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Cloud characterization using a particle-counter dropsonde

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Routine meteorological data is obtained in the atmosphere using disposable radiosondes, giving temperature, pressure, humidity and wind speed. Additional measurements are obtained from dropsondes, released from research aircraft. However, a crucial property not yet measured is the size and concentration of atmospheric particulates, including cloud particles or aerosols. Instead, indirect measurements are employed, relying on remote sensing. In addition, research aircraft can be used in situ, but airborne measurements are expensive, and aircraft use is restricted to near-horizontal profiling, which can be a limitation, as phenomena such convection develop in the vertical direction.

The Centre for Atmospheric and Instrumentation Research at University of Hertfordshire develops light-scattering instruments for the characterization of aerosols and cloud particles. Recently a range of low-cost, miniature particle counters has been created, intended for use with systems such as disposable balloon-borne radiosondes, dropsondes, or in dense ground-based sensor networks. Versions for different particle size ranges exist. They have been used for vertical profiling of aerosols such as mineral dust or volcanic ash. However, a disadvantage of optical particle counters that sample through a narrow inlet is that they can become blocked, which can happen in a cloud, for example. Hence, a different counter version has been developed, which can have open-path geometry, as the sensing zone is defined optically rather than being delimited by the flow system. This counter is currently being used by the UK Met Office in a ground-based fog monitoring network. It has also been adapted for use with radiosondes or dropsondes. The dropsonde version has been successfully tested by launching it from research aircraft together with the so-called KITsonde, developed at the Karlsruhe Institute of Technology, which determines standard meteorological variables and GPS position for transmission back to the aircraft. During the test a warm convective cloud was sampled and characterized in terms of droplet concentration and size distribution.