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Airborne lidar observations of Saharan dust during FENNEC

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In June 2011 and June 2012, the Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 research aircraft took part in the Fennec campaign. The main purpose was to quantify and model boundary layer and aerosol processes over the Saharan "heat low" region, the greatest dust region during summer. Although the central Sahara is extremely remote, the meteorology of this region is vital in driving the West African monsoon, and the dry and dusty air layers are closely related to the formation of Atlantic tropical cyclones.

In this presentation, we shall characterise these air layers using data collected with the on-board lidar together with dropsondes. The interpretation of lidar signals in this particular geometry represents a challenge (nadir observations of thick layers), but we shall show that a suitable data inversion framework is possible under certain assumptions. The quality of the lidar data will be assessed using in-situ data from the nephelometer and optical particle counters.

Deep air layers containing dust have been observed up to altitude of 5-6 km above mean sea level. The analysis of temperature and dew point profiles are used to identify the boundary layer and residual layer tops, and in conjunction with lidar observations this serves to quantify the dust content of both layers. An aerosol-laden residual layer is usually found during the campaign at an altitude of 2-6 km in the morning hours, with little aerosol below. The aerosol in the boundary layer is seen to develop later when solar heating of the surface induces turbulence until in the late afternoon the top of the boundary layer reaches up to $\sim$ 6 km. Clouds embedded in aerosol layers and aerosol-cloud interactions have also been revealed. Dust aerosol has been observed in most cases, but a thin polluted non-dusty layer has been observed during one flight.