**Robust Approach for Environmental and Health Practice: Novel Paradigm for Data Treatment and Analysis**

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## Robust approach for environmental and health practice: novel paradigm for data treatment and analysis

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Knowledge of concentration of atmospheric aerosol particles may provide an important information in applications concerning human health. Aerosol studies reach into several fields of science. In the past decades it was shown that enhanced concentration of atmospheric aerosol lead to increased mortality on cardiopulmonary diseases and lung cancer. Specifically, the fine fraction of aerosol particles formed anthropogenically correlates with adverse health effects most strongly. The main part of the anthropogenic aerosol emerges from combustion processes; heavy industry, thermal power plants, waste incinerators, traffic, local heating, and biomass burning produce over 99 % of anthropogenic particulate mass. However, not all aerosol particles producad by humans are potentionally harmful. Many people suffering of asthma cherish the modern aerosol inhalers that allow them more comfortable breathing. The increasing demand for functional nanoparticles provides new employment opportunities in the material industry and research.

Particles of different sizes reach into different parts of the human respiratory tract. Depending on the particle size they can deposit or can be breathed out. When assessing the impact of the aerosol to human health it is therefore important to know both the total concentration of particles and their particle size distribution. Atmospheric aerosol is a mixture of particles coming from several sources and, in addition to that, they undergo complex physical and chemical transformations during transport in the atmosphere. As a result, the particle size distribution is often multimodal and the type of the distribution function is not known in advance.

Statistical methods of estimation of particle size distribution are either nonparametric or semiparametric. The nonparametric methods are based on histograms. However, these methods suffer from the risk of underfitting or overfitting. Methods based on entropy require large amount of computation and thus are not good candidates for implementation in automatic monitoring systems. Semiparametric methods usually express the distribution function as a linear combination of two or three lognormal distributions. Such an approach cannot describe distributions possessing greater number of modes. Moreover, in many cases the third lognormal distribution rather improves the description of another asymmetric mode and the third mode is missed.

This work presents a robust method of estimation of particle size distribution based on mathematical gnostics. The algorithm may either be used as a manual tool for analyzing a small number of particle size distributions ex post or as a routine implemented in automatic monitoring devices for near real time processing of measured data and immediate online display on a web site. The method has sucessfully been implemented for near real time analysis of data measured by a scanning mobility particle sizer conformant to recommendations defined in the framework of the EUSAAR project.

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