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A new high-resolution central Saharan dust source map from automated satellite dust plume tracking

Ian Ashpole and Richard Washington

Climate Research Lab, School of Geography and the Environment, University of Oxford, United Kingdom
(ian.ashpole@ouce.ox.ac.uk)

In this paper we outline a new objective dust source detection method for the central Sahara, based on the automated tracking of individual dust plumes in 15 minute, 0.03 degree resolution data from the Spinning Enhanced Visible and Infrared Imager (SEVIRI). The method is used to map the origin of summertime dust storms in the central Sahara for June to August 2004 – 2010. It reveals the sources of these events in unprecedented detail, allowing for the identification of specific, highly active source areas for the first time. The study of collocated surface features reveals that many of the sources are likely associated with palaeo-lakes and outwash plains. Extensive non source areas are associated with low albedo and elevated terrain, pointing to the mountainous regions of the Sahara. Additionally, sand seas are not identified as important source areas, but their margins can be. The automated tracking method also facilitates analysis of the transport direction of dust clouds from key source regions, and the inference of emission mechanisms. It is found that there are two broad domains within the central Sahara: one in southwest Algeria and northwest Mali, characterised primarily by transport to the southeast and very likely dominated by low-level jets embedded in the northeasterly Harmattan winds; and a second in southern Algeria, northeast Niger and northwest Mali where there is no preferred transport direction and a strong potential association between dust events and deep convection, pointing towards cold pool outflows as the likely deflation mechanism.