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USEFULNESS OF UAV-MOUNTED MULTISENSORS SYSTEM FOR IN SITU ATMOSPHERIC MEASUREMENT: A CASE STUDY FROM WROCŁAW, POLAND

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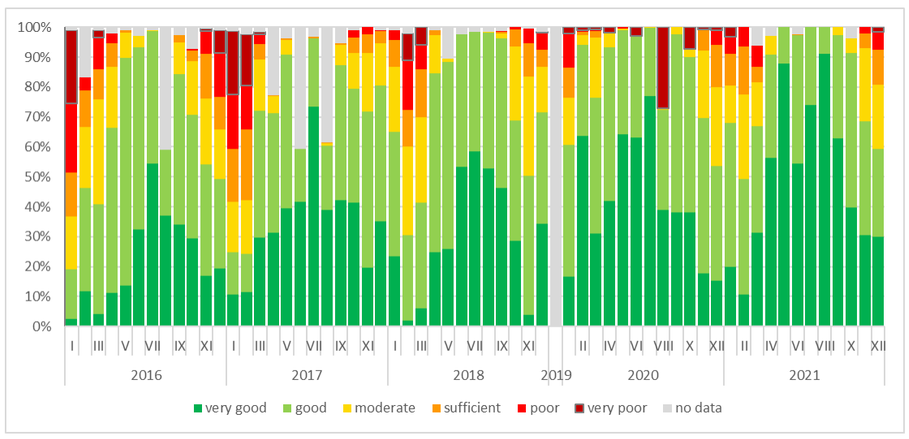
INTRODUCTION

Air pollution, especially particulate matter (PM), is one of the most serious environmental threats worldwide. It is challenging in terms of both public health, impact on climate, and the reduction of visibility. The assessment of spatial variability of PMx allows us to understand better the processes cause the smog episodes, and may also be an additional element for the validation the results of dispersion model. The study presents the results of measurements of basic meteorological parameters and air pollution involving the multi-sensors system. A Matrice 600 hexacopter with an installed environmental head was used as the measurement platform. This system enables us to measure the concentrations of PM2.5, PM10, air temperature and humidity.



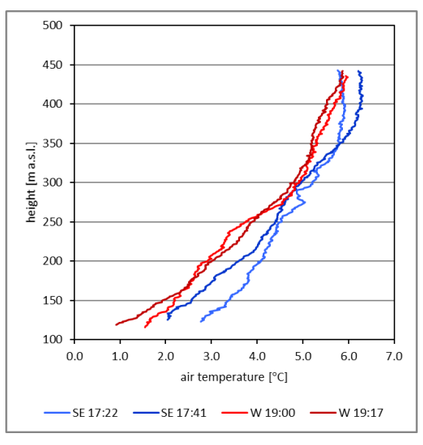
Wrocław, Poland - site of measurements

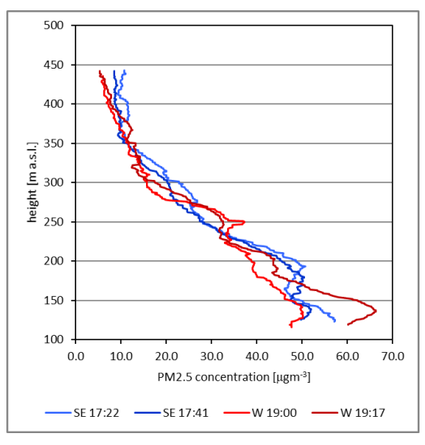
- *Air quality below UE standards*
- *average annual PM10/PM2.5 concentrations slightly below UE permissible level*
- *(generally) average number of days above limit value for PM10: 40 – 65 per year (UE norm – 35 days) (depending of severity of a winter)*
- *limited information about the air quality in Wrocław area (only three automatic measurements stations – two managed by GIOŚ and one by University of Wrocław station*

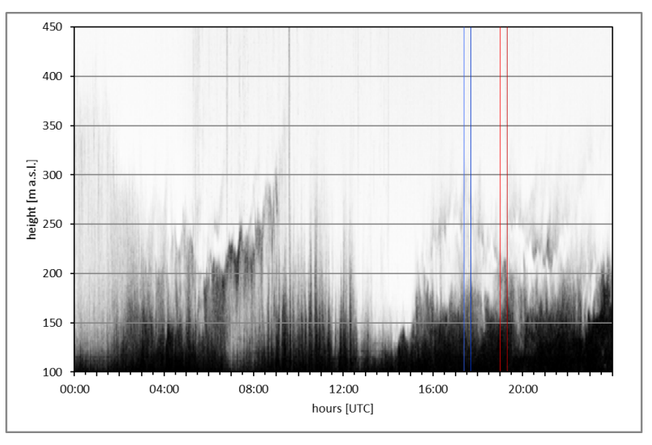
UAV MEASUREMENTS

Customized Matrice 600Pro hexacopter;
Prototype environmental head developed by Optimum Tymiński Co. and Dept. of Clim. and Env. Prot. UWr;
Measurement of PM10, PM2.5, O3 concentration, air temperature and humidity, registration of flight parameters;
Flight up to 40 min; distance 2 km;

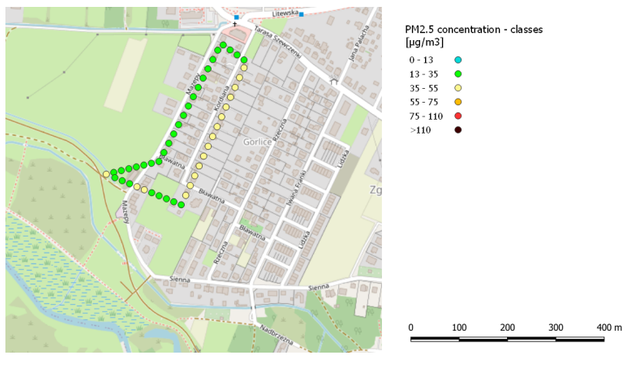
RESULTS







Vertical profile of air temperature, and PM2.5 concentration, and sodar echogram (dark horizontal areas indicate inversion layer, so-called "spiky echoes" during day indicate convection), results of horizontal profiling (f-g). Flights on November 24, 2020.
As indicated by the sodar data, dyring the nightthe inversion was characterized by a wavy structure caused by stronger mixing processes



CONCLUSIONS

Research on the atmospheric boundary layer involving sensors mounted on drones is an interesting alternative to traditional measurement platforms, such as profile in-situ measurements or remote sensing technics. They can be used in various environments, e.g., in polar regions, in varying terrain, or in urban areas .
The studies indicate, first of all, the influence of the boundary layer structure on the concentrations of pollutant and the strongly vertical variability of the parameters analyzed in the vertical profile.
Our solution, by simultaneous measurements of meteorological variables and air quality, allows for a detailed analysis of the influence of the structure of the ABL on air quality. It also could complements remote sensing measurements

The research was funded within the LIFE-MAPPINAIR/PL Project