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Characterization of dust aerosol over United Arab Emirates

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Measurement site – Al Dhaid



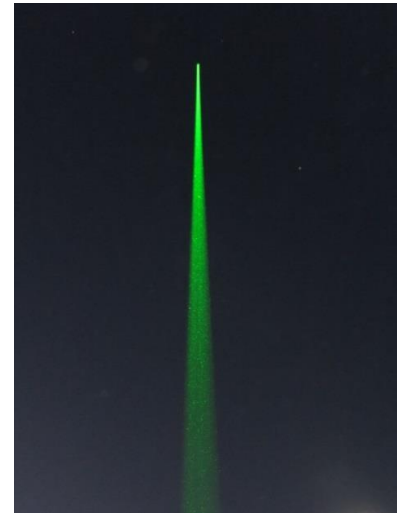
- One-year field campaign
(Mar. 2018 - Feb. 2019)
- **Remote sensing** & **In-situ**
 - PollyXT Raman LiDAR
 - Halo Doppler LiDAR
 - DMPS
 - OPC
 - CCN
 - etc.



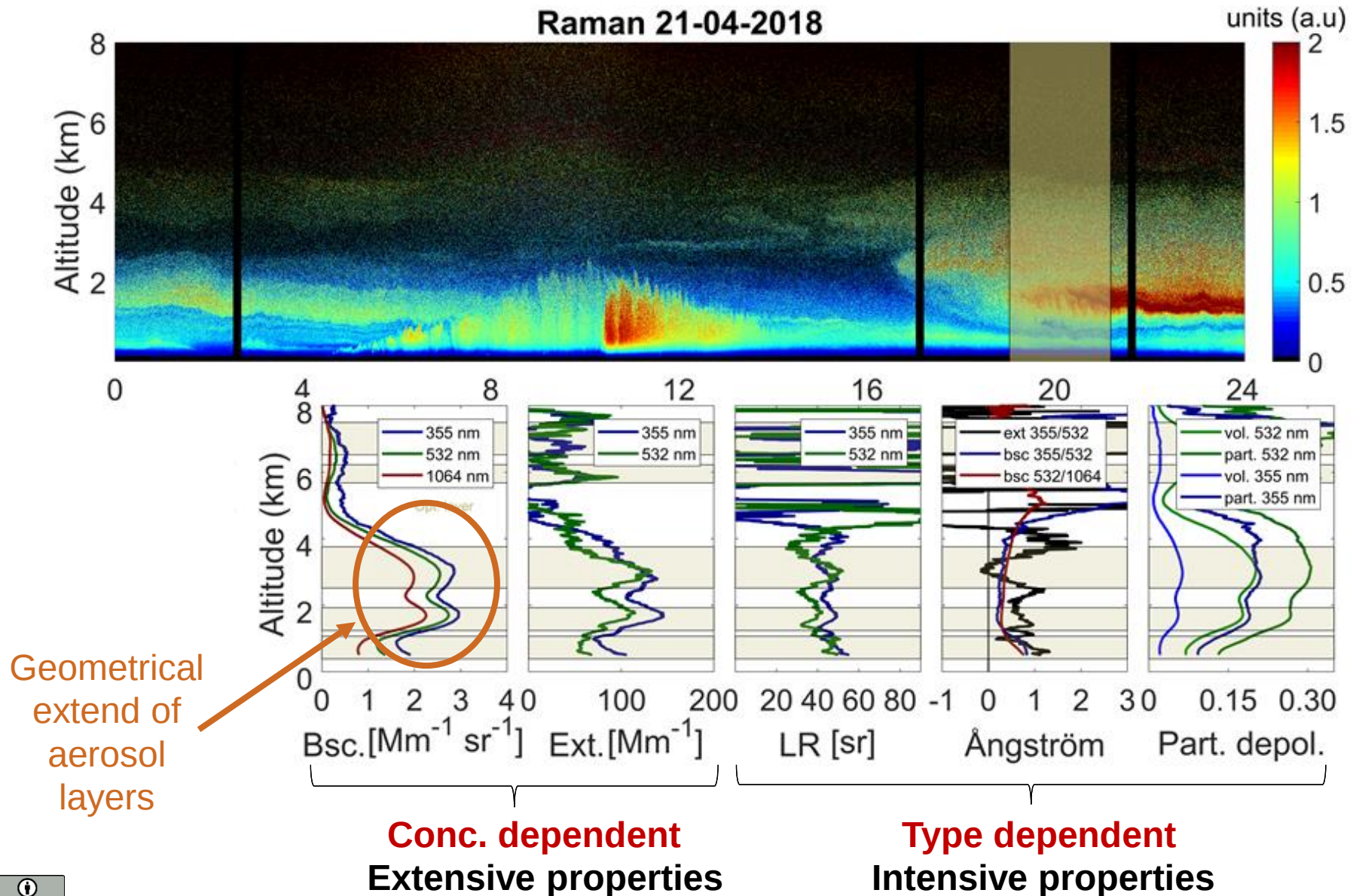
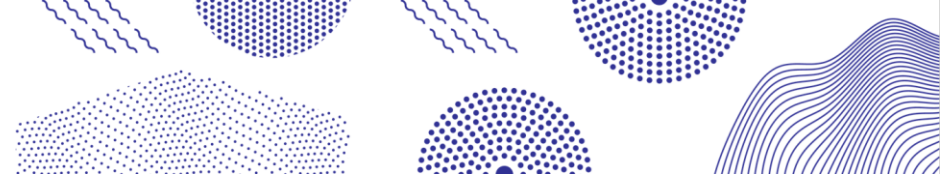
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PollyXT multi-wavelength Raman lidar

