Temporal variation of the chemical composition of Asian dust at Tajikistan

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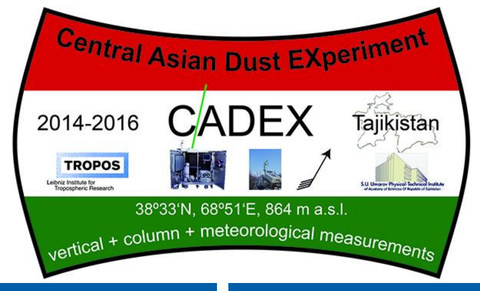

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Introduction

Mineral dust is a source of ambient pollution. At Dushanbe, mineral dust originating from desert regions such as Karakum, Dawir, Lut is often observed at relatively high concentrations. During the CADEX experiment, the chemical composition of mineral dust was characterized to determine the sources and mass concentration levels of important aerosol chemical components such as, aerosol trace metals, elemental and organic carbon, inorganic and organic ions.

Methods

A high volume sampler (Digitel DHA-80) was used to collect aerosol samples in a 48 h routine on quarz fiber filters. The samples were analyzed for soluble ions (via IC), elemental and organic carbon (thermal desorption) as well as trace metals (via Total Reflection X-ray Flourescence, TXRF) and organic compounds (GC-MS).

Results

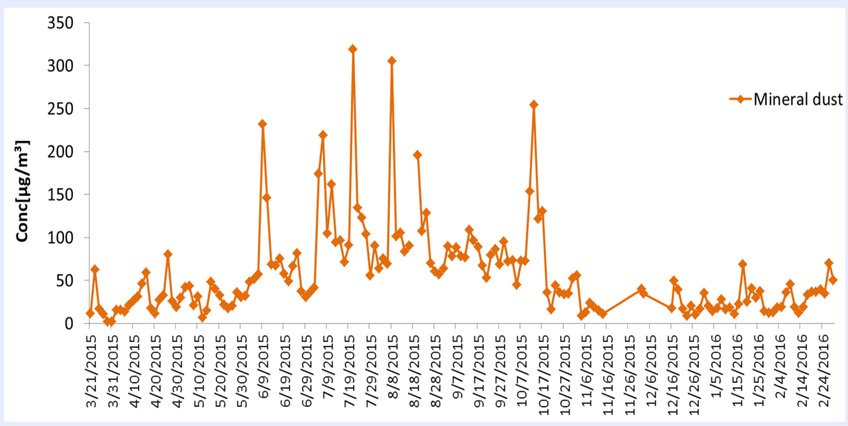

Fig. 1: *Temporal variation of mineral dust concentration at Dushanbe from March 2015 to February 2016. Peaks indicated days of dust storms*

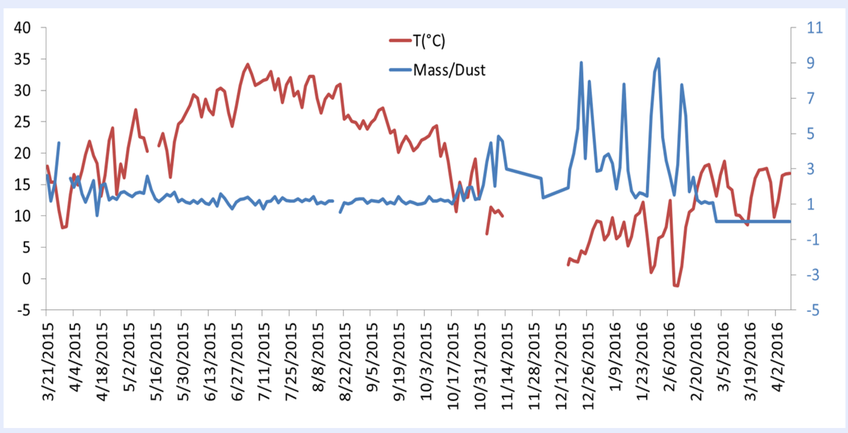

Fig. 2: *Temporal variation of ambient temperature and aerosol mass/mineral dust ratio. High aerosol mass/mineral dust ratio was observed when temperatures fell below 10˚ C*

