

Soudano-Saharan Depressions and their Importance for Precipitation and Dust: A New Perspective on a Classical Synoptic Concept

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According to a classical synoptic concept Soudano-Saharan depressions (SSDs) are surface lows, which track westward over tropical West Africa, curve anticyclonically across the Sahara and may then transform into eastward moving Mediterranean cyclones. Occurrence frequency and track location undergo a marked seasonal cycle. Interactions between troughs in the upper-level westerlies and mid-level African easterly waves have been suggested as a mechanism for their formation. SSDs have been reported to be associated with dust storms and precipitation over northern Africa.

This paper presents the first-ever systematic investigation of SSDs using reanalysis and satellite data. Depressions are identified and tracked objectively based on closed contours in 0000 UTC fields of 925 hPa geopotential height from the European Centre for Medium-Range Weather Forecasts ERA-Interim reanalysis (1989–2008). To classify as potential SSDs, tracks must (1) start to the south of 20°N, (2) intersect 15°–30°N, 10°W–30°E, (3) cover a meridional distance of at least 10° latitude and (4) have a minimum lifetime of 24 hours.

Even with a relatively low threshold of 4 gpm only 50 potential SSDs are found (annual average 2.5, monthly range 0–6). Lagrangian and Eulerian composite analyses reveal that the identified systems (1) are mostly shallow lee troughs of the Central Saharan and Atlas Mountains during the warm season without a well-defined cyclonic wind field, (2) do not show the seasonal track variation described in the literature, (3) mostly occur in association with high-pressure anomalies over the Mediterranean Sea and (4) are not associated with significant increases in dustiness and precipitation. These results strongly suggest that the disturbances described as SSDs do not manifest themselves as traceable low-level depressions, calling for a fundamental revision of the classical concept in the literature.