Grain-Size Signatures of Saharan Dust over the Atlantic Ocean at 12°N

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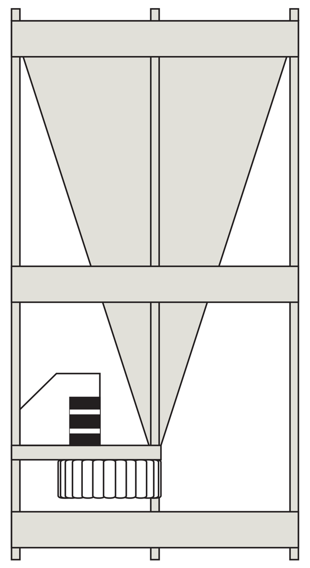
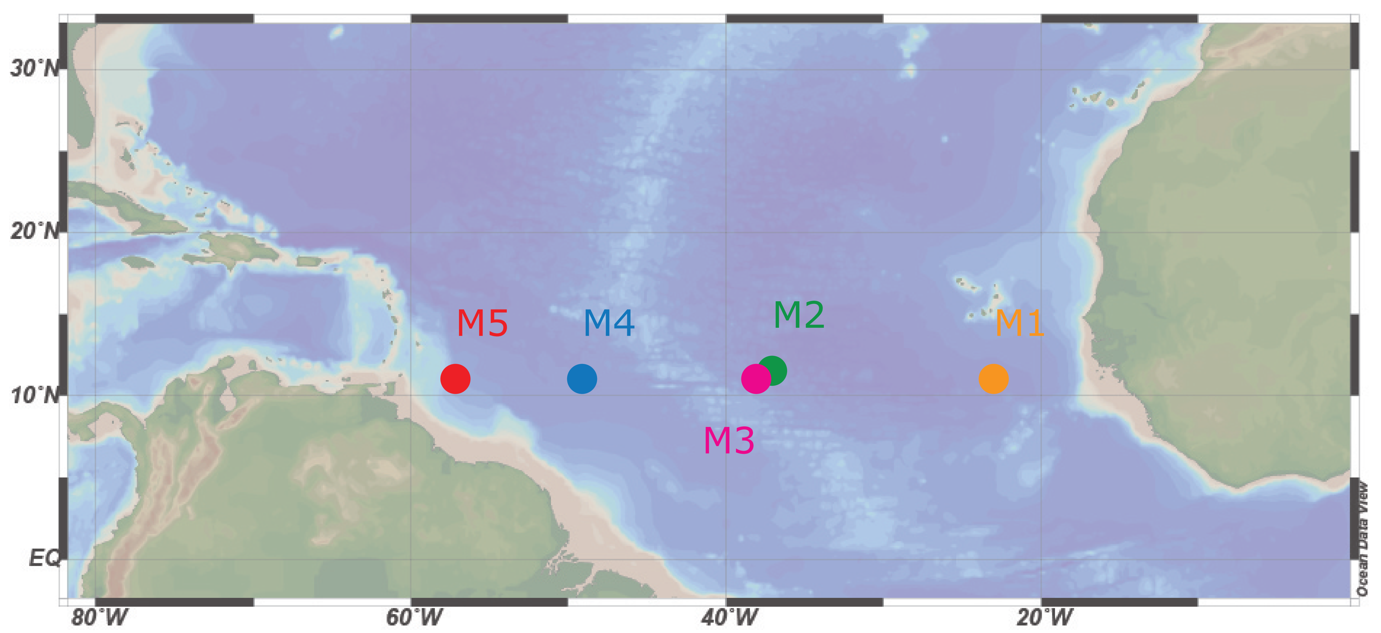
Introduction

Every year, approximately 200 million tons of Saharan dust are deposited in the Atlantic Ocean[1]. On its way from source to sink, this dust can affect climate by scattering & absorbing incoming and reflected radiation, and by changing cloud properties[2,3]. Once deposited, the dust can affect surface albedo and stimulate the global carbon cycle with transported nutrients. The effect on climate is largely determined by particle characteristics including particle size, shape, composition and mineralogy[2,3,4]. The particle size of dust is highly underpredicted in transport models and large particles are not accounted for[5,6]. This can affect the modeled dust flux, radiative effects and nutrient transport[6].

