Spatio-temporal distribution of tropospheric aerosols over Southeast tip of Istanbul measured by Mie-Raman lidar

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Outline

- Introduction
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  - History
- Experimental
- Results
- Questions

Location: Gebze

- Heart of Turkish Industry
- 40° 47' 56'' N, 29° 25' 54'‘ E
- 200 m altitude
- 500.000 population
- At the Southeast border to Istanbul
- Heavily industrialized area

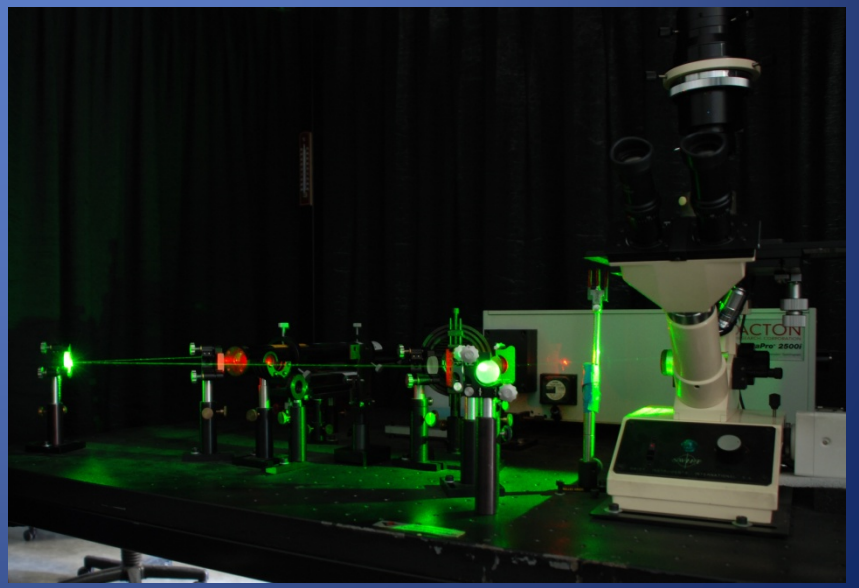
Location: Gebze

Location: MRC

- Turkish Scientific and Technological Research Council (TUBITAK) Marmara Research Center (MRC)
- Established in 1972
- 8000 acres, 1500 scientific personnel

Location: K09 LS Laboratory

- Materials Institute
- K09 Laser Spectroscopy Laboratory
- Led by Prof. Dr. Kerim Allahverdi
- 3 Phd, 1 MSc, 1 Specialist, 2 Technicians



History: K09 Lab

- Confocal laser Raman and photoluminescence microspectrometer
- Thermoluminescence
- Portable Raman microspectrometer
- Multiwavelength Mie-Raman aerosol lidar
- New projects are in development

History: MW lidar

- Theory and design started as early as 2008
- May 2009, finished and first measurements
- Summer 2009:, Extensive measurements
- Spring 2010: Eyjafyallaökull eruption
- Measurements on a regular basis
- Spring 2011: EARLINET

Experimental: Transmitter

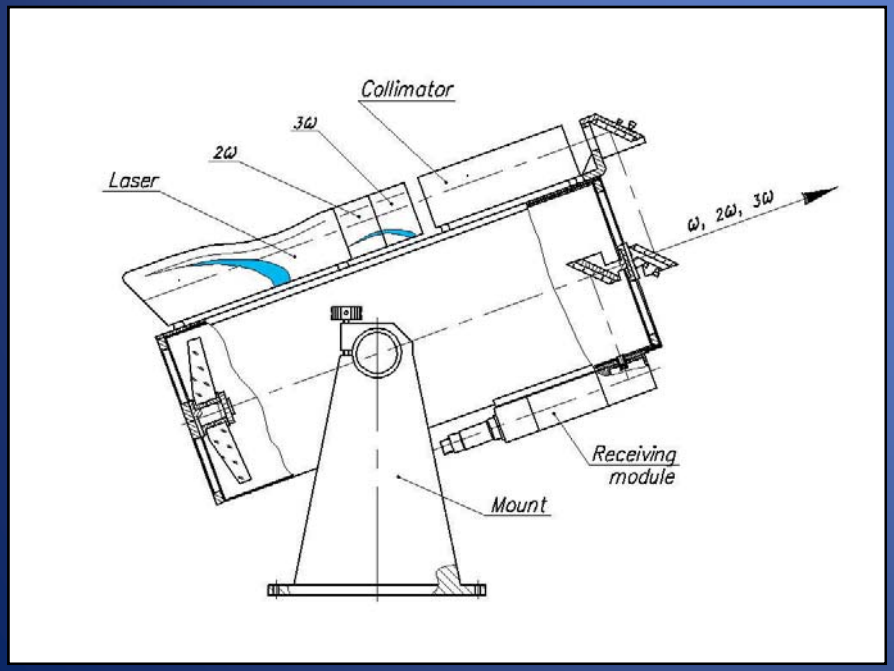
- Quantell Brilliant b Nd:YAG laser
- 2nd and 3rd harmonics
- 855 / 400 / 240 mJ pulses at 1064 / 532 / 355 nm wavelengths respectively
- Frequency 10 Hz
- 5-6 nanosecond pulses

