First Airborne Lidar Measurements of Methane and Carbon Dioxide Applying the MERLIN Demonstrator CHARM-F

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CHARM-F is the new airborne four-wavelengths lidar for simultaneous soundings of atmospheric CO_2 and CH4. Due to its high technological conformity it is also a demonstrator for MERLIN, the French-German satellite mission providing a methane lidar. MERLIN's Preliminary Design Review was successfully passed recently. The launch is planned for 2020. First CHARM-F measurements were performed in Spring 2015 onboard the German research aircraft HALO. The aircraft's maximum flight altitude of 15 km and special features of the lidar, such as a relatively large laser ground spot, result in data similar to those obtained by a spaceborne system. The CHARM-F and MERLIN lidars are designed in the IPDA (integrated path differential absorption) configuration using short double pulses, which gives column averaged gas mixing ratios between the system and ground. The successfully completed CHARM-F flight measurements provide a valuable dataset, which supports the retrieval algorithm development for MERLIN notably. Furthermore, the dataset allows detailed analyses of measurement sensitivities, general studies on the IPDA principle and on system design questions. These activities are supported by another instrument onboard the aircraft during the flight campaign: a cavity ring down spectrometer, providing in-situ data of carbon dioxide, methane and water vapor with high accuracy and precision, which is ideal for validation purposes of the aircraft lidar. For the near future, detailed characterizations of CHARM-F are planned, further support of the MERLIN design, as well as the scientific aircraft campaign CoMet.