Set-up

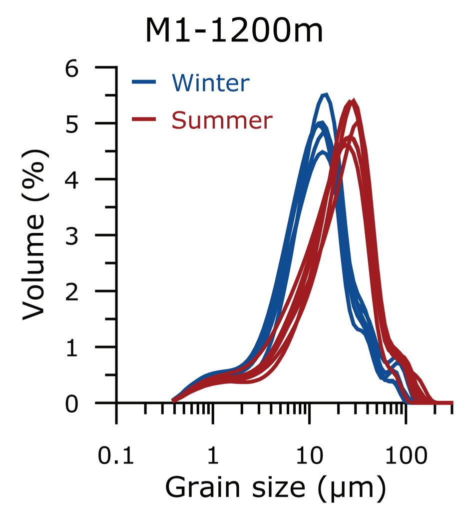
Seven sediment traps in the equatorial North-Atlantic Ocean (12°N) have been sampling Saharan dust from October 2012 to November 2013, at five locations and two depths (1200m and 3500m). Each sediment trap yields 24 samples at 16-day resolution. The grain size of all samples was analyzed on a Coulter LS13320 after all biogenic constituents were chemically removed.

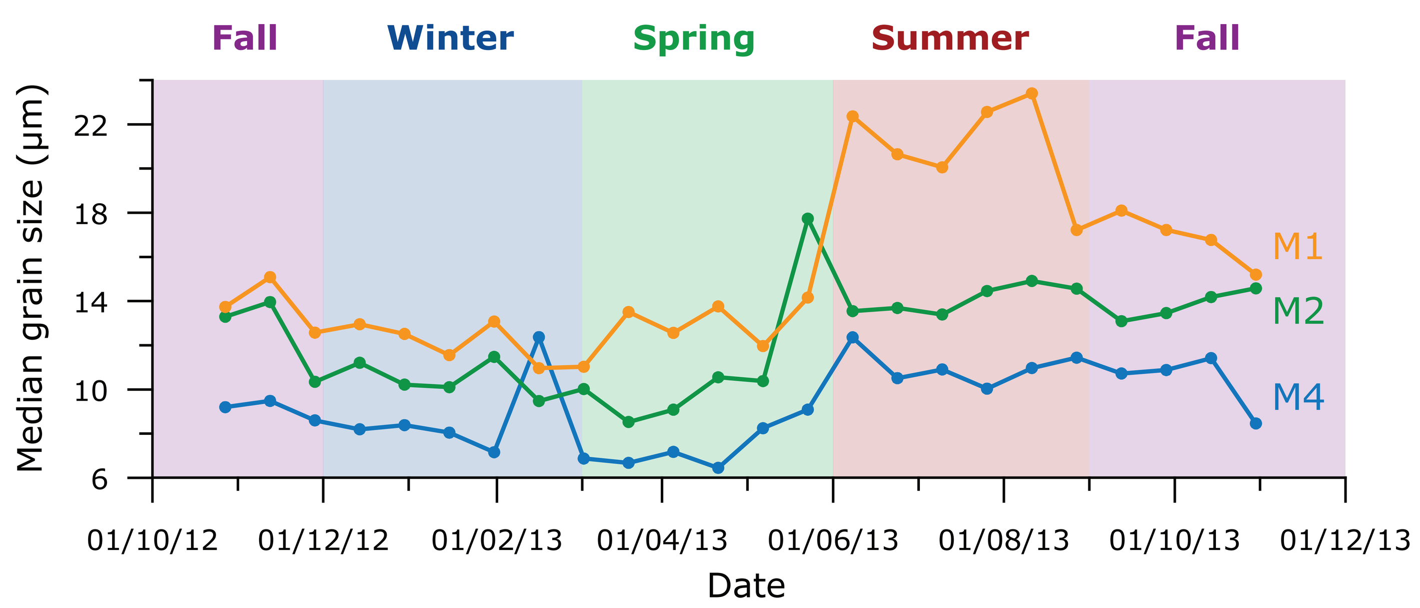




Results 1: Seasonality

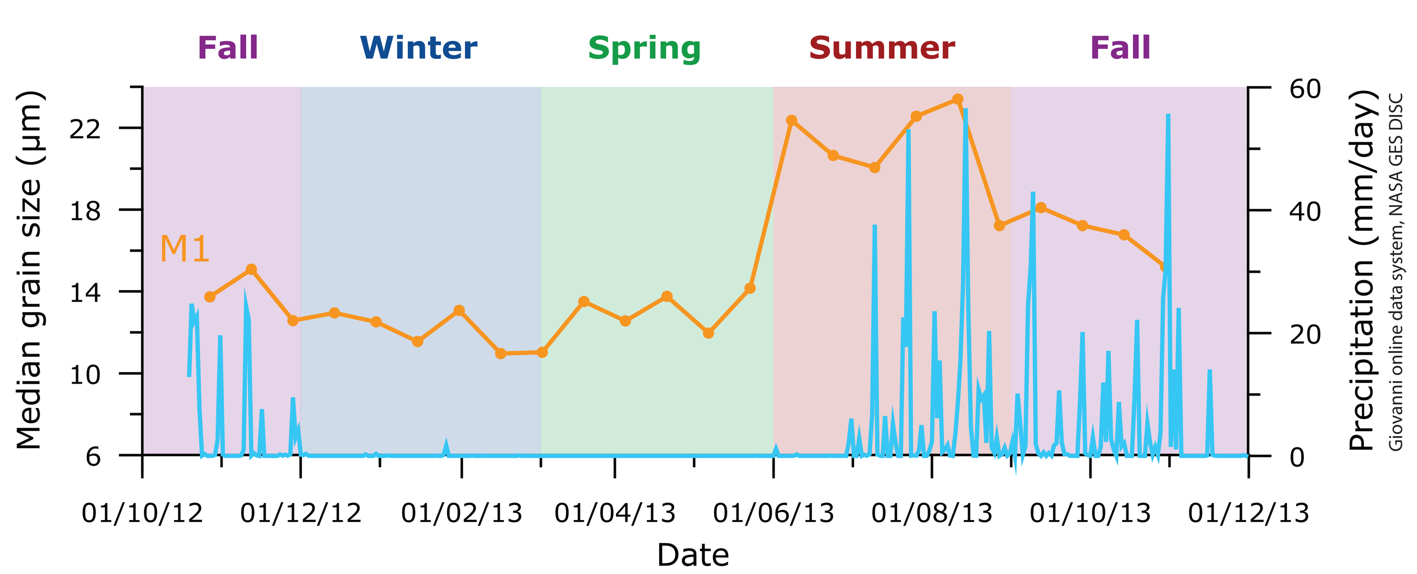
The particle size of Saharan dust shows seasonal variations, with coarser-grained dust in summer, and finer-grained dust in winter. This is true for the entire transect. However, the grain-size difference between seasons becomes smaller at greater distances from the source.