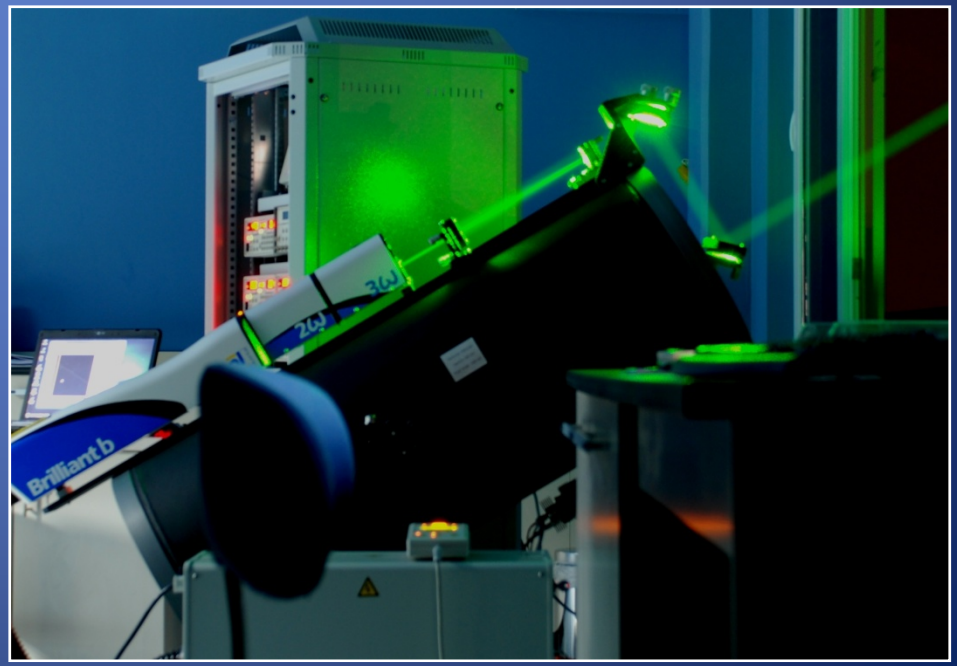
Experimental: Collimator

- 8 mm diameter laser beam is collimated to;
  - ✓ Decrease divergence (0.02 mrad)
  - ✓ Increase diameter (40 mm)
- Laser and collimator mounted on top of the telescope

Experimental: Telescope

- Newtonian telescope with 400 mm main mirror
- 120 cm focal length





Experimental: Spectrum analyzer

- 7 channels:
  - ✓ 5 Hamamatsu R194 ADC's
  - ✓ 1 Hamamatsu H7422 photosensor
  - ✓ 1 NIR-enhanced LICEL Avalanche photodiode
  - ✓ 3 elastic channels (355 [perpendicular and parallel], 532 and 1064 nm)
  - ✓ 3 Raman channels (387 and 608 nm for Nitrogen Raman signals and 408 for water vapor Raman signal)

