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Natural and anthropogenic factors of near-surface ozone seasonal variations in the Northern Eurasia

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The influence of climatically significant regional sources of nitrogen oxides (NO_x=NO+NO_2), and biogenic volatile organic compounds (VOCs) on photochemical generation of near-surface ozone (O_3) in the lower troposphere over Europe and Siberia was studied using a global 3D chemical transport model GEOS-Chem, and observations at ZOTTO (Zotino Tall Tower Observatory, 60.26 N, 89.24 E). The sensitivity of the O_3 field to total emissions of ozone precursors was calculated using the model based on the 2007–2012 databases for anthropogenic (EDGAR) and biogenic (MEGAN) emissions. The amount of photochemical ozone generated during summer months was in good correlation with the age of air-mass determined from the ratio between NO_x and NO_y (total reactive nitrogen), when the average contribution of regional sources is ΔO_3 ~10–15 ppb, which is 20–30% of background ozone concentration in the middle latitudes (O_3 ~35–45 ppb). The quantitative estimates of ozone production efficiency $\Delta O_3/\Delta(NO_y - NO_x)$ for summer months of indicated period (~10–30 mol O_3/mol NO_x) were in good agreement with the theory of photochemical ozone generation under the rural conditions.

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