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Study of surface energy budget and test of a newly developed fast photoacoustic spectroscopy based hygrometer in field campaign Szeged (Hungary)

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A micrometeorological field measurement campaign dedicated to study the surface energy budget and the structure of the boundary layer focusing on the transient layer forming periods during night-time was organized in the period of 10th of November to 3rd of December 2013 in the nearby of Szeged, Hungary. A temporary micrometeorological measurement station was set up at the coordinates N:46.239943; E:20.089758, approximately 1700 m far from a national meteorology station (N:46.255711; E:20.09052).

In the experimental micrometeorological site different types of instruments were installed to measure numerous parameters:

- standard meteorological measurements (p, T, wet, wind speed and direction at three different levels, relative humidity at two levels and absolute humidity at one level)
- radiation budget components
- surface temperature and leaf wetness
- soil temperature, moisture and heat flux into the deeper soil layer
- eddy-covariance measurements (t, H, LE CO_2) at 3 m level using Campbell open-path IRGA (EC150) system.

At the national meteorology station (http://adatok.geo.u-szeged.hu/?lang=eng) besides their standard measurement equipment and measurement routine a SODAR was installed and continuously operated.

These ground based measurements were combined with and supported by UAV, quadcopter and tethered balloon based vertical profile measurements of p, T, rh.

For this measurement campaign as a modification of a previously developed airborne ready dual channel hygrometer, a fast photoacoustic spectroscopy based hygrometer was developed for absolute humidity measurements. The estimated response time of the system is faster than 15 Hz, which was achieved by the replacement of the data acquisition system and by recording the raw photoacoustic signal sampled at rate of 48 kHz for post-processing. During the campaign this new system was compared to a TDL system commercially available at Li-COR Inc.

Besides the testing of the newly developed fast photoacoustic hygrometer the main goal of the present study is the determination of the total energy budget and the accuracy of its closure. Results and consequences of the measurements will be presented.