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Measuring atmospheric aerosols of organic origin on multirotor Unmanned Aerial Vehicles (UAVs).

Claudio Crazzolara, Andreas Platis, and Jens Bange
Eberhard Karls Universität Tübingen, ZAG, Germany (claudio.crazzolara@student.uni-tuebingen.de)

In-situ measurements of the spatial distribution and transportation of atmospheric organic particles such as pollen and spores are of great interdisciplinary interest such as:

- In agriculture to investigate the spread of transgenetic material,
- In paleoclimatology to improve the accuracy of paleoclimate models derived from pollen grains retrieved from sediments, and
- In meteorology/climate research to determine the role of spores and pollen acting as nuclei in cloud formation processes.

The few known state of the art in-situ measurement systems are using passive sampling units carried by fixed wing UAVs, thus providing only limited spatial resolution of aerosol concentration. Also the passively sampled air volume is determined with low accuracy as it is only calculated by the length of the flight path.

We will present a new approach, which is based on the use of a multirotor UAV providing a versatile platform. On this UAV an optical particle counter in addition to a particle collecting unit, e.g. a conventional filter element and/or a inertial mass separator were installed. Both sampling units were driven by a mass flow controlled blower. This allows not only an accurate determination of the number and size concentration, but also an exact classification of the type of collected aerosol particles as well as an accurate determination of the sampled air volume. In addition, due to the application of a multirotor UAV with its automated position stabilisation system, the aerosol concentration can be measured with a very high spatial resolution of less than 1 m in all three dimensions.

The combination of comprehensive determination of number, type and classification of aerosol particles in combination with the very high spatial resolution provides not only valuable progress in agriculture, paleoclimatology and meteorology, but also opens up the application of multirotor UAVs in new fields, for example for precise determination of the mechanisms of generation and distribution of fine particulate matter as the result of road traffic.