GROUND-BASED CHARACTERISATION OF AEROSOL CHEMICAL COMPOSITION DURING THE SALTRACE CAMPAIGN

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Introduction

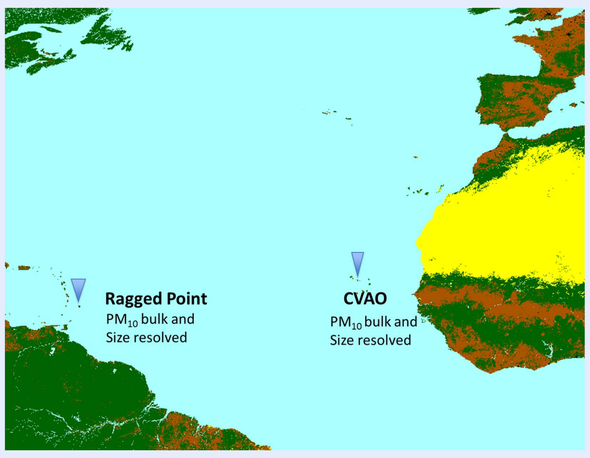

Fig. 1: *Geographical depiction of ground-based stations during SALTRACE experiment*

The transport of mineral dust over long distances can lead to changes in its chemical and physical properties. During the SALTRACE experiment, Saharan dust transport over the Atlantic was characterized using both ground-based and airborne measurements. Amongst others, one of the goals were to characterize the chemical properties of aged dust in the Caribbean. This was achieved by a comparison of the chemical properties close to the source regions (Cape Verde) and far away from the source region (Barbados, Ragged Point).

Experiment and Sampling

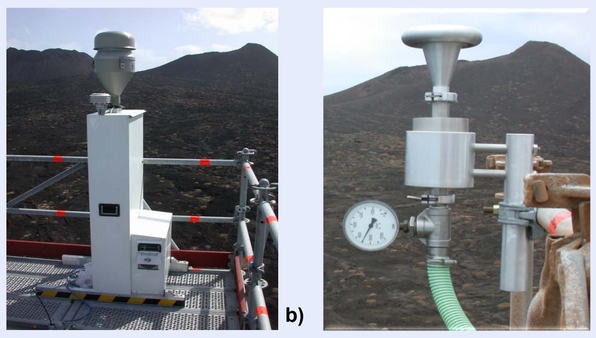

Fig. 2: *a) Digitel DHA-80 high volume sampler with PM_{10}-inlet, 500 l/min sampling rate b) 5-stage BERNER impactor with 75 l/min, sampling rate, stage cut-offs: 0.05 - 0.14 - 0.42 - 1.2 - 3.5 -10 µm.*

Aerosol particles were collected at the top of a 30 m tower at the CVAO and 25 m tower at Ragged Point using a high volume DIGITEL DHA-80 (Fig. 2a) for bulk PM_{10} particles and a five-stage BERNER impactor (Fig. 2b) with PM_{10} cutoff 0.05-10 µm for size resolved analysis.

The size-resolved particles were collected on aluminum foils while the bulk particles were collected on pre-heated quartz fiber filters. Inorganic ions, soluble and total trace metals, OC/EC were analyzed from these filters.

Trace metals

	CVAO (ng/m³)	Ragged Point (ng/m³)
Si	392 ± 196	1495 ± 850
K	157 ± 55	265 ± 99
Ca	295 ± 158	555 ± 231
Fe	119 ± 52	578 ± 284
Ti	11 ± 5.4	62 ± 31
Mn	2 ± 1.2	12 ± 6
Cr	4.71 ± 3.09	2.83 ± 0.85
Cu	4.21 ± 2.29	0.55 ± 0.2
V	1.25 ± 0.51	1.68 ± 0.84
Zn	3.24 ± 1.3	1.88 ± 0.72
Ni	0.86 ± 0.24	0.76 ± 0.3
Pb	0.96 ± 0.31	0.84 ± 0.34

Table 1: *Trace metal concentrations observed at CVAO and Ragged Point.*

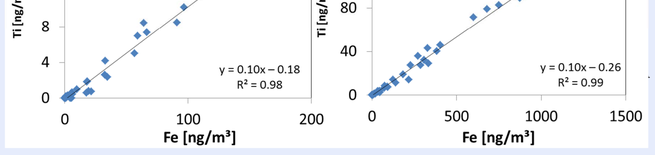

Fig. 7: *Ti used as dust traces showed good correlation with iron and also similar ratios at both stations*

Z/Ti	CVAO 03/07/13	Ragged Point 10/07/13
Si	33.34	29.94
Mn	0.25	0.21
Co	0.02	0.015

Table 2: *Mineral dust elemental ratios observed during dust events at CVAO and Ragged Point.*

- Higher crustal metals and lower anthropogenic derived metals at Ragged Point in comparison to the CVAO.
- Similar mineral dust signatures observed at CVAO and Ragged Point, indicating same dust composition
- Lower aerosol pH and higher aerosol acidic components were observed at the CVAO than at Ragged Point, indicating that less acidic medium was available for atmospheric processing at Ragged Point as compared to at the CVAO.

