STUDIES OF THE NUMBER CONCENTRATION AND SIZE DISTRIBUTION OF THE SUSPENDED DUST PARTICLES IN THE ATMOSPHERE OF QENA/EGYPT

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Abstract. Studies of particle number concentration, size, shape and distribution of the dust particles suspended in the atmosphere of Qena (upper Egypt) have been conducted. The results show that the concentration of these particles decreases with increasing size according to the Junge power law size distribution: \( n(d_p) = \frac{C}{\ln 10} (d_p)^{-(\alpha + 1)} \). The values of the exponent \( \alpha \) range from 1.3 to 2. The largest number of particles have sizes less than 2 \( \mu m \) with irregular shape. The effect of some weather conditions on the total number of particles was considered. The total number of particles and effective mean diameters were calculated.

1. Introduction

Suspended particulate matters in the atmosphere can originate through the action of air currents or turbulence (dispersion aerosols) or be formed in the atmosphere when supersaturated vapors condense or when gases react chemically to form a nonvolatile product (condensation aerosols). Both the dispersion and condensation of aerosols are influenced by a variety of factors, such as weather patterns, terrain features, the place of emission, the location of receptors, and many other factors. Dispersion aerosols are, in most cases, more than 0.5 \( \mu m \) in diameter and comprise a broad range of particle size. When the dispersed phase is solid, the dispersion aerosols are called dust and usually consists of individual or slightly aggregated particles of irregular form (Patterson, 1984). Much of the concern about particulate matter suspended in the atmosphere arises because particles of certain size can be inhaled and retained by the human respiratory system. Concern also arises because particulate matter in the atmosphere absorbs UV radiation from the sun to the extent that UV deficiency can cause rickets in children unless their diet is supplemented with vitamin D (Stern et al., 1987).

In this paper, a study of the dust particles suspended in the atmosphere of Qena is presented. This study includes a count of the total number of particles (TNP)) per unit area, particle size, and shape as well as a count of the number of particles of each size range. Statistical and theoretical treatments of the results have also been accomplished.

2. Methods and Materials

Suspended dust particles have been collected from the atmosphere on cellulose
nitrate membrane filters of 0.8 μm pore size and 50 mm diameter (Sartorius GmbH, West Germany-Model 11304). The filter holder was connected by plastic tubing to a dust sampler of flow rate 1.5 m³hr⁻¹ (Sartorius GmbH, West Germany, Model 16711). The sampling processes were carried out at the roofs of the faculties of Science and Education (about 25 m above the ground). Sites of collection are marked on Figure 1, which represents a location map of the sampling area. Station No. (1) represents a desert area while Station No. (2) is urban area. In this way, the collection sites cover the most important sources of the dust particles suspended in the atmosphere of Qena.

Measurement of particle size distributions was carried out by taking equal areas of the membrane filters (2 cm²), upon which the suspended dust particles were collected and transferring them to slides for microscopic analysis. The slides were decked with cover slides that were fixed by using natural gum (BDH product, England, type DPX mountant 1993). The slides were then examined under an oil immersion objective lens of magnification power 100 × in combination with a calibrated filler micrometer eyepiece of magnification power 8 ×. The resolution