# Development of the Dual-wavelength Mie-Raman Lidar for Weather Modification Application


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Weather modification refers to the alternation of atmospheric conditions by human activity which is sufficient to modify the weather on local or regional scales, commonly known as cloud seeding. Weather modification is regarded as the solution to many atmospheric necessities such as water resource management, disaster prevention and mitigation and air quality improvement. To well depict the whole process of cloud seeding implementation, the size changing of aerosol and clouds particles must be elaborately observed. Weather radar and millimeter radar are used to evaluate the cloud seeding implementation, but only works in observing the large clouds particles and precipitation and fail to observe the key transition progresses from aerosol to CCN and cloud droplets due to the long radar wavelength. These key transition progresses are vital for the cloud seeding and can be observed by lidar with a short wavelength.

This paper presents the development of the dual-wavelength Mie-Raman lidar for weather modification application. The lidar system is installed in a standard movable shelter. Two wavelengths of 355nm and 532nm transmits simultaneously through a small window on the roof of the shelter. The atmosphere backscattered light goes through the adjacent large window on the roof and is collected by a Cassegrainian telescope with 400mm in diameter. The receiving channels include the 355nm Mie scattering signal, the 532nm parallel and perpendicular Mie scattering signal and the nitrogen Raman scattering signal at wavelength of 607nm. To overcome the far end calibration problem caused by opaque clouds, a novel design of using near end calibration method is proposed, including the CCD side scattering imaging technique to retrieve the overlap function and to supple the blind zone data and the weather station and the visibility measurement to provide the calibration constant. The CCD cameras installed at the roof corner in the shelter to achieve the maximum distance to the laser beams. The weather station and the visibility meter are installed on the roof with extended cylinder.

This lidar system has been built and well tested, as well as the retrieval algorithms, and carried out for IOP for several months. This lidar is set to continues measurement and acquire one profile in every 5 minutes. The data products comprise extinction coefficient, backscattering coefficient, depolarization ratio, lidar ratio, effective radius, number concertation, boundary layer height, cloud height and aerosol and clouds classification. The retrieval algorithms and the results of each data products will be presented in detail in this paper. The typical cases will also be described and discussed as well, which show the advantages for weather modification research.