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Identification and Tracking of Soudano-Sahelian Depressions: Case Studies and Climatology

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According to a classical synoptic concept Soudano-Saharan depressions (SSDs) are surface lows that move on seasonally varying, westward tracks over tropical West Africa, curve anticyclonically across the Sahara, and may then transform into eastward moving Mediterranean cyclones. SSDs have been reported to be associated with dust storms and heavy precipitation over North Africa.

Here we present the first-ever attempt to investigate SSDs in an objective way with modern re-analysis and satellite data. Cyclones are identified and tracked from 6-hourly ECMWF ERA Interim reanalysis (1989–2008) using the cyclone identification and tracking algorithm developed by Wernli and Schwierz (2006) adapted to conditions over northern Africa. The identification is based on geopotential fields at 925 hPa instead of surface pressure to account for the orography over Africa. Anomalies are taken instead of absolute fields to minimize impacts of the strong diurnal cycle. The routine identifies cyclones by their minima in the anomaly field. At every 6-hr time step each identified cyclone is surrounded by the outermost closed contour line, and geographical coordinates, core pressure, and area are recorded. For cyclone tracking, individual tracks are composed by linking identified minima of the actual time step to minima identified in the previous time step. The distance of related minima is required to be minimal and smaller than a predefined threshold.

Criteria based on lifetime and track are applied to select SSDs from all identified cyclones. A climatology of SSDs has been computed and will be investigated with regard to lifetime, track density, core pressure, annual cycle and interannual variability. Case studies of individual identified SSD tracks related to serve weather conditions like heavy precipitation, thunderstorms, and dust storms as reported by e.g. weather stations and indicated by satellite observations will be analyzed to improve the understanding of the development, tracking and lifetime of SSDs.

Wernli, H., C. Schwierz, 2006: Surface cyclones in the ERA-40 dataset (1958-2001). Part I: Novel identification method and global climatology. J. Atmos. Sci., 63, 2486-2507.