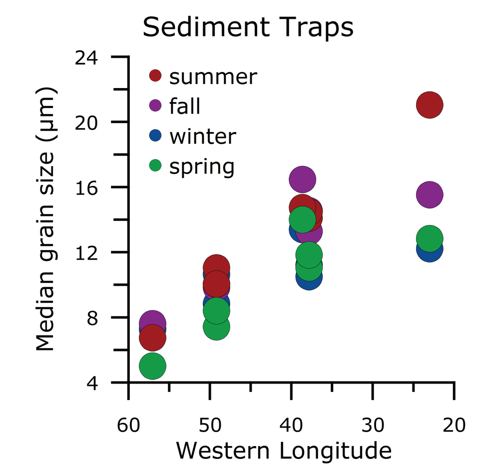
Results 2: Grain Size and Precipitation

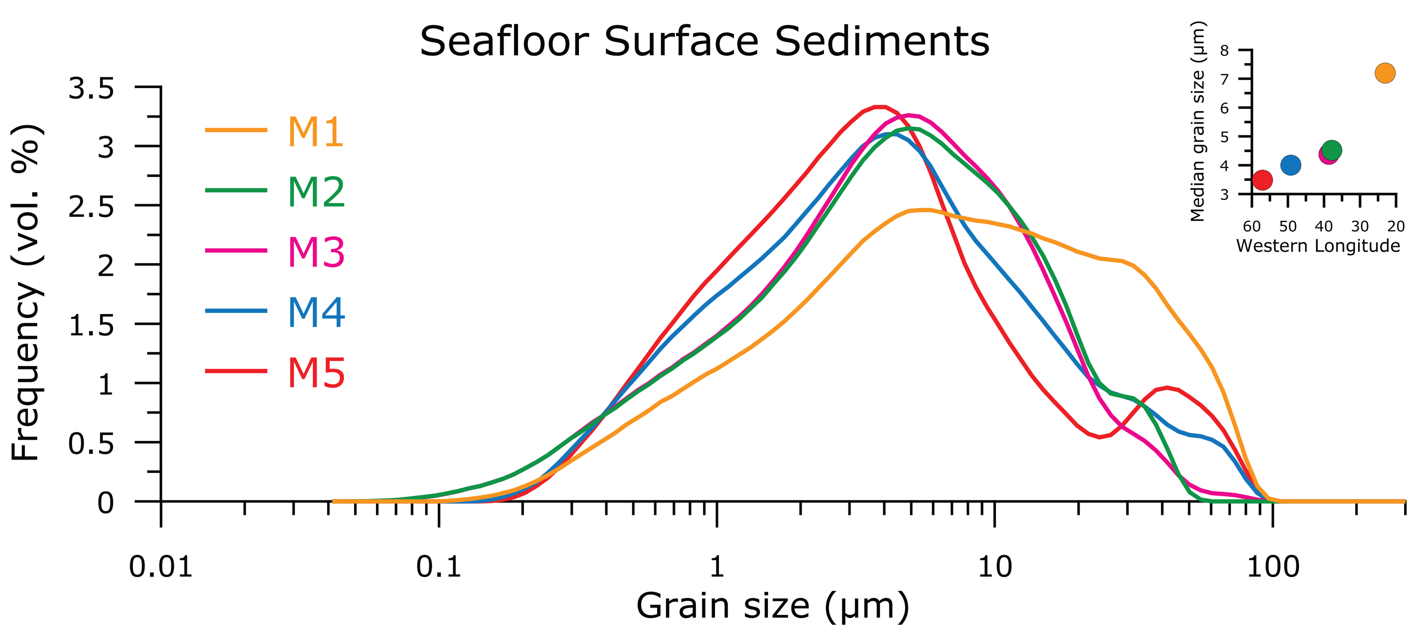
Coarser-grained dust in summer coincides with increased precipitation. We hypothesize that in summer, more and coarser-grained dust is deposited by wet deposition, creating this seasonal grain-size difference.



Results 3: Downwind Fining

The particle size of the dust collected by the sediment traps shows a down-wind fining trend: the easternmost trap contained coarser-grained dust and the dust becomes finer-grained towards the west. This is also observed in seafloor surface sediments, collected at the same sites.





Conclusions

1. Climate- and transport-models underpredict the particle size of transported dust. **2.** Dust in summer is coarser-grained than in winter, due to increased wet deposition. **3.** The difference in grain-size between the different seasons becomes smaller down-wind. **4.** Particle size decreases down-wind, for both sediment traps and seafloor surface sediments.

References

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