

Confirmation of Illegal Incineration in Rural Areas using Scanning LIDAR

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The Korean government enforces a fine dust seasonal management system to reduce aerosols emitted from illegal incineration in rural areas during the winter and spring period. The burning of agricultural by-products in rural areas is prohibited by law but is still prevalent. Illegal incinerations mainly occur on a small scale in a wide area; so, managing and controlling them is difficult. Aerosols in rural areas are harmful to human health as agricultural by-products and various waste materials such as wood and Styrofoam are incinerated together. In addition, there is no study on the characteristics, surrounding effects, and quantification of aerosols generated by the incineration of agricultural by-products.

To monitor illegal incineration of agricultural waste, we measured mass concentration of particulate matter (PM) using scanning Light Detection and Range (Lidar). The scanning Lidar can observe PM₁₀ and PM_{2.5} mass concentration in an area with a radius of 5 km at 30-minute intervals with a distance resolution of 30 m. Laser wavelengths are 532 nm (p and s) and 1064 nm, the pulse energy is less than 1 mJ, and beam divergence is 0.3 mrad.

The measurement period was from Jan.28 to Mar.13, 2021, and the effective observation duration was 24 days due to weather conditions. The measurement site is a rural area in Gimje city, Jeollabuk-do, Korea, where illegal incineration often occurs. Horizontal angles of the scanning area were divided into 18 directions (0°–190°). The observation height is about 10 m above the ground. We detected 11 suspicious signals of illegal incineration at the farmland, empty lot, and wood boiler on the scanning area for 209 loop measurements. We immediately mobilized and confirmed the incineration site through the information on the longitude and latitude of lidar peaks; however, checking for small and short-time cases is difficult because of the large area. Nevertheless, this is a remarkable result that can solve the practical problems of cracking down burning cases that occurred randomly and adversely impact the residential area. Also, scanning lidar measurement enables the study related to aerosol properties and pollution effects by detecting emissions cases and accumulating continuous monitoring data.