Aerosol dust absorption - measurements with a reference instrument (PTAAM-2λ) and impact on the climate as measured in airborne JATAC/CAVA-AW 2021/2022 campaigns

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INTRODUCTION & METHODOLOGY

Mineral dust lab resuspension measurements

- Carried out between University of Nova Gorica and Haze Instruments d.o.o.
- **LOCATION**: Chamber experiments at Haze d.o.o., Ljubljana
- **TIME**: May 2023
- **MAIN OBJECTIVE:** Obtain compensation schemes for filter photometers deriving the absorption coefficients of mineral dust particles and derive their mass absorption cross section with a reference absorption measurement instrument, the PTAAM-2λ. The samples were obtained from FRAGMENT measurement campaigns between 2019 and 2022 from: Sahara (Morocco), Mojave desert (USA), Icelandic dust and Jordan.
- **Instruments:**
  - **Filter Photometers:** Aethalometer (AE33) and CLAP
  - **Photo-thermal interferometer:** PTAAM-2λ
  - **Optical Particle Spectrometer (OPS):** GRIMM OPC with bins from 0.253 nm to 35 nm
  - **Offline filters:** weighted for measuring total concentration and mineralogical composition
  - **Integrating Nephelometer:** Aurora 4000 measuring forward and backward scattering

CAWA-AW CAMPAIGN OVERVIEW

CAWA-AW (Calibration and Validation for Aeolus - Aerosols/Winds)

- part of JATAC campaign, carried out by University of Nova Gorica
- **LOCATION**: Cape Verde Islands
- **TIME**: September 2021 and September 2022
- **MAIN OBJECTIVE:** support Aeolus validation and calibration based on the in-situ airborne aerosol observations in the lower troposphere

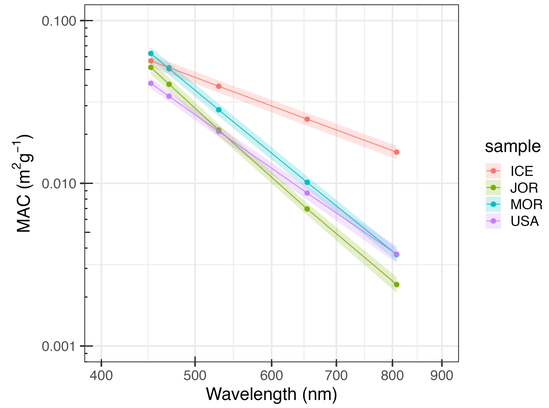
[Left] Ultralight airplane Aerospool Advantic WT-10 equipped with inlets for fine and coarse aerosols and [Right] two Continuous Light Absorption Photometers for aerosol light absorption measurements at the fine and coarse fraction, a polar integrating nephelometer Ecotech Aurora 4000 for aerosol light scattering measurements, two optical particle counters for measuring the particle size distribution and additional meteorological sensors (CO2 sensor, RH).

RESULTS

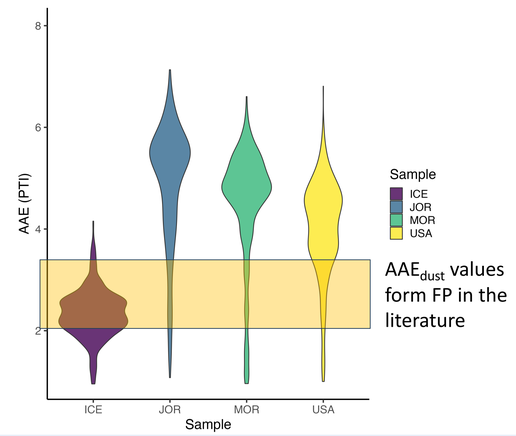
Mineral dust lab resuspension

Mass absorption cross-section (MAC)

Sample	MAC (m^2g^{-1})	
	450 nm	808 nm
Iceland (ICE)	$56.5x10^{-3}$	$15.5x10^{-3}$
Jordan (JOR)	$51.6x10^{-3}$	$2.3x10^{-3}$
Morocco (MOR)	$62.8x10^{-3}$	$3.6x10^{-3}$
Mojave (USA)	$41.16x10^{-3}$	$3.7x10^{-3}$

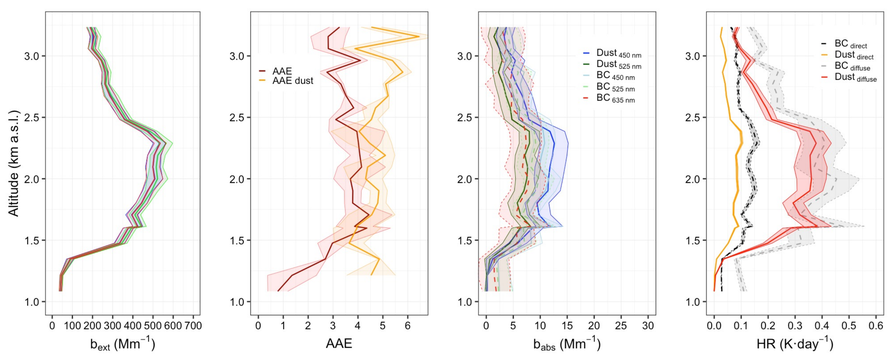


Absorption Angstrom Exponent (AAE)

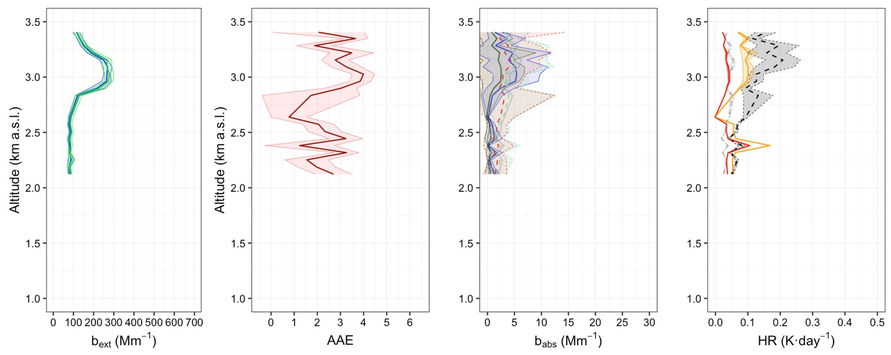


In-situ aircraft measurements over Cabo Verde during CAWA-AW

Case study: 16th of September 2021



Case study: 16th of September 2022



DISCUSSION

- **MAC** measurements without multiple scattering artefacts show slightly **lower MAC values** than those found in the literature and assumed by the models (Fialho et al., 2006, Caponi et al., 2017)
- AAE of dust measurements show much higher values than those obtained form FP in the literature
- This AAE measurements are similar to the AAE$_{dust}$ measurements obtained during aircraft measurements over dust plumes over Cabo Verde within the SAL
- Similar effect of mineral dust on the Heating Rate (HR) within a dust-loaded SAL, specially for the diffuse radiation.

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