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A new airborne tandem measurement platform for cloud-radiation interaction studies: The AIRcraft Towed Sensor Shuttle (AIRTOSS)

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The Earth's radiation budget is strongly driven by the radiative impact of clouds, which in turn depends on the clouds' microphysical and macrophysical properties. Thus, simultaneous measurements of these properties are required, whereby the collocation of the probing is essential. Therefore, a new airborne tandem measurement platform has been developed, consisting of (1) a Learjet 35A research aircraft and (2) the AIRcraft Towed Sensor Shuttle (AIRTOSS). AIRTOSS is an instrumented drag-body, which is detached from, towed by, and retracted onto the Learjet. The towing cable can be as long as four kilometres, the weight that can be carried by AIRTOSS is in the range of 40 kg. While the Learjet is mainly equipped with radiation instruments, the AIRTOSS carries instrumentation to measure cloud microphysical properties and flight attitude of the AIRTOSS.
We report on a 'proof-of-concept' campaign in September 2007 from Northern Germany where three test flights with AIRTOSS were performed. Several manoeuvres were flown to prove its attitude stability. The tandem constellation has been tested and approved for altitudes up to 7620 m, air speeds varying between 90 and 205 m/s, and towing cable lengths up to 4 km. The AIRTOSS flight attitude data reveal certain sensitivities for specific flight manoeuvres such as turns, airspeed and altitude changes, and towing cable length changes.
Besides the test for manoeuvre compatibility also simultaneous observations of cloud microphysics and radiation have been made in and above stratocumulus clouds. These measurements confirm the suitability of the AIRTOSS for cloud-radiation interaction studies.
The presentation shall give an overview of the tandem measurement platform. Measurements of AIRTOSS flight attitude as well as observations of cloud microphysical and radiative properties will be discussed. An outline of future plans will be given, e.g. the implementation of radiation sensors onto the AIRTOSS.