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South Africa's agricultural dust sources and events from the MSG SEVIRI record

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Our aim was to determine South Africa's major dust sources using the MSG (Meteosat Second Generation) SEVIRI (Spinning Enhanced Visible and Infra-red Imager) image record from 2006-2016. A total of 334497 images were examined, which revealed 178 discrete dust plumes on 75 dust-producing days. These originated largely from the Free State to the north of Bloemfontein. Landsat derived National Geospatial data suggests that emission areas consist mostly of grass and low shrublands as well as commercial rainfed agriculture.

The dust emission season from June to January overlaps with the dry season and coincides with the maize harvest period. 2015 and 2016 saw almost half of all event days in the 11-year record, which is matched by a severe drought index (SPEI Standardised Precipitation-Evapotranspiration Index) and strong winds (ERA5). This period is also accompanied by a below average NDVI (Normalized Difference Vegetation Index) response for cropland areas, while DAFF (Department: Agriculture, Forestry and Fisheries) crop data reports a notable decline in Free State maize cover from 1.2 to 0.6 million hectares and a pronounced increase in fallow land from 140 thousand to 790 thousand hectares over the same time span.

Dust events adhere to distinct diurnal patterns, are almost entirely midday occurrences and are accompanied by hourly average windspeeds of up to 11 m s^{-1}. HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) suggests that aerosols would largely head towards the Indian Ocean with the passing of cold fronts. South Africa's major dust sources in the SEVIRI record appear to be mostly anthropogenic in nature and a function of both land cover and land management practices associated with rainfed agriculture on soils rich in silt and sand. The soil textures in the Free State, especially those associated with arenosols extend into the wider drier interior, including the Kalahari, where future climate scenarios have predicted increases in dust emissions from both soils and dunes. Notwithstanding other land-use practices, we would argue that the 2015-2016 dust season in South Africa provides an insight into potential future regional scenarios, given increases in drought, associated bare cover and an increase in windiness.