Experimental: Data processing unit

- Transient recorder LICEL TR40-160

Results: Eyjafyallaökull ash plumes

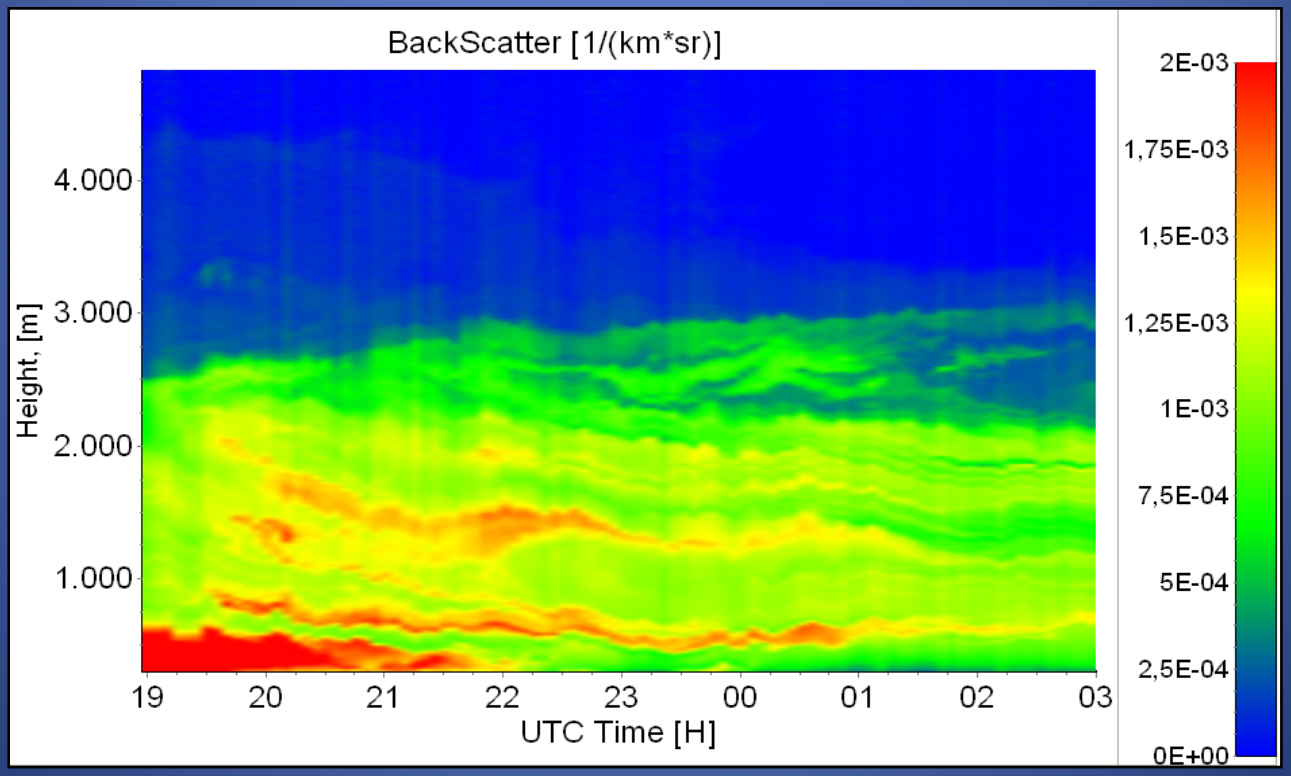
- 14 April 2010: Volcano eruption in Iceland
- Air traffic over Europe effected since WW2

Results: Eyjafyallaökull ash plumes

- European Aerosol Lidar Research Network (EARLINET) followed the event with daily measurements at several stations
- In late May 2010, ash reached Turkey
- The multiwavelength Mie-Raman lidar at TUBITAK MRC MI K09 Laser Spectroscopy Lab detected and determined the main characteristics of the ash plumes

