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Determination of temperature and humidity profiles in the atmospheric boundary layer by fast ascending UAVs

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Meteorological UAVs (unmanned aerial vehicles) represent an economical and flexible platform for measurements of temperature and humidity in the atmospheric boundary layer. A corresponding measurement system is under development at the University of Bergen. The system, SUMO (small unmanned meteorological observer), has proven promising results in the field campaign FLOHOF in the central parts of Iceland, summer 2007.

Due to energy related issues (i.e battery capacity), a compromise has to be done between ascent/descent speed and accuracy of the measurements when profiling the atmosphere with an ultra light UAV such as SUMO. The resulting energetically optimised ascent/descent speed is in the order of 10m/s, a relative high speed compared to e.g radiosondes which have a typical ascent speed of around 5 m/s.

Since the temperature and humidity instruments need a certain time to adapt to their ambient environment the result of the high vertical speed is a warm bias in ascent and a cold bias in descent data. Measurements taken during FLOHOF show that the associated time lag of the sensors is of a rather deterministic nature and of a noticeable magnitude worth to be corrected. A numerical method based on digital filters is suggested for this purpose. The method is investigated on synthetic profiles of temperature and humidity and thereafter applied on real profiles from the FLOHOF campaign.

Temperature and humidity profiles from the SUMO system are presented and com-

pared with the data of another uav system KALI together with data from a tethered balloon.