

# Real-time relationship between digital visibility and PM2.5 at the middle of Taiwan

C.-H. Luo<sup>1\*</sup> and S. Yang<sup>2</sup>

<sup>1</sup>Department of Safety, Health and Environmental Engineering, Hungkuang University, Taichung, 43302, Taiwan (ROC)

<sup>2</sup>Center of General Education, Toko University, Chiayi, 61363, Taiwan (ROC)

Keywords: atmospheric visibility, air quality, PM2.5, digital image processing.

Presenting author email: andyluo@hk.edu.tw

Atmospheric clarity presents the visual quality of the atmospheric environment and has been quantitatively detected by several digital visibility indexes investigated by several image processors (Luo *et al* 2005, Luo *et al* 2011). Visibility impairment due to airborne submicro-sized aerosols has been studied over the past years. Real-time digital visibility and PM2.5 monitoring were investigated, and their relationship was analyzed at the middle of Taiwan in this study.

Atmospheric visibility was detected the Long Path Visibility Transmissometer (LPV-4, OPTEC, Inc., US) and the images of related landscape were recorded at the same time. The digital visibility was calculated by the image processor and presented by the image index (Figure 1).

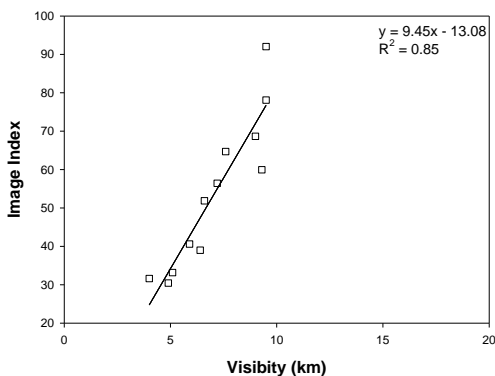


Figure 1. The linear relationship between the atmospheric and digital visibility values.

Figure 2 shows the images and the related digital index values. PM2.5 data was collected from the nearby monitoring station.

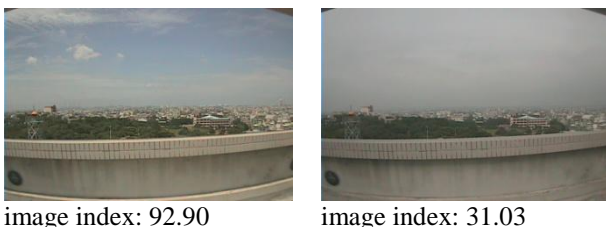


Figure 2. The atmospheric images and related digital image index values.

The coefficient of variation (CV) of the hourly level changes of digital visibility and PM2.5

concentration for two week measurements was normalized in the following equation.

$$CV = \frac{\text{hourly value} - \text{mean value}}{\text{mean value}}$$

Finally, sixth-order curve fitting function was used to analyze and build the relationship between digital visibility index and PM2.5 concentration in Figure 3. According to the results, the change of PM2.5 show a downward trend, but digital visibility value presents the change in the rising trend around 8:00. From 11:00 to 14:00, PM2.5 changed downwards, and digital visibility value showed the upward change. A time delay of change trends appeared and should be discussed more in depth.

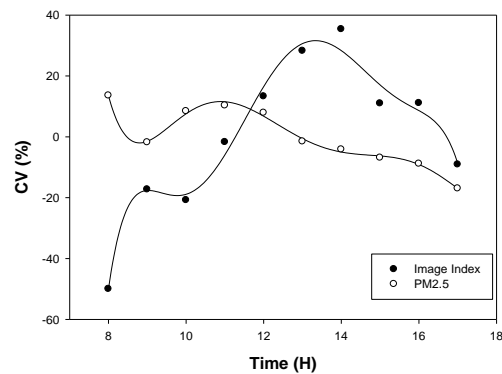


Figure 3. This is a comparison between digital image index and PM2.5 concentration.

This work was supported by the National Science Council of Taiwan under contract no. NSC 100-2628-E-241-001.

Luo, C.-H., Liaw, J.-J., Wen, C.-Y., Yuan, C.-S. and Lo, C.-C. (2005) *Atmos. Environ.* **39**, 2545-2552.

Luo, C.-H., Lin, K.-H., Wen C.-Y., Chiu S.-H., Yuan C.-S. and Yang S. (2011) *INT. J. REMOTE. SENS.* **32**, 9801-9810.