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Trend estimates of AERONET-observed and model-simulated AOTs between 1993 and 2013

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Recently, several researches have been actively conducted on the temporal changes in global aerosol by model simulations and satellite/ground observations. However, most studies of the trend estimates were based on monthly arithmetic means that are not good enough to present measures of central tendency in generally right-skewed AOT distributions. Therefore their results can be biased by the extreme values (i.e. outliers). This study uses several percentiles (i.e. the lowest 5%, 25%, 50%, 75%, and 95% in monthly cumulative distributions of the Aerosol Robotic Network (AERONET) all-points L2.0 data) that are less sensitive to the outliers, and provides the trend estimates to be more statistically robust. By applying various aerosol type classifications based on Ångström exponent, Single scattering albedo, and fine-mode fraction, we investigate the causes leading to the AOT trends over different regions. Furthermore, we minimize the possible uncertainty in the trend estimates regarding the underrepresented aerosols below clouds by integrating the model-simulated AOT from EMAC (ECHAM5/MESSy for Atmospheric Chemistry). In addition, the trend estimates of EMAC-simulated AOTs decomposed into several aerosol components (i.e. black carbon, organic carbon, dust, aerosol water, sea salt, and water soluble compounds) are potentially useful to identify the leading causes.