Geophysical Research Abstracts
Vol. 18, EGU2016-7783, 2016
EGU General Assembly 2016

Optical cloud detection from a disposable airborne sensor

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In-situ measurement of cloud droplet microphysical properties is most commonly made from manned aircraft platforms due to the size and weight of the instrumentation, which is both costly and typically limited to sampling only a few clouds. This work describes the development of a small, lightweight (<200g), disposable, optical cloud sensor which is designed for use on routine radiosonde balloon flights and also small unmanned aerial vehicle (UAV) platforms. The sensor employs the backscatter principle, using an ultra-bright LED as the illumination source, with a photodiode detector. Scattering of the LED light by cloud droplets generates a small optical signal which is separated from background light fluctuations using a lock-in technique. The signal to noise obtained permits cloud detection using the scattered LED light, even in daytime.

During recent field tests in Pallas, Finland, the retrieved optical sensor signal has been compared with the DMT Cloud and Aerosol Spectrometer (CAS) which measures cloud droplets in the size range from 0.5 to 50 microns. Both sensors were installed at the hill top observatory of Sammaltunturi during a field campaign in October and November 2015, which experienced long periods of immersion inside cloud. Preliminary analysis shows very good agreement between the CAPS and the disposable cloud sensor for cloud droplets >5micron effective diameter. Such data and calibration of the sensor will be discussed here, as will simultaneous balloon launches of the optical cloud sensor through the same cloud layers.