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THE AETHALOMETER — AN INSTRUMENT FOR THE REAL-TIME MEASUREMENT OF OPTICAL ABSORPTION BY AEROSOL PARTICLES*

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ABSTRACT

We describe an instrument that measures the concentration of optically absorbing aerosol particles in real time. This absorption is normally due to black carbon, which is a good tracer for combustion emission. The minimum resolving times range from seconds in urban environments to minutes in remote locations. We present results obtained during operation on an aircraft. Due to the time resolution capability, we can determine the spatial distributions of absorbing aerosol. From the Greek word "αιθαλουν," "to blacken with soot," we have named this instrument the aethalometer.

INTRODUCTION

Aerosol particles emitted from combustion sources contain many different carbonaceous compounds and structures. One of these components is carbon in a microcrystalline graphitic form (ref.1), which, due to its strong optical absorption, is termed "black carbon." This material can only be produced by incomplete combustion: there are no secondary mechanisms known for its production from airborne precursors. It is also inert to transformation in the atmosphere and therefore possesses qualities that make it a good tracer for combustion emissions. Chemical techniques (ref.2) for the determination of the black carbon content of aerosol samples collected on filters are generally complex and time consuming. In contrast, optical measurements are often simple and rapid. Since most ambient aerosols do not contain large amounts of other noncarbonaceous absorbing particulate material, a measurement of optical absorption of the filter deposit corresponds very closely to the black carbon determination. These methods and results are discussed in detail by Gundel et al. (ref.3). Here we describe an instrument that uses an optical technique to measure the concentration of aerosol black carbon in real time. From the Greek word "αιθαλουν," "to blacken with soot," we have named the instrument the aethalometer.

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