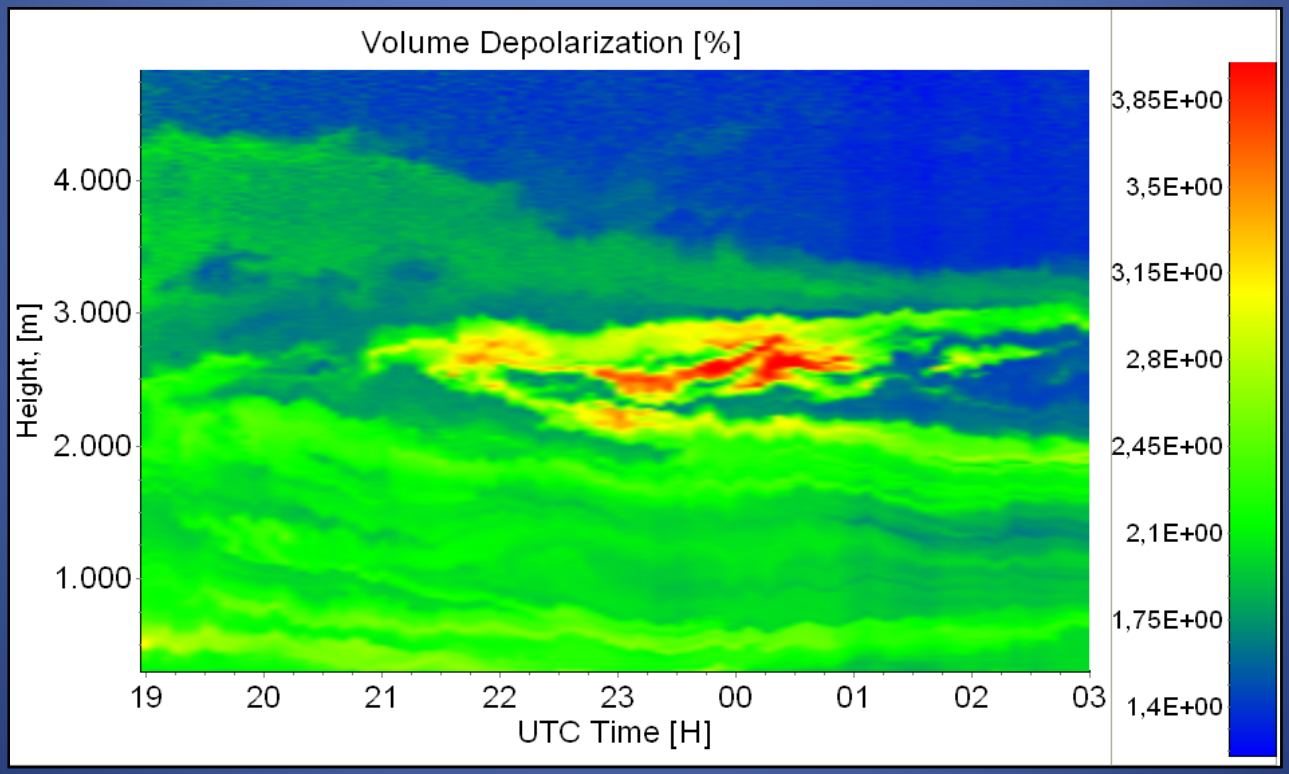
Results: Eyjafyallaökull ash plumes

- Color map derived from backscatter coefficients



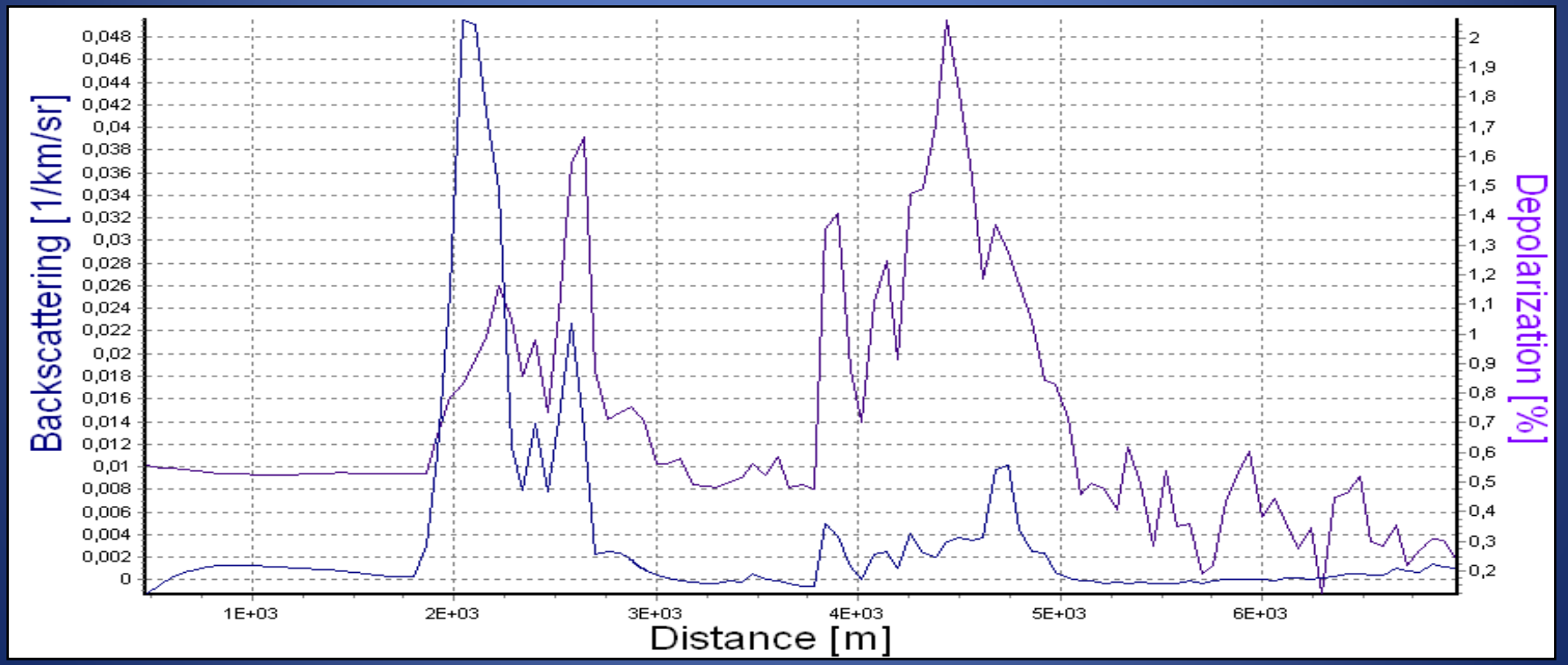
Results: Eyjafyallaöküll ash plumes

- Color map of volume depolarization



Results: Eyjafyallaökull ash plumes

- Backscatter and polarization combined and compared

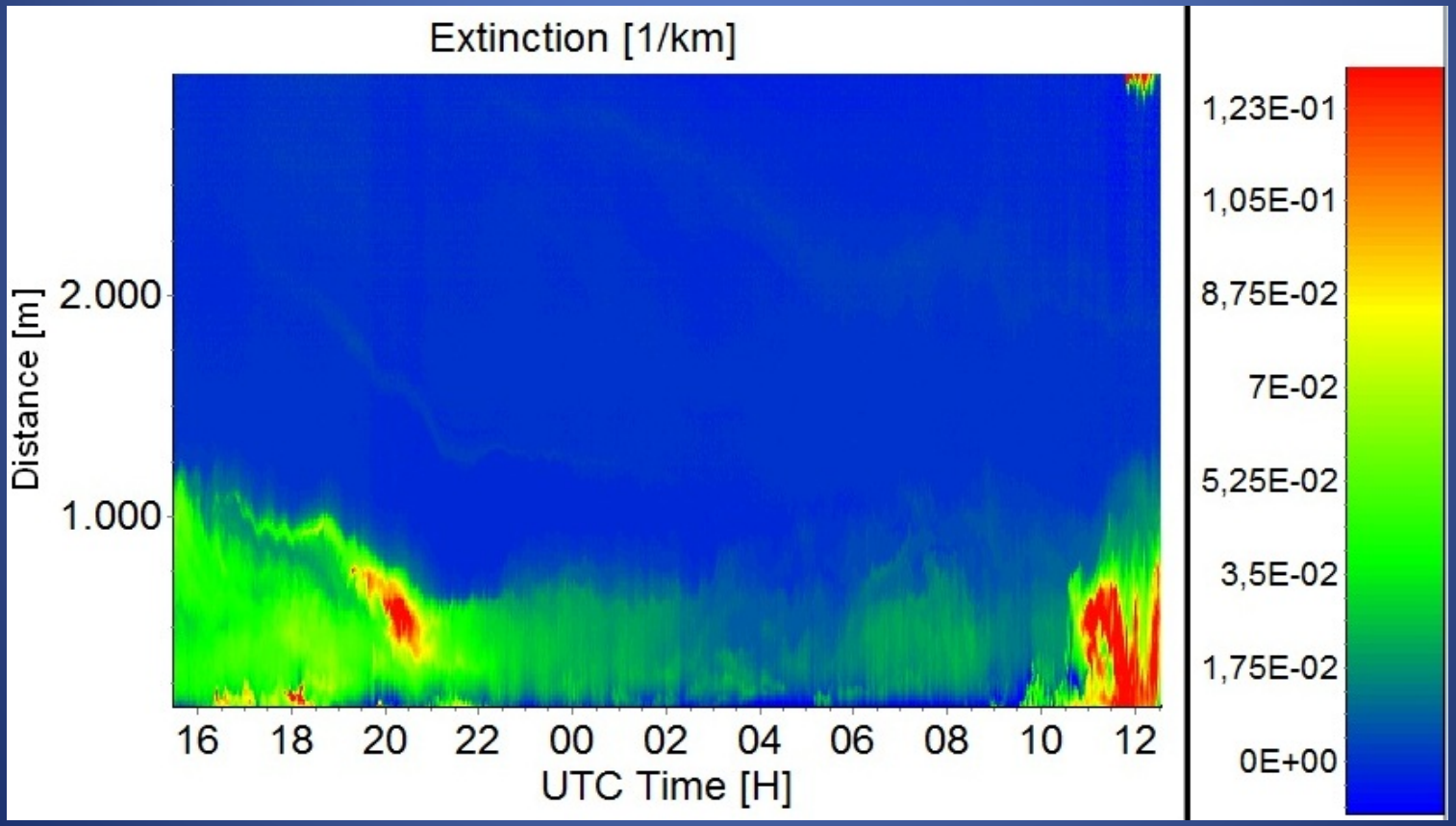


Results: Spring 2011 Dust

- Regular measurements for the study of dust
- Measurement angle: 22^0 with the horizontal
- Measurement direction: 225^0 SW
- Every Thursday starting at 17:00, 24 hour measurements
- January to May
- Days with low clouds and rains omitted
- Results include aerosol backscatter and extinction coefficients, polarization