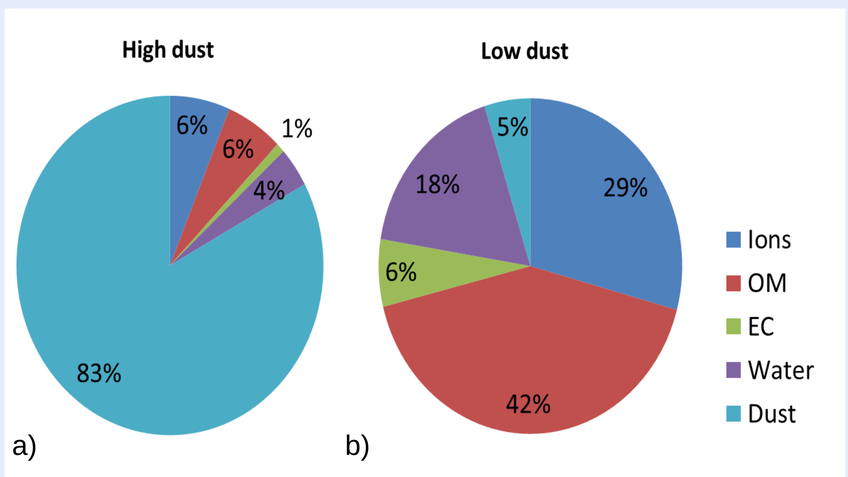

Fig. 3: *Aerosol chemical composition during days of a) less dust (31.03.15) and b) high dust (21.07.15) loadings. Sulfate, nitrate and ammonium were the main ions.*

Conclusions

- Strong seasonal patterns of aerosol chemical components were observed
- Coal combustion, traffic, metallurgical industry, long range transport and mineral dust were the main sources of emissions
- Mineral dust at Dushanbe is more Ca and Fe-rich in comparison to Saharan dust

Results

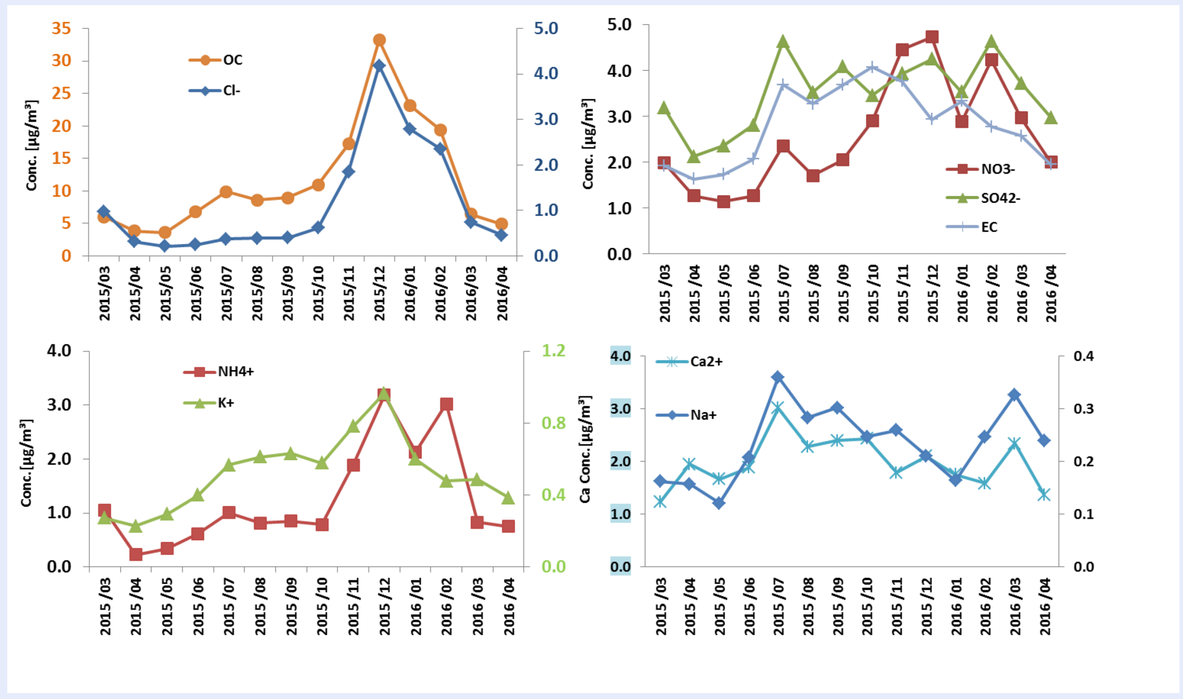

Fig. 4: *Seasonal variation of aerosol chemical components. Strong winter peaks observed for Cl, OC, NH4, NO3 and K while EC and SO4 both show summer and winter peaks.*

a)

	Max	Min	Average	Stdev
Ca	6526	191	2312	1570
Fe	2610	106	862	588
Al	1953	29	761	496
K	1222	255	564	218
Zn	792	29	244	185
Ti	140	3	49	32
Pb	78	8	31	18
Mn	62	10	24	13
Cr	6.4	0.8	2.7	1.4
V	5.7	0.2	2.1	1.3
Cu	5.4	0.9	2.6	1.2
As	4.1	0.0	0.7	0.7
Ni	3.7	0.7	1.7	0.9
Co	3.5	0.0	0.7	0.8
Se	0.7	0.1	0.3	0.1

