Shutting down dust emission during the middle Holocene drought in the Sonoran Desert, Arizona, USA

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Motivation

Aridity Index (Lachniet et al. 2020)

<table>
<thead>
<tr>
<th>Records Peak Aridity [%]</th>
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Cal Age [ka B.P.]

- Late Holocene: 4.2 ka
- Mid-Holocene: 8.2 ka
- Late Pleistocene/Early Holocene
Motivation
Classification of dust sources

Transport-limited

Supply-limited

Availability-limited
Hypothesis

Climate changes to an arid phase

Decreasing vegetation coverage exposes available sediments

Decreasing storm frequency and magnitude
Decreases dust sources sediment refill

Increasing Dust flux

Decreasing Dust flux
Results

Potential dust sources

Modis deep blue aerosol
Results

Active dust sources
Results

Active dust sources

Alluvial Fan
Results

Active dust sources

Silty-clay wash
Silty-clay Wash

Alluvial fan

Google Earth
Results

Active dust sources

Colorado and Gila River Flood Plains
Results

Active dust sources

Playa
Results

Potential dust sources

Legend
- Arizona Dust Sources
- California Dust Sources
- MW
- Summer Dust
- Winter Dust

Transport-limited

Supply-limited
Results

Major Elements

- Major elements triangle diagram reveals that MZW samples are mixed between two end members, the local bedrock and Arizona dust sources. Dust sources have high Al values; thus, Al-based dust flux was calculated.

- Mojave Desert values were taken from Reheis et al., 2009.
Results
Grain Size End Member (EM) Modeling Analysis

Fine End Member (13 µm)

Coarse End Member (34, 75 µm)
Results

Grain Size End Member (EM) Modeling Analysis

[Graphs showing distributions for Colorado River Flood Plain, Playa, Alluvial Fan, Gila River Flood Plain, and Silty-clay Wash.]
Aridity Index vs. Cal. Age [ka B.P.]

Dust Flux $\frac{gr}{cm^2 \cdot year}$

Bedrock Flux $\frac{gr}{cm^2 \cdot year}$

Supply-limited

Transport-limited

Dust increases during wet phase

Dust decreases during drought
Conclusions

• The current dust sources of Arizona were identified and studied, reviling summer coarse dust arriving from the Sonoran Desert and fine winter dust from the Mojave Desert.

• Arizona’s dust-cycle is controlled by the characteristics of dust sources (i.e., supply-limited and transport-limited) and climate change (humid/drought).

• Dust flux was found to be minimal during arid periods of the Holocene.
Questions?