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Applications of the Remotely Piloted Aircraft (RPA) 'MASC' in Atmospheric Boundary Layer Research

Norman Wildmann, Andreas Platis, David-James Tupman, and Jens Bange

Eberhard-Karls-University Tübingen, Center for Applied Geosciences, Tübingen, Germany
(norman.wildmann@uni-tuebingen.de)

The remotely piloted aircraft (RPA) MASC (Multipurpose Airborne Sensor Carrier) was developed at the University of Tübingen in cooperation with the University of Stuttgart, University of Applied Sciences Ostwestfalen-Lippe and 'ROKE-Modelle'. Its purpose is the investigation of thermodynamic processes in the atmospheric boundary layer (ABL), including observations of temperature, humidity and wind profiles, as well as the measurement of turbulent heat, moisture and momentum fluxes.
The aircraft is electrically powered, has a maximum wingspan of 3.40∼m and a total weight of 5-8∼kg, depending on the battery- and payload. The standard meteorological payload consists of two temperature sensors, a humidity sensor, a flow probe, an inertial measurement unit and a GNSS. The sensors were optimized for the resolution of small-scale turbulence down to length scales in the sub-meter range. In normal operation, the aircraft is automatically controlled by the ROCS (Research Onboard Computer System) autopilot to be able to fly predefined paths at constant altitude and airspeed. Only take-off and landing are carried out by a human RC pilot.
Since 2012, the system is operational and has since then been deployed in more than ten measurement campaigns, with more than 100 measurement flights. The fields of research that were tackled in these campaigns include sensor validation, fundamental boundary-layer research and wind-energy research. In 2014, for the first time, two MASC have been operated at the same time within a distance of a few kilometres, in order to investigate the wind field over an escarpment in the Swabian Alb. Furthermore, MASC was first deployed off-shore in October 2014, starting from the German island Heligoland in the North Sea, for the purpose of characterization of the marine boundary layer for offshore wind parks. Detailed descriptions of the experimental setup and first preliminary results will be presented.