Research Highlight

'Airborne lidar overlap correction: how we spin an aircraft in circles to characterize an instrument'

Summary

A lidar is a remote sensing instrument to detect and measure aerosols and clouds in the atmosphere. It is often subject to an instrumental artefact in the atmospheric layers that are closer to the instrument (the near range) due to the incomplete overlap region (where the receiver "does not see" the entire laser beam), whereas it is free of such issues in the far range. Knowledge of the "overlap correction function" of the lidar system allows to correct and better exploit the observations.

Research aircraft are powerful tools for the study of atmospheric processes and constituents, and have been used for more than 70 years to further our understanding of meteorology and the atmospheric sciences. During two flights, an innovative method was exploited to characterize the lidar on-board the United Kingdom's atmospheric research aircraft (the Facility for Airborne Atmospheric Measurements, or FAAM). The aircraft was made to spin in circles (orbits) to change the viewing angle of the instrument. By progressing through steeper orbits (subjecting the scientists on-board to an acceleration of up to 2g) a range of increasing viewing angles was achieved. A number of calculations making use of linear regression permitted to reconstruct the overlap correction function of the instrument. It also permitted to detect some changes that occurred in the instrument itself, between the two flights.

Impact

The knowledge of the overlap correction function permits extending the usable portion of the observations from a lidar instrument in the near-range. In turn, this can extend the application of such an instrument: if deployed on the ground, the correction can yield a better understanding of the atmospheric boundary layer. For an airborne system, it can improve the synergy with other measurements taken on-board and help characterize the aerosol plumes in which the aircraft is flying. In summary, the authors

Authors' bios

Dr. Mariana Adam is a senior researcher at the National Institute of Research and Development for Optoelectronics - INOE 2000, where she mostly works on aerosol optical properties as retrieved from lidar. When this research was performed, she worked at the Met Office (the United Kingdom's meteorological agency), where she was the lidar expert for the implementation of the UK lidar network for volcanic ash monitoring.

propose a new protocol for the characterization of such systems, which can be applied for airborne deployments. For airborne instruments, special manoeuvers of the aircraft are proposed in combination with the proposed calculation method. With this research, the authors improve our exploitation of atmospheric instrumentation that is used, and contribute to further our understanding of meteorology, air quality and climate change.

Prof. Franco Marenco is an associate professor at the Climate and Atmosphere Research Center (CARE-C) of the Cyprus Institute, where he leads the Remote Sensing group. When this research was performed, he worked at the Met Office (the United Kingdom's meteorological agency), where he specialized in the airborne and spaceborne atmospheric sciences.

Reference

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