Filed Measurement of Water Vapor Distribution near Ground with a Small Raman LIDAR

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Water vapor is one of the most important atmospheric minor constituents, which significantly affects various meteorological phenomenon, such as precipitation, cloud formation, latent heat transport. Therefore, it is expected to develop a state-of-the-art measurement technique of water vapor distribution near such as volcanic fumarole and forest. The former is known as an indicator of volcanic activity. The latter leads to understanding forest-atmosphere interaction. Thus, measurement of water vapor distribution and variation at various fields is of great significance. A Raman lidar is an active remote sensing technique for profiling atmospheric parameters, including water vapor mixing ratio (WVMR). We have developed portable Raman lidars for profiling water vapor, and applied it for a field experiment at volcano and over forest.

First, we have improved performance of the lidar system by installing an electric shutter, and realized a laser control system with a laptop computer for automatic and continuous observation of WVMR at a remote field site.

Vertical and horizontal scanning observations around the volcanic crater at Mt. Aso were carried out on October 2008. The result clearly showed that there are two types of peak of WVMR with and without enhancement of BSR(Back Scatter Ratio). The former comes from fumarole clouds at a volcano, and the latter is cause by evaporation of volcanic lake. To our knowledge, this was the first measurement to distinguish two sorts of WVMRs sources at a volcano.

The observation over forest at Shigaraki was initiated in May 2009. Vertical cross section of water vapor distribution was observed for the night time, over the national forest. WVMR variations of an amplitude of 3.2 (g/kg) were detected, correlated with variations of aerosol backscatter ratio. And this indicates possibility of topographically-affected WVMR variations.

To summarize, we have developed a portable Raman lidar system for future applications, and successfully observed water vapor distribution near ground over a forest and a volcano.