Geophysical Research Abstracts
Vol. 19, EGU2017-14909, 2017
EGU General Assembly 2017

Observations of cross-Saharan transport of water vapour via cycle of cold pools and moist convection

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Very limited observational data has previously limited our ability to study meteorological processes in the Sahara. The Sahara is a key component of the West African monsoon and the world's largest dust source, but its representation is a major uncertainty in global models. Past studies have shown that there is a persistent warm and dry model bias throughout the Sahara, and this has been attributed to the lack of convectively-generated cold pools in the model, which can ventilate the central Sahara from its margins.

Here we present an observed case from June 2012 which explains how cold pools are able to transport water vapour across a large area of the Sahara over a period of several days. A daily cycle is found to occur, where deep convection in the evening generates moist cold pools that then feed the next day's convection; the new convection in turn generates new cold pools, providing a vertical recycling of moisture. Trajectories driven by analyses can capture the general direction of transport, but not its full extent, especially at night when cold pools are most active, highlighting the difficulties for models to capture these processes. These results show the importance of cold pools for moisture transport, dust and clouds in the region, and demonstrate the need to include these processes in models to improve the representation of the Saharan atmosphere.