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Temperature, humidity and wind measurements using small quadrotor UAS platform

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Vertical profile atmospheric data have critical influence both on numerical weather prediction and nowcasting methods. Besides the well-established rawinsonde measurements, manned and unmanned aerial vehicles have an increasing role as the carrying platform for such observations, especially for experimental purposes.
The development of the meteorological instrumentations for UAS started in Hungary in international cooperation at the beginning first decade of the XXI century. Temperature, moisture and wind profiles were measured in the PBL. Investigation of the turbulence with 5-hole probe sensor system also started. Mapping of differences of temperature and moisture profiles in the urban and rural environments especially in the case of transient stratifications were also performed using quadrocopter measurements in Szeged (Southern part of Hungary).
A new research program is designed to develop a new UAS platform for weather monitoring in the lower 3-4 km. Purchase of the fixed and rotary wing UAS are in progress and the development of sensors have also started.
Results from the earlier surface layer and PBL profile measurements (profiles of the transient stratification) and the first results of this new project especially wind measurements with small quadrocopters will be presented. Five different UAS wind profile measurement methods have been investigated; their advantages and disadvantages have been compared and analyzed.
Comercial quadrotor RPAs (Remotely Piloted Aircrafts) can be piloted in attitude mode, i.e. without GNSS positioning, but maintaining horizontal altitude resulting in a zero airspeed equilibrium state. The ground speed of such a drone tends to be the ambient wind speed, similarly to pilot balloons and rawinsondes, yielding an opportunity for direct upper air wind measurements. On the other hand, the inertia and the load factor of a drone are several order of magnitude higher than that of a balloon, resulting in an unmeasured (unknown?) higher response time. Using hot wire anemometry, the relative airspeed as a deviation from wind speed can be observed and this can be applied as a measure of the wind observation error. The preliminary results of field measurements will also be presented.