the surface ozone and aerosol content with solar activity. Variation of the concentration of both these atmospheric components have a period close to 11 years that has a 2(3)-year phase lag with respect to solar activity. Analyzing possible causes of such behaviour we discarded hypotheses of the anthropogenic origin of the trend and post-volcanic influence of El Chichon and Penatubo eruptions. It turned out, that variation of aerosol number concentration correlates with atmospheric circulation forms (W, E, and C), which are governed by solar activity.
Then we analysed sequentially an ozone mechanism and variations of incoming ultraviolet radiation to determine possible causes of this phenomenon. As a result we found an intermediate process, which consists in the influence of increasing UV radiation on plants. At the beginning of UV radiation increase it is observed suppression of the vegetation. After 1- or 2-year adaptation period its productivity becomes stronger that leads to the emission of additional amount of ozone and aerosol precursors. This hypothesis has been verified using Normalized Difference Vegetation Index (NDVI) and gave good results. Prediction of the long-term changes in the surface ozone and aerosol concentrations has been done based on this hypothesis.

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