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HOLOGondel: A novel in-situ cloud measurement platform on a cable car with a digital holographic imager

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Cloud particle properties observed in-situ are commonly conducted from airborne or ground-based measurements. When compared to airborne measurements, the advantages of ground-based measurements are a higher spatial resolution and much less costly to perform. However, ground-based observations allow only single-point measurements within a cloud.
To overcome this disadvantage, a novel measurement platform with a digital holographic imager has been developed to allow in-situ cloud observations on the roof of a cable car cabin. With a traveling velocity of a cable car of a few m/s, such a measurement platform yields a spatial resolution comparable to those of ground-based measurements. In addition, it is possible to obtain vertical profiles of the microphysical properties within the cloud, because of the vertical distance covered by the cable car of approximately 800m.
The major technical challenges for such a measurement platform are the lack of an external power supply and the additional weight constrain on a cable car cabin. To allow continuous operation for eight hours with a battery and to stay within the weight limit of 25kg at the same time, a compact design with carefully chosen material and components with a low power consumption was necessary.
The new measurement platform HOLOGondel is equipped with a HOLographic Imager for Microscopic Objects (HOLIMO 3G). Digital in-line holography offers the advantages of measuring simultaneously an ensemble of cloud particles within a well-defined detection volume over a large range of particle size. The image captured, a hologram, yields information about the three-dimensional position, size and a shadow-graph of each particle within the detection volume. The HOLIMO 3G instrument is equipped with a 30MP camera and a 1.8 times magnifying, both-sided telecentric lens system. At a frame rate of six pictures per second a sample volume rate of about 100 cm3s-1 at a maximum resolution of 7 μm is achieved. This configuration allows to measure the vertical profiles of the number concentration and size distribution of liquid cloud droplets and ice crystals, the spatial scale of mixing between these two and the partitioning with respect to particle size. In addition, auxiliary measurements of the temperature, relative humidity and GPS position of the captured images are conducted.
A first field campaign will be performed at the Eggishorn in the Bernese Alps from January until March 2015. With its short distance from the research station Jungfraujoch (JFJ) there is a chance to measure the same air masses twice (concurrent measurement with the HOLIMO 3M instrument at JFJ). The comparison of these measurements will contribute to a better understanding of the spatial and temporal evolution of orographic MPCs.