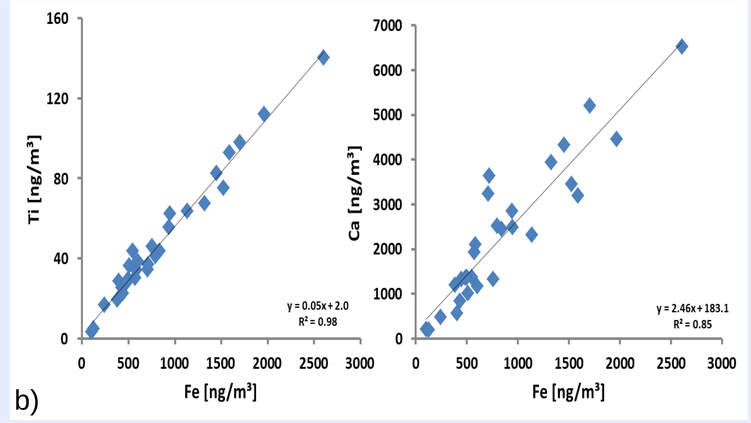

Fig. 5: *a)Trace metal concentrations and b) good correlation between iron, calcium and titanium indicating strong influence of mineral dust*

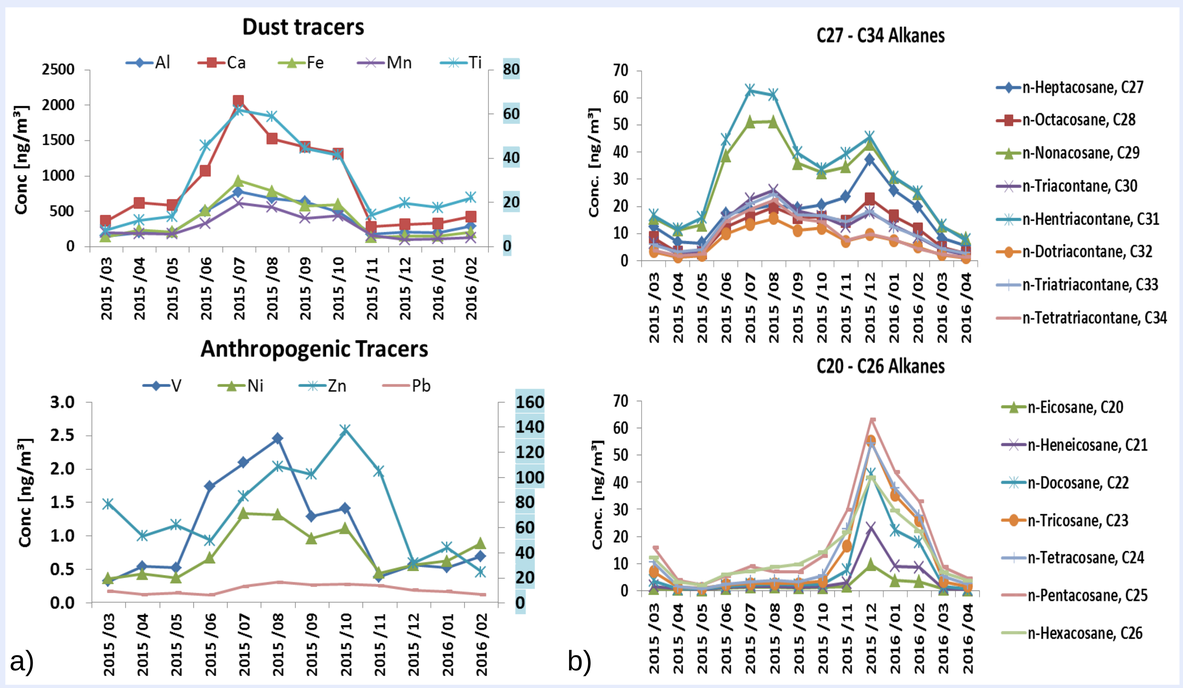

Fig. 6: *Seasonal variation of a) mineral dust and anthropogenic trace metals and b) alkanes, showing different seasonal patterns. Mineral dust elements showed strong summer peaks while for C20-C26 alkanes winter peaks were observed .*

Z/Ti	CVAO Cape Verde	Dushanbe
Fe	10.84	18.3
Ca	12.2	47.5
Mn	0.25	0.46
Co	0.02	0.016

Asian dust at Dushanbe shows higher iron and calcium content in comparison to Saharan dust observed at Cape Verde. This indicates a possible difference in the mineralogy of the dust sources in these regions.