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Humidity dependence of aerosol scattering coefficient at Fukue Is. in spring 2009:Relationship with chemical composition

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The aerosol scattering coefficient, together with the absorption coefficient, is an important parameter to define the aerosol extinction coefficient and single scattering albedo, which control the direct effect of aerosols on the Earth's climate. In most cases aerosol particles contain large amount of hydrophilic constituents and thereby the scattering coefficient increases with relative humidity (RH) because of the growth of the particles in size. However, observations of the scattering coefficient are often made in buildings equipped with air conditioning, and thus the RH condition for the measurements can be different from ambient condition (because of temperature difference between outside and inside), requiring careful attention when the reported values are to be used in the analysis.
We employed an integrating nephelometer with an air inlet equipped with a humidifier, where the RH can be controlled between 30 and 90%, to measure the scattering coefficient at Fukue Island atmospheric environment observatory (32.75N, 128.68E) in May 2009. The aims of the observations are to estimate the coefficient under the real ambient RH condition, to derive more reasonable single scattering albedo value for the atmosphere, and to study the relationship between the RH dependence of the scattering coefficient and the chemical composition. As an average over the campaign period, the scattering coefficient under the ambient RH condition was >1.5 times higher than that observed under the dry condition (RH=40%), suggesting that the RH effect is necessary to take into account. The coefficients under the ambient RH conditions agreed better with the extinction coefficient derived from a MAX-DOAS instrument, a remote sensing instrument measuring the atmosphere under the ambient RH condition. The RH dependence was found to be weakened when the relative fraction of organics is larger than sulfate (as observed by Aerodyne AMS). This result was consistent with past literatures.

Keywords: aerosol, chemical composition, optical property, trans-boundary air pollution