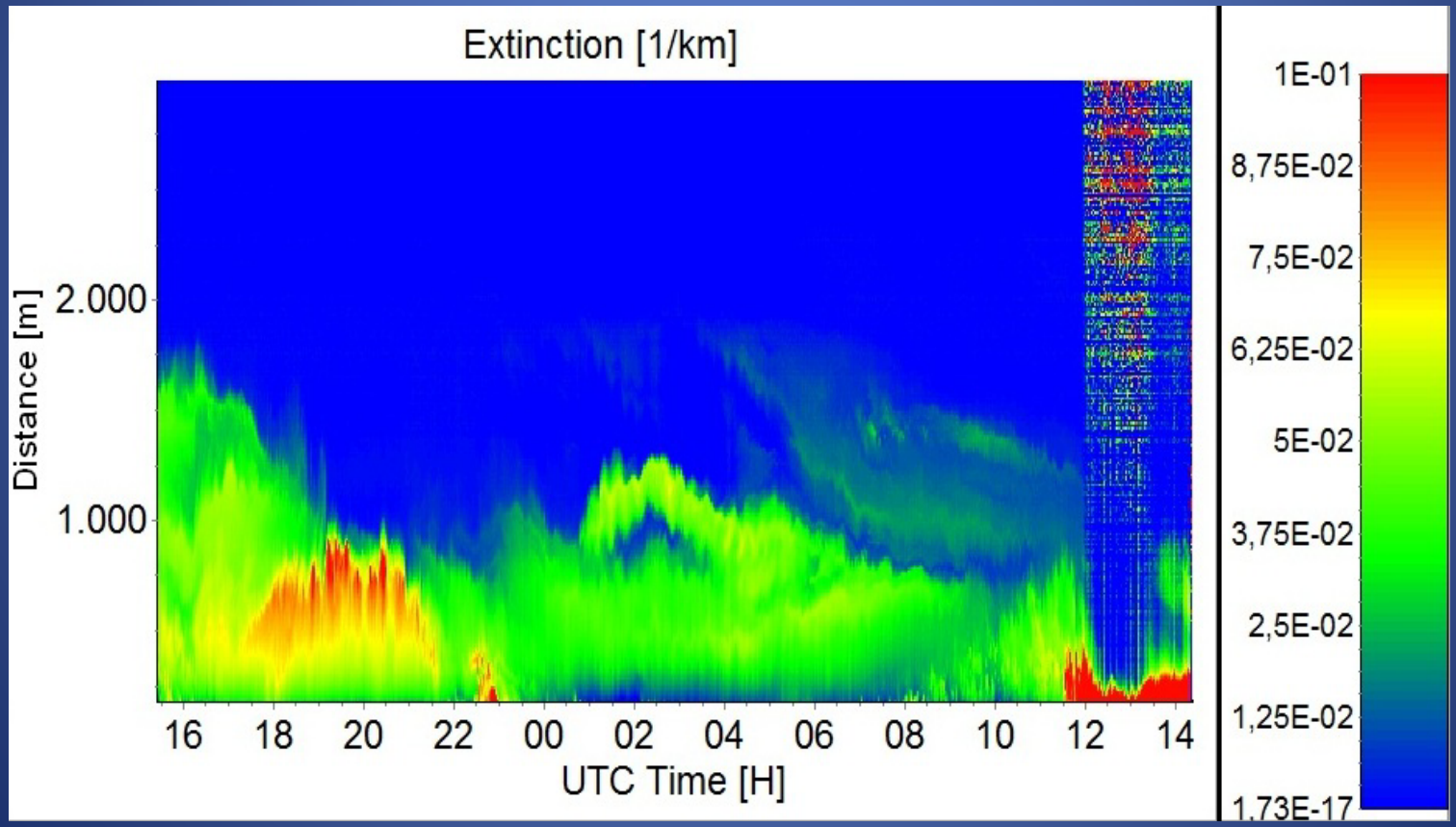
Results: Spring 2011 Dust

- 27.01.2011: Extinction at 532 nm



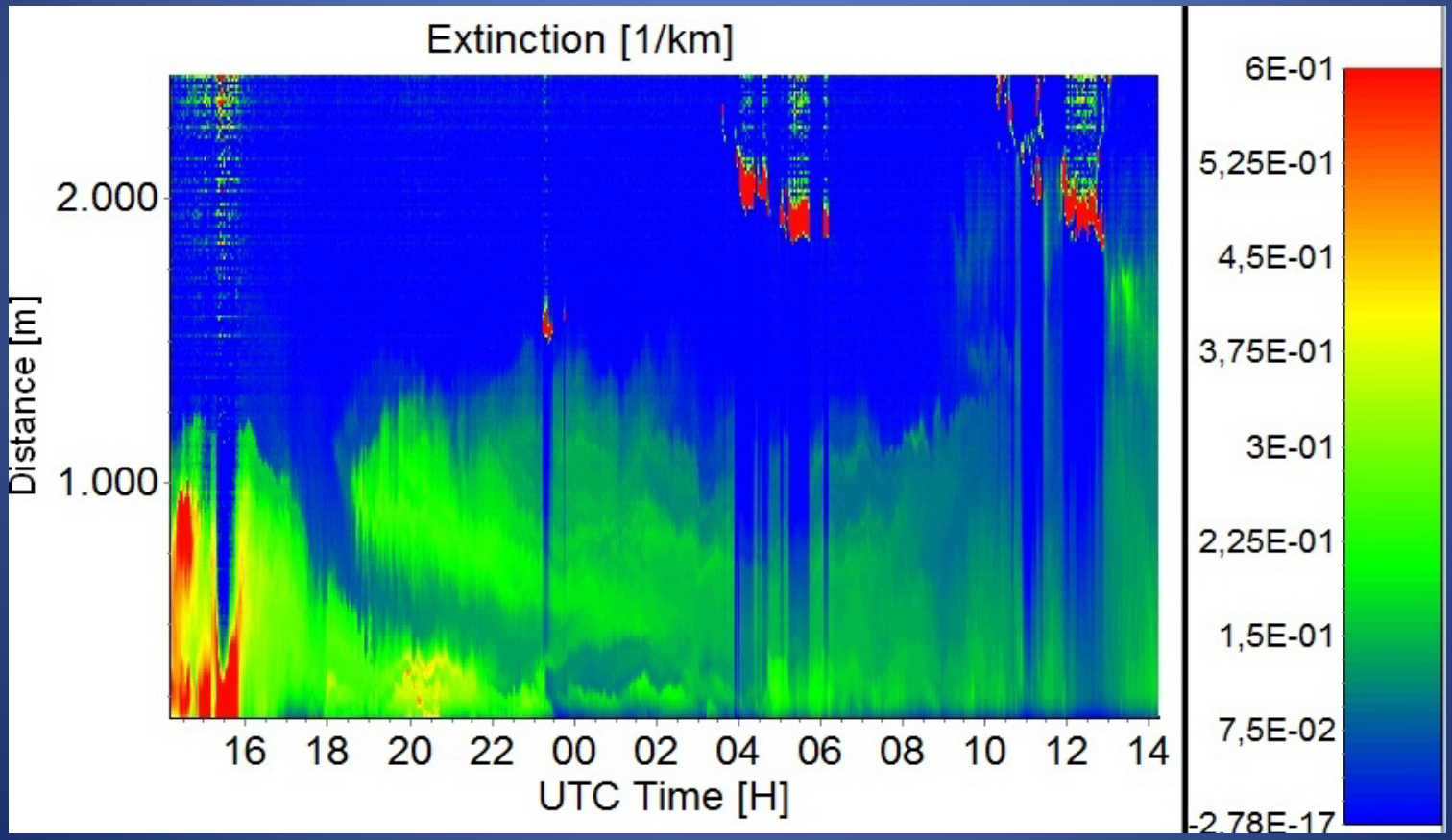
Results: Spring 2011 Dust

- 10.02.2011: Extinction at 532 nm



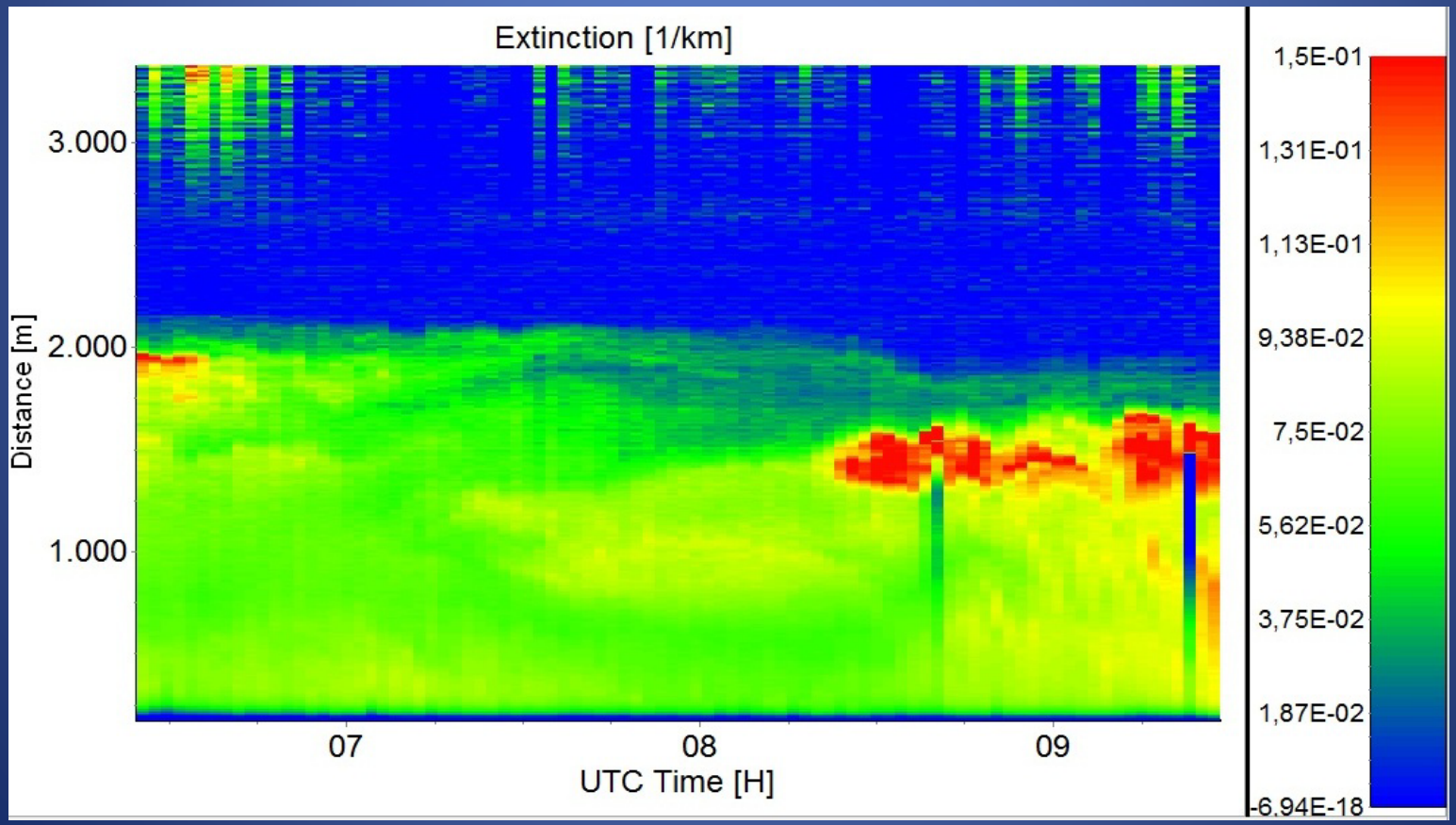