Soluble iron concentrations were slightly higher at CVAO in comparison to Ragged Point. This could also be due to less influence of anthropogenic sources at Ragged Point.

- Higher soluble iron was observed only in the fine mode particles indicating that most of the mineral dust particles concentrated in the coarse mode did not undergo significant atmospheric processing that could enhance their soluble content.

Acknowledgement

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Results

Strong variation in aerosol mass concentration with peak concentrations of about 50 µg/m³ indicating days of strong Saharan dust influence on aerosol loadings. However, aerosol mass at both stations was concentrated in the coarse mode. Average mass concentrations were 23.58 ± 9.1 µg/m³ and 28.04 ± 11.1 µg/m³ at CVAO and Ragged Point, respectively.

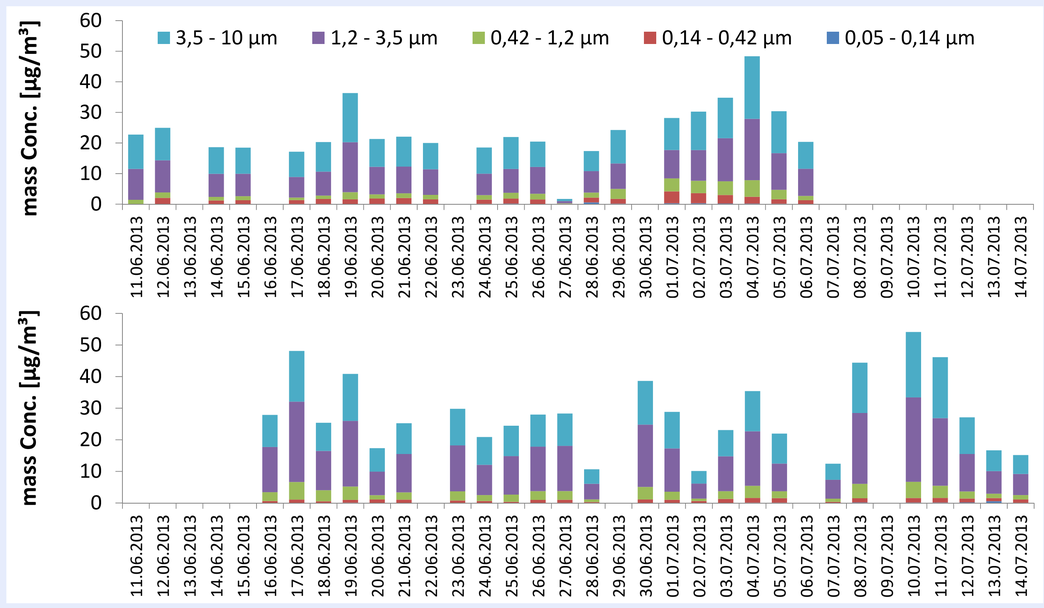

Fig. 3: *Size resolved aerosol mass concentration at CVAO (top) and Ragged Point (bottom) during four weeks of parallel measurement s at both stations.*

Aerosol mass was dominated (80%) by sea salt and mineral dust with higher mineral dust than sea salt observed at Ragged Point in comparison to CVAO.

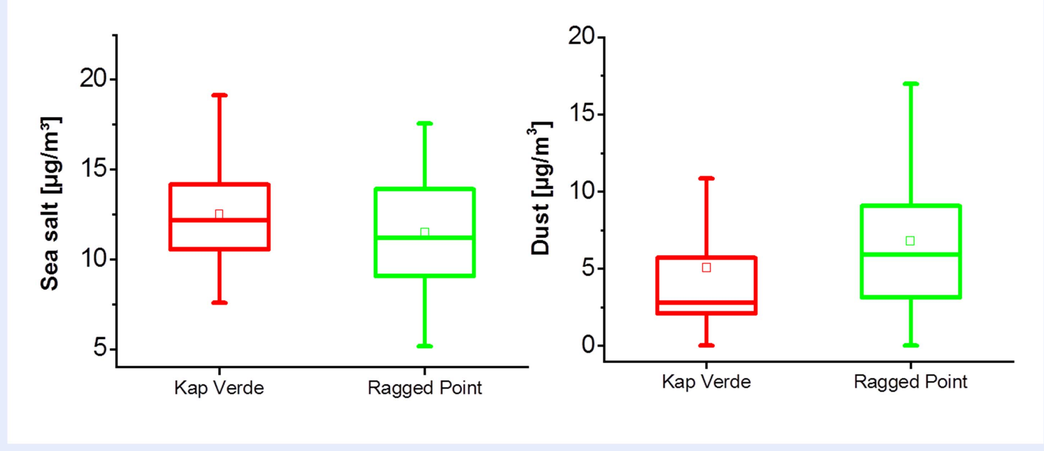

Fig. 4: *Sea Salt and mineral dust aerosol compositions at Ragged Point and CVAO*

