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Interaction of pollution plumes and discontinuous fields in atmospheric chemistry models MAURICIO SANTILLANA, MICHAEL P. BRENNER, Harvard University, YEVGENIY RASTIGEYEV, North Carolina Agricultural and Technical State University, DANIEL J. JACOB, Harvard University —
Atmospheric pollutants originate from concentrated sources such as cities, power plants, and biomass fires. They are injected in the troposphere where eddies and convective motions of various scales act to shear and dilute the pollution plumes as they are advected downwind. Despite this shear and dilution, observations from aircraft, sondes, and satellites show that pollution plumes in the remote free troposphere can preserve their identity as well-defined layers for a week or more as they are transported on intercontinental scales. This structure cannot be reproduced in the standard Eulerian chemical transport models used for global modeling of tropospheric composition, instead, the plumes dissipate far too quickly. In this work, we study how the structure of plumes is modified when they cross discontinuities arising for example: from the moving day-night boundaries or from abrupt unresolved horizontal temperature changes (for example in horizontal ocean-land or ocean-ice transitions). Chemical reactions within the plumes depend strongly on photon availability and temperature, and thus, discontinuities in these variables lead to discontinuous changes in reaction rate constants.

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