

LETTER TO THE EDITOR

Comments on “Deposition and transformation rates of sulphur oxides during atmospheric transport over the Atlantic”, by L. P. Prahm, U. Torp and R. M. Stern

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The main subjects of the paper by Prahm et al. (1976) are the long range transport and the deposition of atmospheric sulphur compounds over the North Atlantic ocean. Besides that, the paper discusses some other points of interest, one of which is the size distribution of atmospheric aerosol particles. We will comment on this aspect.

The size distribution of atmospheric aerosols is determined in Prahm et al. (1976) by examining particles collected on Satorius 0.8 μm membrane filters with the aid of the Scanning Electron Microscope (SEM). We cannot follow the optimistic view of the authors, that it is possible in this way to obtain a size distribution which can be compared with those of other papers.

In general, particles are collected on any filter by several effects. Particles much larger than the pore size are collected on the filter's surface by the sieving effect. Particles of a size comparable to the structural elements of the filter (Prahm et al. (1976) show photographs with roughly 1 μm material thickness) are collected by inertia effects (impaction) on these elements. This occurs mainly on the filter surface or very close behind it, so the particles could travel on nearly straight trajectories. Particles much smaller than the structural elements are collected by diffusion in the depth of the filter. They will hardly be collected on surface elements, so most of them are not visible for surface inspection. The assumption by Prahm et al. (1976) that only a small fraction of these particles disappears in the depth of the material is certainly not describing the actual deposition.

As the photographs (Prahm et al., 1976) show, the inspected surfaces are rather uneven, with holes, structural elements, shadows, obstructed areas, and other effects which prevent complete

inspection and counting within the surface area. This is the case with most filters except nucleopore filters and one has to be very careful in establishing absolute aerosol size distributions from such photographs.

Furthermore, one has to keep in mind that Prahm et al. (1976) had to distinguish between 0.2-mm and 0.4-mm images on the photographs in order to establish the size distribution of the 0.02- μm to 0.04- μm particles. The uncertainty in determining the size of these particles should then be rather large, even if a hand-held microscope is used afterwards. There are a few more facts to be considered. From our own measurements of the content of marine aerosols the organic material accounts for roughly 10% of the total particle mass (Ketseridis et al., 1976). Most of this material will probably evaporate in the vacuum used for coating the filter surfaces. Recent and unpublished data of our measurements indicate that organic material becomes more abundant with decreasing particle size, so this possible loss of particle material might be quite important for the smallest particles under inspection. As Gravenhorst (1975) showed in his critical study on marine sulphate, this material accounts for roughly 30% of the total mass. Its relative abundance increases as the particle size decreases. Winkler (1975) showed that the Aitken particles smaller than 0.1 μm in radius consist mainly of sulphur in the elemental distribution. From that it is concluded that the Aitken particles are mainly ammonium sulphate.

From our own experiments (Schütz, 1977) it is known that pure ammonium sulphate evaporates without residues in the vacuum of the coating devices, and thus the particles are undetectable in SEM studies. If we assume the aerosol particles to

be of mixed nature, the evaporation of any content of ammonium sulphate should be considered and would lead to a considerable loss in size of the individual particle.

We conclude that all of the effects mentioned above might influence the evaluation of the SEM photographs and thus the determination of the

aerosol size distribution. Disregarding these effects makes the results rather vague, and any comparisons with other size distributions become questionable. We emphasize, however, that size distributions of the kind shown in Prahm et al. (1976) are possible but that they can hardly be confirmed by the method applied by these authors.

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