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Overview and Insights gained by Airborne Observations over the Sahara during Fennec

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The Fennec research program involves a diverse range of observations and modelling activities which were designed to tackle the data sparse regions of the Sahara desert. This area can be considered as one of the final frontiers in observational challenge for climate scientists. Weather and climate prediction models show significant systematic errors over the Sahara desert manifested as differences in radiation reaching and leaving the surface, surface temperature, winds, and in representation of the boundary layer. The remoteness of this hostile environment means that it has never been the subject of concentrated surface and airborne observations which are required to reduce these uncertainties.

During June 2011 and June 2012 over 200 hours of scientific flying was carried by the UK BAe146 FAAM aircraft, and in 2011 the UK aircraft flew a number of coordinated missions with the SAFIRE Falcon D-20 aircraft. These joint missions permitted extended temporal coverage of specific atmospheric features in the region not possible with a single aircraft. The second season of flying in June 2012 was subjected to two dominant weather regimes. Initially the operating region was dominated by maritime flow, which was then replaced by the climatological deep Saharan heat low pressure system which was in place throughout the 2011 IOP. This has provided opportunities to compare these different regimes and the transition between them.

We will outline the advantages of using an aircraft as observational platforms, the ability to link together spatial and temporal features across the vast arena of the Sahara which are simply not accessible through fixed ground sites or even satellites. We will provide details of the comprehensive instrumentation payload, overview of the flight schedule & meteorology behind flights in both 2011 and 2012. We report some of the key findings which were only accessible to us through the use of airborne platforms. These include the first observations of heat flux profile in the Saharan Boundary layer, detailed vertical profiles of mineral dust size distribution both near-field and following various periods of atmospheric transport, insitu sampling of an aged haboob, and coordinated remote sensing LIDAR and radiation measurements with insitu observations (only possible with two aircraft).