

Relationship of surface O₃ to large-scale circulation patterns during two recent winters

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We demonstrate a direct connection between large-scale circulation patterns and surface O₃ using atmospheric observations obtained during winters 2002 and 2003. Measurements at two rural sites in the northeastern U.S. revealed that median mixing ratios of O₃ in winter 2003 were increased by up to 80% compared to 2002, and greatly exceeded previous spring annual maximums. To explain this we propose that strong meridional flows in winter 2003 frequently transported O₃-rich mid-tropospheric air masses from high latitudes to the northeastern U.S. while cooling regional climate 4.4°C below normal. Our measurements also show that an exceptionally elevated spring O₃ maximum occurred in 2003. The impact from this winter enhancement on the levels of O₃ and other species during the following months will be largely driven by actual climatic conditions.

GEOPHYSICAL RESEARCH LETTERS, VOL. 31, L06108, doi:10.1029/2003GL018860, 2004