

## Mixed-phase and ice cloud microphysical properties measured with the spectroscopic water Raman lidar RAMSES

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RAMSES, the Raman Lidar for Atmospheric Moisture Sensing, is operated at the Lindenberg Meteorological Observatory (Richard-Aßmann-Observatorium) of the German Meteorological Service (DWD) since 2005. The unique feature of this instrument is its capability to measure the Raman spectrum of the water molecule in all of its three phases, which allows one to determine, in addition to several cloud optical parameters and temperature, the water vapor mixing ratio and the water content of liquid-water, mixed-phase, and ice clouds. Because RAMSES also measures the fluorescence spectrum of atmospheric particles, it can contribute significantly not only to cloud process studies but also to investigations in cloud-aerosol interactions.

Following an overview of the lidar system, a brief introduction is given to the data analysis methods used to calculate cloud water content and to derive particle microphysical properties such as effective particle size. Measurement examples are then presented that demonstrate the scope of RAMSES, including cases of cloud phase transition, cloud supercooling, and mixing of aerosol layers with cloud systems.