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Multidecadal trend analysis of aerosol radiative properties at a global scale

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In order to assess the global evolution of aerosol parameters affecting climate change, a long-term trend analyses of aerosol optical properties were performed on time series from 52 stations situated across five continents. The time series of measured scattering, backscattering and absorption coefficients as well as the derived single scattering albedo, backscattering fraction, scattering and absorption Ångström exponents covered at least 10 years and up to 40 years for some stations. The non-parametric seasonal Mann-Kendall (MK) statistical test associated with several prewhitening methods and with the Sen's slope were used as main trend analysis methods. Comparisons with General Least Mean Square associated with Autoregressive Bootstrap (GLS/ARB) and with standard Least Mean Square analysis (LMS) enabled confirmation of the detected MK statistically significant trends and the assessment of advantages and limitations of each method. Currently, scattering and backscattering coefficients trends are mostly decreasing in Europe and North America and are not statistically significant in Asia, while polar stations exhibit a mix of increasing and decreasing trends. A few increasing trends are also found at some stations in North America and Australia. Absorption coefficients time series also exhibit primarily decreasing trends. For single scattering albedo, 52% of the sites exhibit statistically significant positive trends, mostly in Asia, Eastern/Northern Europe and Arctic, 18% of sites exhibit statistically significant negative trends, mostly in central Europe and central North America, while the remaining 30% of sites have trends, which are not statistically significant. In addition to evaluating trends for the overall time series, the evolution of the trends in sequential 10 year segments was also analyzed. For scattering and backscattering, statistically significant increasing 10 year trends are primarily found for earlier periods (10 year trends ending in 2010-2015) for polar stations and Mauna Loa. For most of the stations, the present-day statistically significant decreasing 10 year trends of the single scattering albedo were preceded by not statistically significant and statistically significant increasing 10 year trends. The effect of air pollution abatement policies in continental North America is very obvious in the 10 year trends of the

scattering coefficient – there is a shift to statistically significant negative trends in 2010-2011 for all stations in the eastern and central US. This long-term trend analysis of aerosol radiative properties with a broad spatial coverage enables a better global view of potential aerosol effects on climate changes.

SARGAN: trend analysis of aerosol radiative properties: Elisabeth Andrews, Andrés Alastuey, Todor Petkov Arsov, John Backman, Benjamin T. Brem, Nicolas Bukowiecki, Cédric Couret, Konstantinos Eleftheriadis, Harald Flentje, Markus Fiebig, Martin Gysel-Beer, Jenny L. Hand, András Hoffer, Rakesh Hooda, Christoph Hueglin, Warren Joubert, Melita Keywood, Jeong Eun Kim, Sang-Woo Kim, Casper Labuschagne, Neng-Huei Lin, Yong Lin, Cathrine Lund Myhre, Krista Luoma, Hassan Lyamani, Angela Marinoni, Olga L. Mayol-Bracero, Nikos Mihalopoulos, Marco Pandolfi, Natalia Prats, Anthony J. Prenni, Jean-Philippe Putaud, Ludwig Ries, Fabienne Reisen, Karine Sellegri, Sangeeta Sharma, Patrick Sheridan, James Patrick Sherman, Junying Sun, Gloria Titos, Elvis Torres, Thomas Tuch, Rolf Weller, Alfred Wiedensohler, Paul Zieger, Paolo Laj