



Understanding and constraining global controls on dust emissions from playas

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Playas are ephemeral, endorheic lake systems that are common in arid regions. They have been identified as both regionally and globally significant sources of mineral dust. Emissions of dust from large playas can therefore impact significantly on regional climate through a range of land/atmosphere interactions. However, not all playas have or will emit dust, and those that do emit dust rarely do so consistently. Thus, global models that target ephemeral lakes at source areas often struggle to model the emission characteristics of the locations accurately. It is clear that our understanding of controls on dust emission from these environments varies at global scales (i.e. relevant to climate models) is poorly understood.

Existing research confirms that the potential for dust emission from playas within dryland regions can be extremely varied; large disparities are noted to exist from one playa to another, and significant spatial/temporal heterogeneity has been observed within those playas that do emit dust. Research also shows that dust fluxes from playa surfaces vary based on hydrological gradient or ephemeral inflows and may change over time in response to human or climate forcing mechanisms. Consequently, despite the presence of abundant fine sediment and suitable wind conditions, some playas will remain supply limited and will not emit dust as they are either too wet (e.g. via extensive groundwater discharge) not salty enough (e.g. salts have been removed from the surface by groundwater recharge) or there is not a sufficient supply of sand (coarse particles) on or at the upwind edge of the playa surface to cause dust emission. Other playas (e.g. Owens Lake) have emitted dust at a disproportionate (regionally/nationally) significant level seemingly without constraint (becoming effectively transport capacity limited) through optimal combinations of the same factors. Finally, we can also see situations where dust emitting playa systems flip between supply and transport capacity limiting factors either seasonally or on an inter-annual basis.

Using a range of examples drawn from ongoing and past research [e.g. the DO4Models project] to provide an overview of key controls on critical thresholds and feedbacks (climate, geochemistry, groundwater regime) for dust emission on playas. Pathways to understanding and quantifying the global emission potential of ephemeral lakes will be presented. Implications for dust emission modelling and future dust scenarios will also be outlined.