



## **Application of airborne measurement system for monitoring vertical profiles of meteorological parameters, black carbon and particulate matter concentration for urban area of Kraków.**

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Air quality in urban and surrounding areas is a major public health problem and a long-term concern to citizens. Recent report of air quality in Europe [1] indicates that many Polish cities do not meet the requirements of air quality standards in European Union [2]. In case of Krakow, many initiatives aiming at the emission reduction have been undertaken to improve the air quality in the city, however, this is more complex problem which depends not only on the distribution and efficiency of pollution emission sources but also on local meteorological conditions.

Here we present results of vertical profile measurements conducted by airborne platform based on hexacopter equipped with set of sensors enabling to measure vertical profiles of air temperature, relative humidity as well as three fractions of particulate matter (PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>) and concentration of black carbon. The measurement system is based on Arduino compatible platform, responsible for communication with the sensors and logging the measurements in the memory card and sending live information to the ground station using 433MHz radioline. The measurement system is powered by a drone battery. For this purpose a step-down converter is used which reduces and stabilizes the input voltage to 5 V. Temperature, relative humidity and atmospheric pressure is measured by combined digital humidity, pressure and temperature sensor BME280 manufactured by BOSCH [3]. Additionally measuring system is equipped with thermocouple type T using for fast response temperature measurement. For PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> measurements a PMS7003 low cost sensor manufactured by Plantower based on light scattering method has been used. To reduce the impact of high humidity and low air temperature on PM measurement, air inlet of Plantower sensor is heated. In addition, to ensure that the air flow is not disturbed, the air inlet is equipped with a cap providing a laminar flow during the climb of the drone. Concentration of black carbon is measured by Aethlabs AE51 aethalometer [4]. It measures the rate of change in absorption of transmitted infrared light through the filter collecting particulate matter. Preliminary results obtained by described system allowed to observe evolution of convective boundary layer after sunrise associated with accumulation of pollutants close to the upper limit of the convective layer.

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