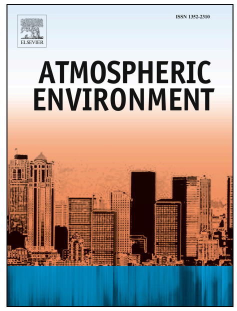

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Observation and simulation study of atmospheric aerosol nonsphericity over the Loess Plateau in northwest China

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Abstract: Aerosol nonsphericity, which is not well depicted in model calculations, seriously affects aerosol optical properties and subsequently alters the radiative forcing of the earth-atmosphere system. Based on aerosol backscattering linear depolarization ratio data observed by a polarization lidar at the Semi-Arid Climate and Environment Observatory of Lanzhou University (SACOL) from September 2009 to August 2012 and numerical computations, the spatial and temporal distribution of the aerosol depolarization ratio, parameterization of the derived aspect ratio and influence of water vapor on aerosol nonsphericity were investigated. Aerosol nonsphericity varied considerably by season, with a pronounced maximum in the spring, when more nonspherical aerosols were transported upward to the free troposphere; moreover, the column-averaged lidar depolarization ratios were 0.13, 0.09, 0.08 and 0.10 for the spring, summer, autumn and winter, respectively. The derived aerosol aspect ratio, a simplified parameter that describes the particle nonsphericity, ranged from 1.00 to 1.30 and peaked at approximately 1.06. A modified log-normal function, which was fitted to the frequency distribution of the derived aspect ratios, yielded a log-normal distribution parameterization for this parameter and provided a better shape input for the aerosol optical modeling. The monthly averaged aspect ratios reached a maximum of 1.13 during the spring and a minimum of 1.04 in autumn. The depolarization ratios decreased significantly with

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