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An Originally Designed Multi-Wavelength Transmission Visibility Meter For Distinguishing Haze From Fog

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Fog and haze are 2 common causes of low visibility. It is generally difficult to distinguish haze from fog since the relative humidity data provided by the automatic weather station is neither accurate nor reliable under high relative humidity conditions.

The Mie scattering theory suggests that the extinction coefficient at shorter wavelengths is larger than that at longer wavelengths for haze since haze particles are generally far less than 1μm. The transition from haze to fog results the particles to grow, decreasing the difference between the extinction coefficients at different wavelengths.

Based on the above theory, we built a transmission visibility meter with 4 working wavelengths. The transmission visibility meter is composed of a CCD camera, a light source and 4 color filters of working wavelengths 415nm, 512nm, 650nm and 850nm. The light emitted by the source is extinct while traveling in the air and is finally recorded by the CCD camera. The extinction coefficient can be computed according to the Bouguer-Lambert law. The transmission visibility meter was also tested in an experiment during the winter time 2009 to 2010 which was held in Wuqing, Tianjin.

The result of the experimental observations under haze conditions clearly showed that the observed extinction coefficient at shorter wavelengths was larger than that at longer wavelengths. While the result under fog conditions showed a rapid decrease when the working wavelength was decreased. This proves the feasibility to use the multi-wavelength transmission visibility meter to distinguish haze from fog. It is also possible to use the obtained extinction coefficients to determine other features of haze or fog.