

Classification of Aerosol over Central Europe by Cluster Analysis of Aerosol Columnar Optical Properties and Backward Trajectory Statistics

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Abstract

A cluster analysis is applied to the Aerosol Robotic Network (AERONET) data obtained at Belsk, Poland, as well as three nearby Central European stations (Leipzig, Minsk and Moldova) for estimation of atmospheric aerosol types. Absorption Ångström exponent (AAE), aerosol optical thickness (AOT) and extinction Ångström exponent (EAE) parameters are used. Clustering in both 2D (AOT, EAE) and 3D (AOT, EAE, AAE) is investigated. A method of air mass backward trajectory analysis is then proposed, with the receptor site at Belsk, to determine possible source regions for each cluster. Four dominant aerosol source regions are identified. The biomass burning aerosol source is localized in the vicinity of Belarusian-Ukrainian border. Slovakia and northern Hungary are found to be the source of urban/industrial pollutants. Western Poland and eastern Germany are the main sources of polluted continental aerosols. The most differentiated source region of Scandinavia, Baltic Sea and Northern Atlantic, associated with lowest values of AOT, corresponds to clean continental and possibly maritime type aerosols.

Key words: aerosol optical properties, aerosol classification, cluster analysis, backward air mass trajectory, aerosol's origin determination.