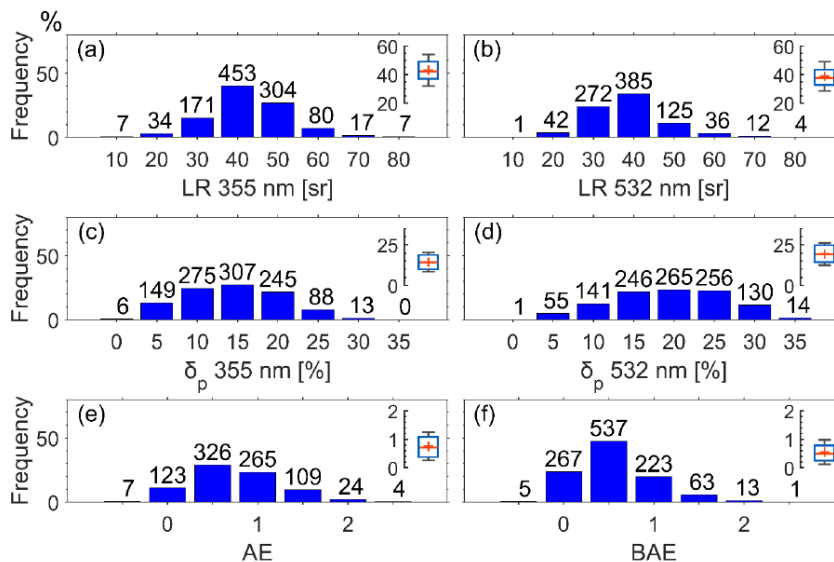
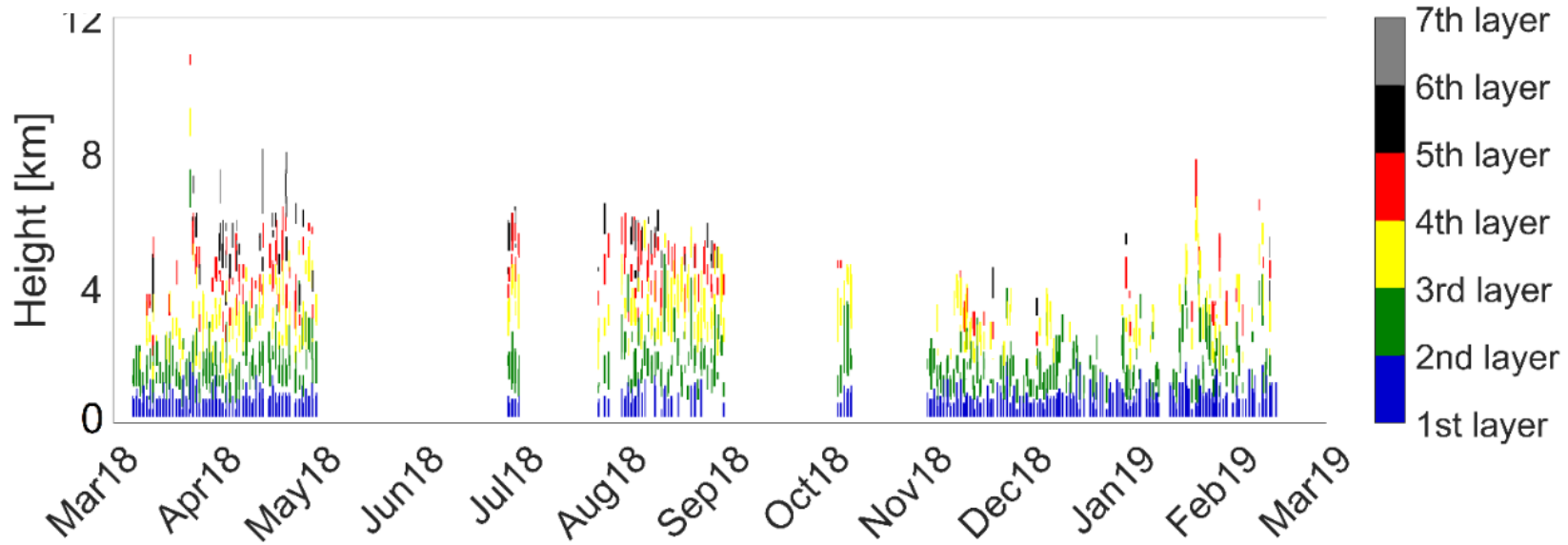
- The main instrument used in the study
- 3 emitted wavelengths (355, 532 & 1064 nm)
- 12 channels for detection
- Vertical resolution 7.5 m
- Additional near-field telescope
 - full detection ~120 m and above