Results: Spring 2011 Dust

- 07.04.2011: Extinction at 355 nm



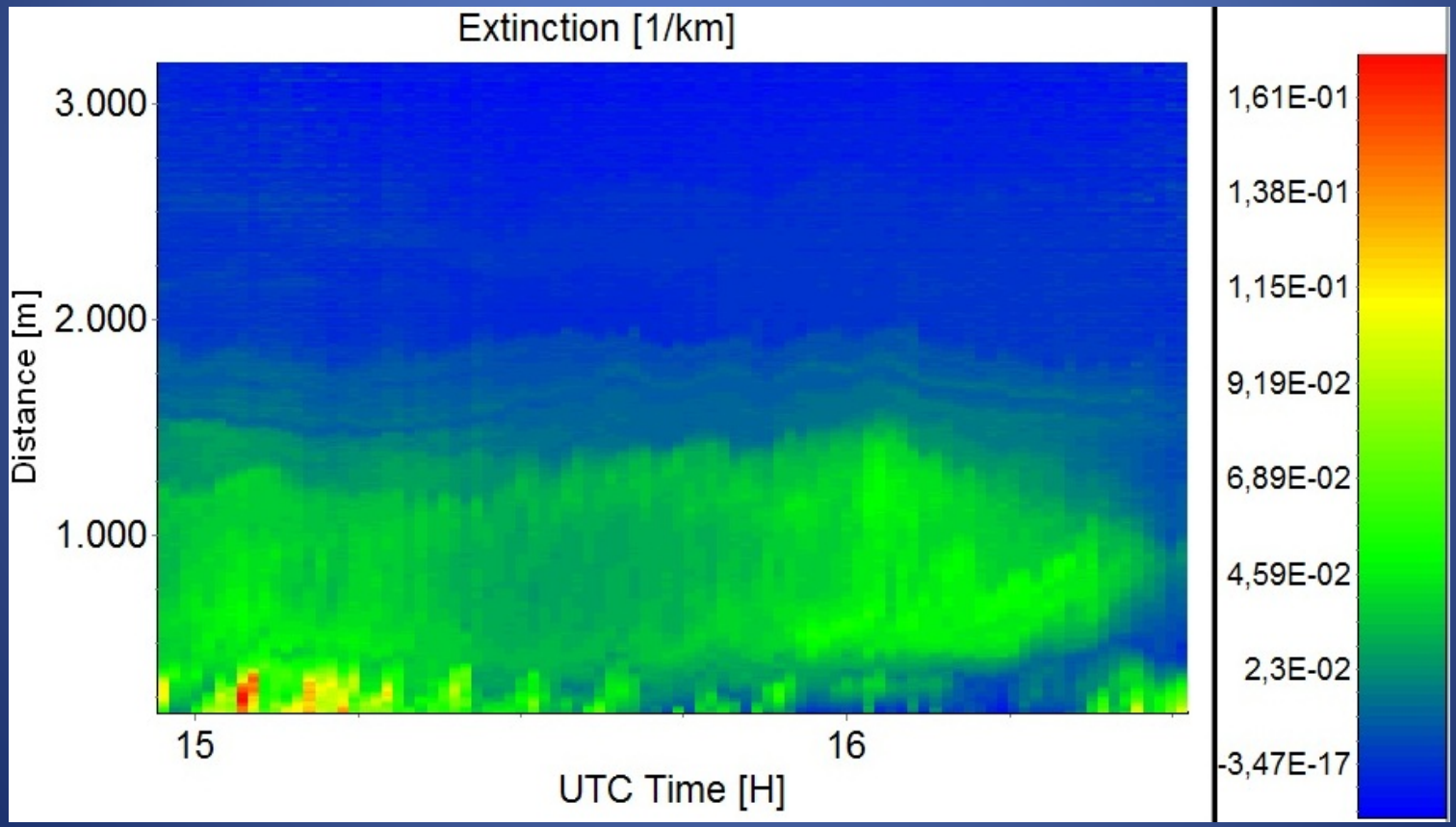
Results: Spring 2011 Dust

- 14.04.2011: Extinction at 355 nm



Results: Spring 2011 Dust

- 26.05.2011: Extinction at 355 nm



Discussion

- Lidar in Turkey is in operation to cover an existing gap of lidar networks
- 2 years have passed and still development
- New projects are on the way, we are open to cooperation


Thank you for your attention!