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An overview of observations from Fennec supersites: The Saharan Heat Low and its ventilation

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During summer over the Sahara, intense insolation and low evaporation produces the hottest and deepest (up to 6km) boundary layers on Earth, and the associated development of an extensive region of low surface pressure, the Saharan Heat Low (SHL). The SHL plays a pivotal role in the West African Monsoon and is co-located with highest dust aerosol loading anywhere in the Earth's atmosphere. Climate and weather forecast models typically have large biases and uncertainties in representation of the SHL. The Fennec field campaign provided uniquely detailed observations of the structure of the Saharan atmosphere and the SHL feature, with supersite-1 (SS1) located close to the SHL centre and SS2 towards its western edge and more affected by Atlantic ventilation. Here we report on the characteristics of the SHL as observed during the Fennec intensive observation period of June 2011. The paper summarises (i) the synoptic and intraseasonal evolution of the SHL, notably the shift from a 'maritime' phase to a 'heat low' phase (ii) the impact of this evolution on the structure of the Saharan Atmospheric Boundary Layer (SABL) at SS1 and SS2 (iii) the nature of ventilation of the SHL around its peripheries (iv) the mean diurnal cycle of the SABL including the development of Low-Level Jet features. Using these data as a benchmark we find that the degree to which models represent SHL ventilation processes is partly a function of scale with weather forecast but not climate scale models able represent many of the key features of ventilation, except those associated with cold pool flows.