Optical properties - Case example



Aerosol layers and statistics of their optical properties



Mean aerosol properties over the site :

$LR_{355\text{nm}} : 43 \pm 11 \text{ sr}$

$LR_{532\text{nm}} : 39 \pm 10 \text{ sr}$

$\text{Depol}_{355\text{nm}} : 15 \pm 6 \%$

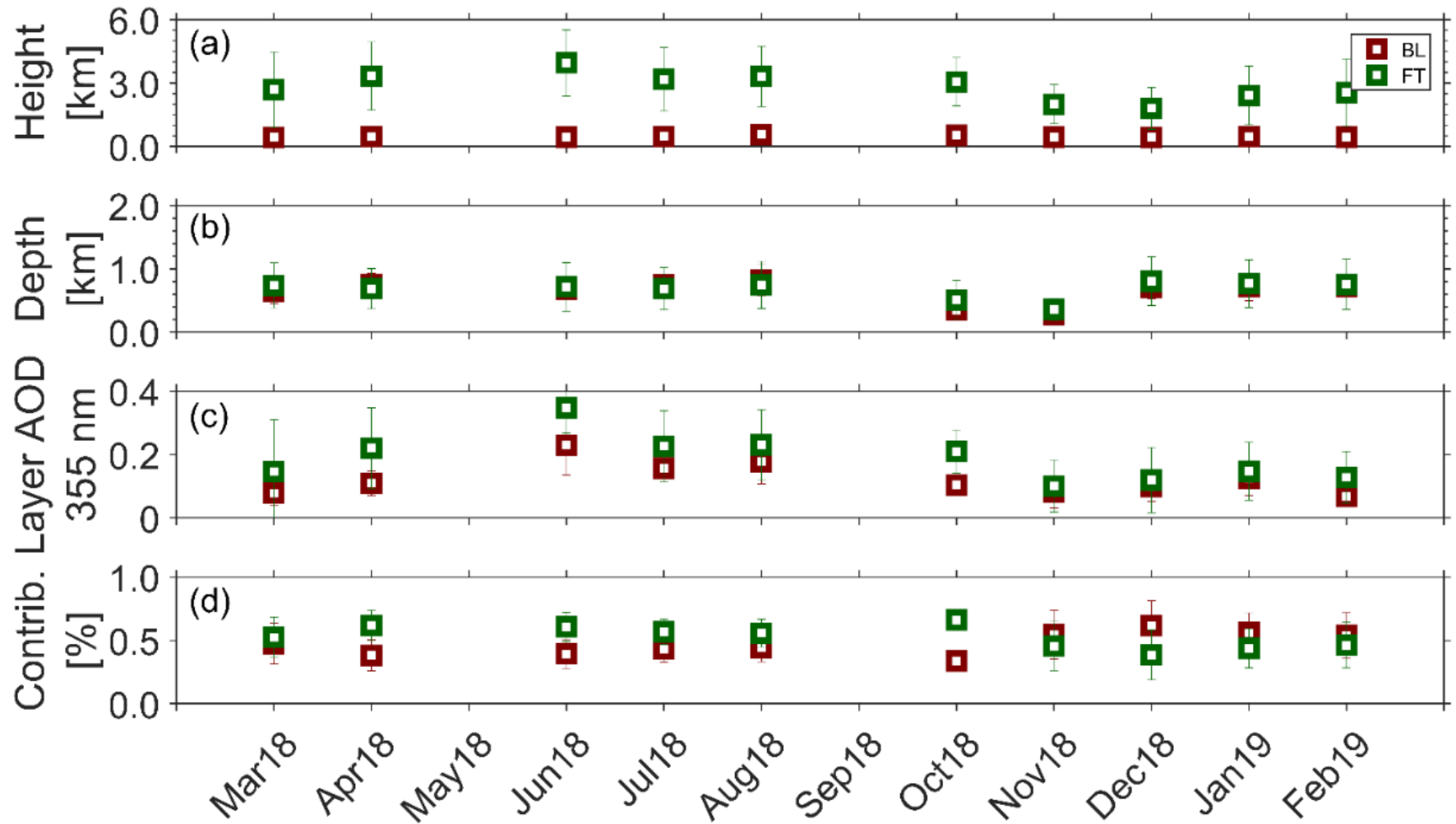
$\text{Depol}_{532\text{nm}} : 19 \pm 7 \%$

