



Investigation Of The Flow Over An Escarpment With Regard To Wind-Energy Research Using Small Remotely Piloted Aircraft.

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The German government has made sustainable energy a high priority social task in the 21st century, and this requires high-efficiency renewable energy technologies which can compete economically with nuclear and fossil-fuel energy resources. Wind energy is of primary importance for renewable electricity generation and large investments are being made in the field. In Southern Germany the best potential sites for wind energy are in complex terrain. However the wind flow in complex terrain is not well understood, and it is not easy to model or predict, which is important for renewable electricity generation.

In a joint effort by several research groups of the WindForS (www.windfors.de) competence cluster, the flow over an escarpment in the Swabian Alb is currently investigated in detail as a potential site for a wind turbine test field. A variety of instruments is installed on site, including a 100 m meteorological tower equipped with sonic anemometers, wind lidars, and a sodar/RASS system. The Environmental Physics working group of the University of Tübingen is collecting airborne in-situ measurements of 3D-wind vector with multiple remotely piloted aircrafts (RPA) on several days of intensive measurements. The goal is to study the airflow in different regimes of thermal stability, different wind speeds and wind directions, as well as different seasons with varying land-use and thus surface roughness, in this complex terrain.

As a flight strategy on days of intensive measurements, two RPAs are operated simultaneously. One RPA is measuring the vertical profile of the undisturbed airflow upstream the escarpment, while the other RPA is measuring in a fine vertical racetrack grid directly over the cliff and further downstream, in order to detect potential flow accelerations, separation, and reattachment. Results of these measurements will be used to initiate and validate a CFD model of the area. Preliminary results of several days of measurements will be presented.