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# Simplified representation of atmospheric aerosol size distributions using absolute principal component analysis

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Abstract. Principal component analysis provides a fast and robust method to reduce the data dimensionality of an aerosol size distribution data set. Here we describe a methodology for applying principal component analysis to aerosol size distribution measurements. We illustrate the method by applying it to data obtained during five field studies. Most variations in the sub-micrometer aerosol size distribution over periods of weeks can be described using 5 components. Using 6 to 8 components preserves virtually all the information in the original data. A key aspect of our approach is the introduction of a new method to weight the data; this preserves the orthogonality of the components while taking the measurement uncertainties into account. We also describe a new method for identifying the approximate number of aerosol components needed to represent the measurement quantitatively. Applying Varimax rotation to the resultant components decomposes a distribution into independent monomodal distributions. Normalizing the components provides physical meaning to the component scores. The method is relatively simple, computationally fast, and numerically robust. The resulting data simplification provides an efficient method of representing complex data sets and should greatly assist in the analysis of size distribution data.

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