$AE_{355/532\text{nm}} : 0.7 \pm 0.5$

$BAE_{355/532\text{nm}} : 0.6 \pm 0.4$

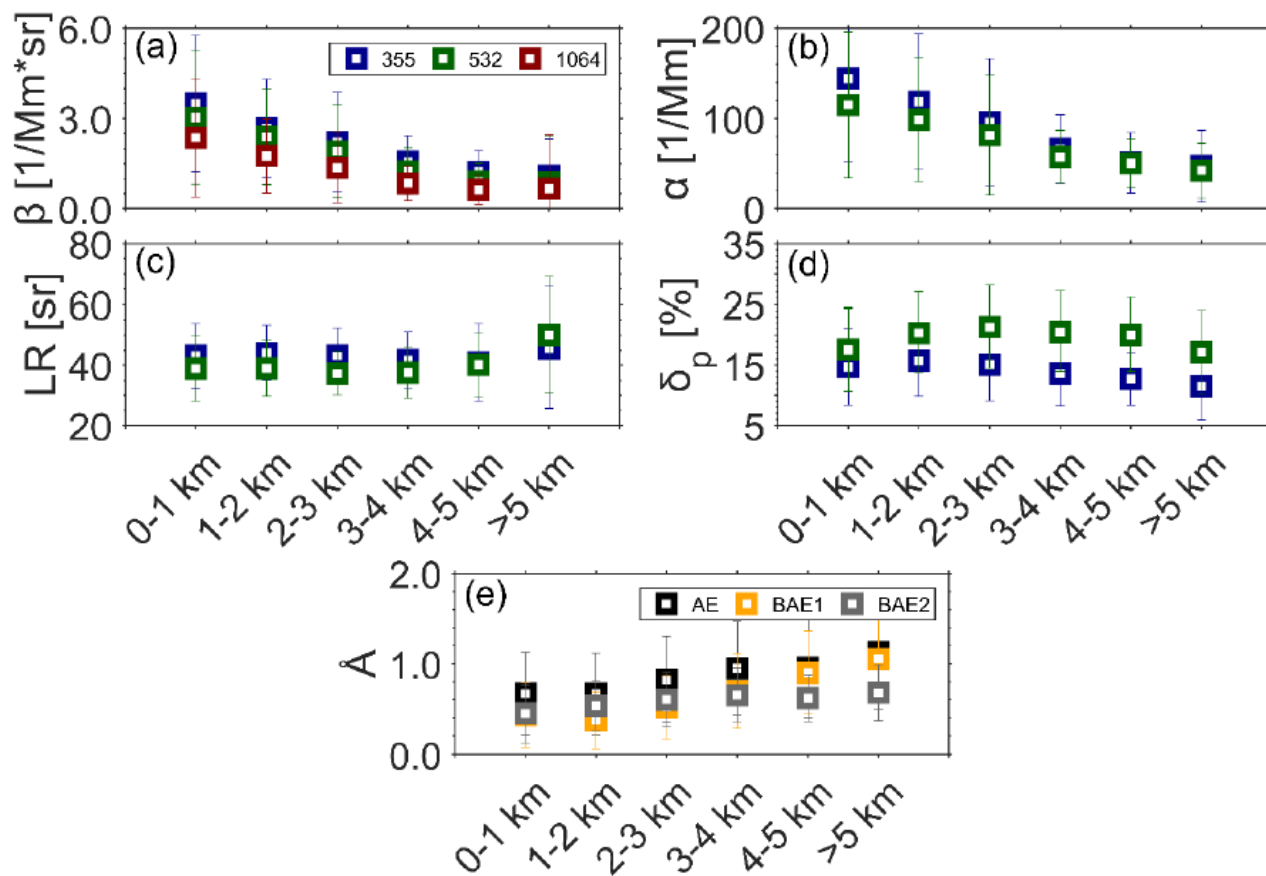


Aerosol optical depth – FT aerosol vs BL aerosol



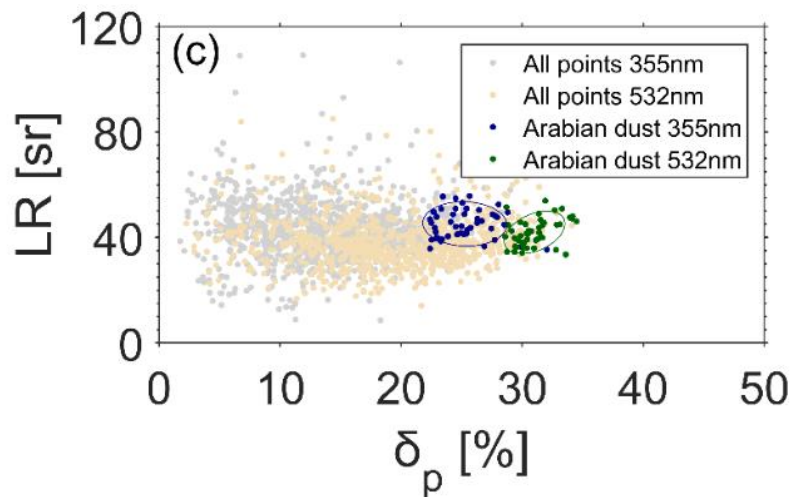
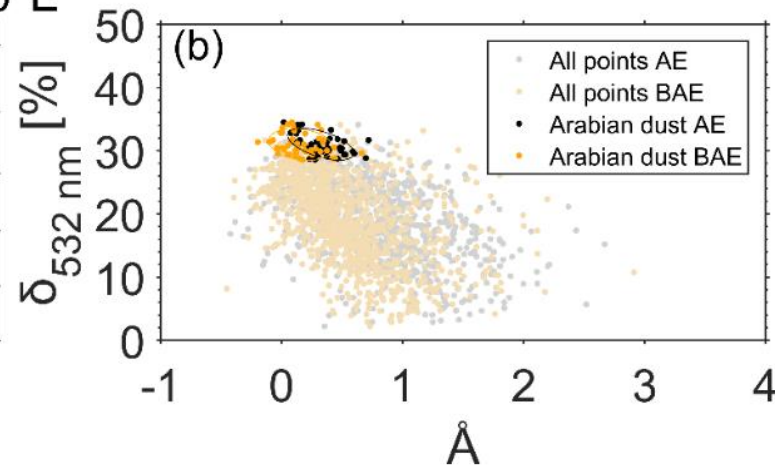
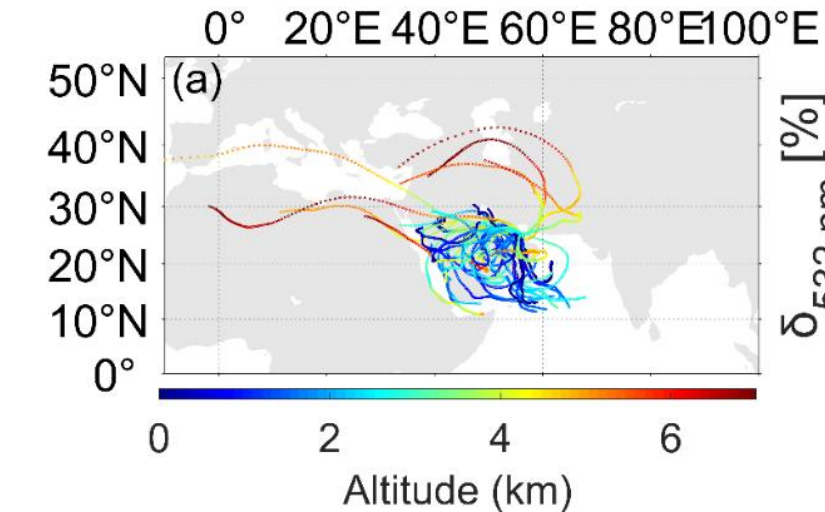
a) Monthly averaged central altitude of the aerosol layers in BL & FT, b) Geometrical depth of the layers, c) AOD of the layers, and d) contribution of BL and FT aerosols to total AOD

Altitude-depended aerosol properties



a) backscatter coefficient, b) extinction coefficient, c) lidar ratio, d) particle depolarization, and e) Ångström exponent (BAE1 = Ångström exponent 355/532, BAE2 = 532/1064)

Arabian dust properties



Mean dust properties over the site:

$LR_{355\text{nm}}$: 45 ± 5 sr

$LR_{532\text{nm}}$: 42 ± 5 sr

$Depol_{355\text{nm}}$: 25 ± 2 %

$Depol_{532\text{nm}}$: 31 ± 2 %

$A_{355/532}$: 0.2 ± 0.2

$A_{532/1064}$: 0.3 ± 0.1

Conclusions

Our study of dust properties over the region in Middle East suggest that:

- The local dust particle linear depolarization is similar to mineral dust originating from Sahara region.

(Depol_{355nm}: 25 ± 2 %, Depol_{532nm}: 31 ± 2 %)

- Lower lidar ratios have been observed compared to Saharan dust.

(LR_{355nm}: 45 ± 5 sr, LR_{532nm}: 42 ± 5 sr)

More information in Filioglou et al., 2020:

<https://www.atmos-chem-phys-discuss.net/acp-2020-133/>

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