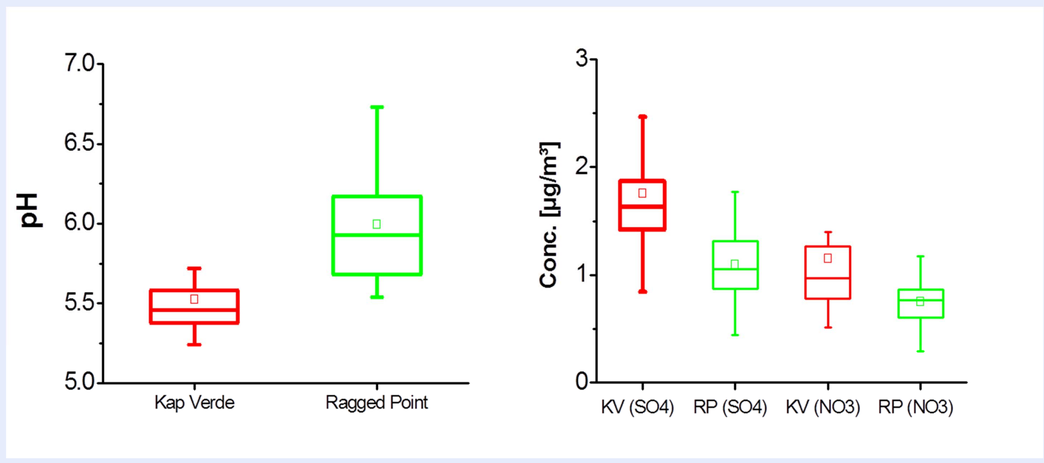

Fig. 5: *Aerosol acidic components (sulfates and nitrates) and pH at Ragged Point and CVAO*

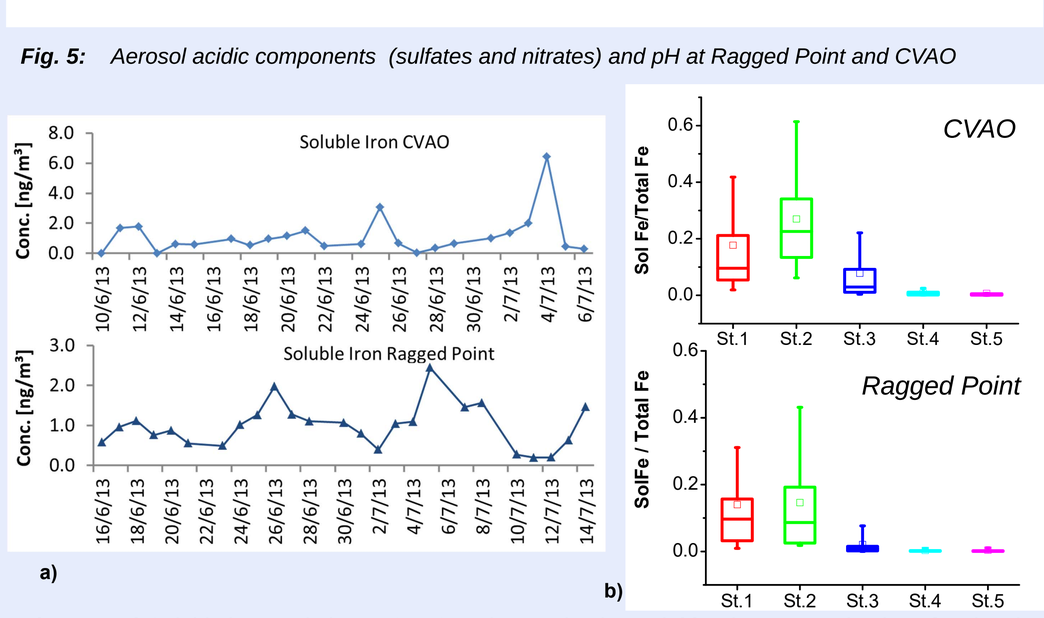

Fig. 6: ***a)*** *Soluble iron Variation at CVAO and ragged point and* ***b)*** *size resolved fractional soluble iron at both stations.*