Geophysical Research Abstracts
Vol. 18, EGU2016-5838-1, 2016
EGU General Assembly 2016

Remote sensing of dust source heterogeneity; Case study Etosha Pan, Namibia

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Etosha Pan is a large playa situated in semi-arid northern Namibia. It sits in a basin 1000 m amsl, has a surface area of approximately 5000 km2. This playa has been identified as one of the largest sources of mineral dust in the Southern Hemisphere.

To both map dust emission events and uncover sub-basin scale controls on mineral dust emissions, multiple time-series of remote sensing data (2004-2014) for this playa are presented. These depict: (a) mineral aerosol concentration in the vicinity of the playa, and (b) the surface hydrology of the playa basin. Seasonal wind velocities/direction data are also presented (ERA-Interim), and together with aerosol characterization, they depict clear seasonality in dust emission/transport, significant inter-annual variability in aerosol loadings, and evidence of inter-event variability in plume chemistry.

The gross spatial and temporal behavior of the dust cycle of this ephemeral lake can be directly related to inherent variability in groundwater depth and periods of surface inundation. In most years, surface water interacts with < 30% of the playa surface; often for relatively short periods (< 3 months). However, Etosha Pan can also experience extensive periods of flooding and inundation (>80% basin cover, lasting for up to 12 months). Data from these wet and dry periods, in conjunction with locations of observed dust plumes emanating from the playa surface, allow us to identify direct links between dust emission and surface hydrology; thereby allowing, for the first time, a characterization of the emission potential of the playa surface. These observations have provided a clear context for both field investigation and modelling of this dust source as part of the DO4-Models (Dust Observations for Models) project that aimed to understand the variability in dust emission processes at relevant scales for climate modelling.