

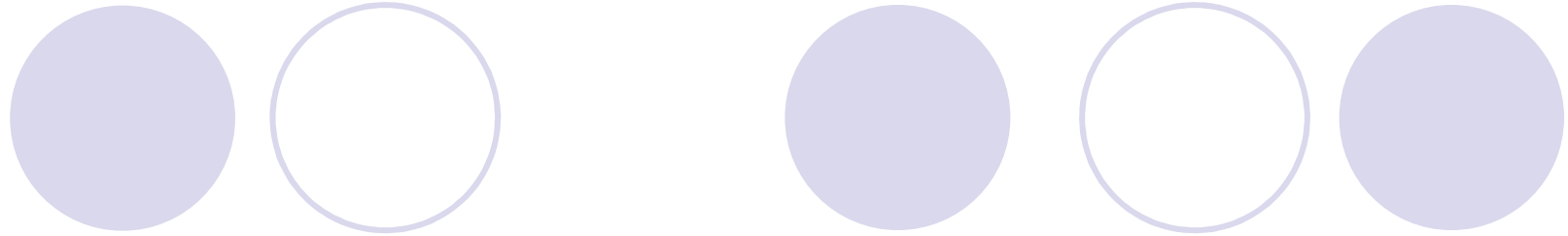
# Some results of the lidar monitoring of the atmospheric aerosol vertical distribution over the territory of Georgia

**M. Todua, G. G. Didebulidze**

Georgian National Astrophysical Observatory  
Ilia Chavchavadze State University

**OTEM**

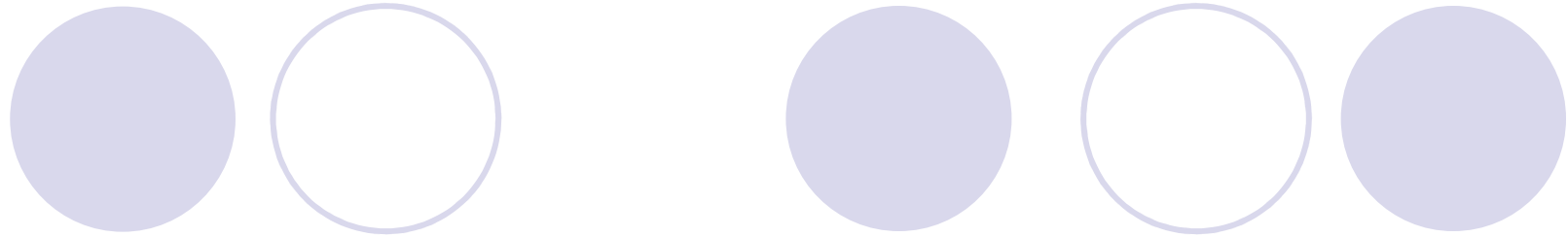
**Bucharest, 2009**



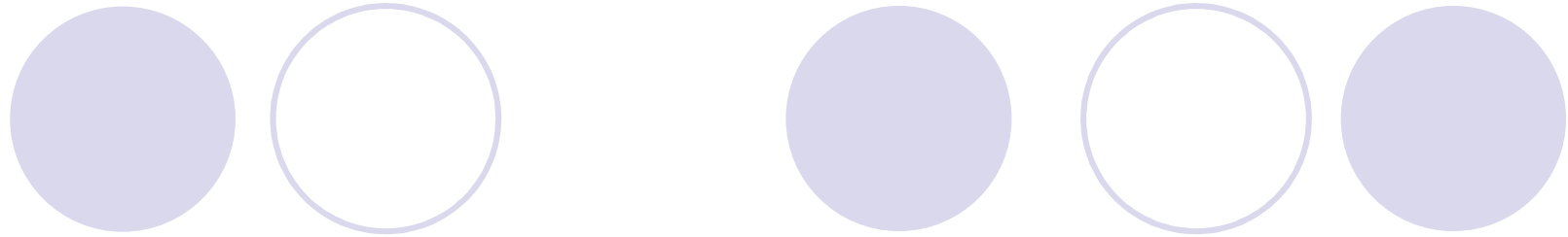
- Aerosol distribution in the Caucasus region is poorly studied
- The observations with the movable lidar system of the Abastumani Astrophysical Observation for monitoring of the aerosol vertical distribution is capable to fill this gap and contribute to the EARLINET network

The Observatory is situated at the South Caucasus Ridge (41.75N, 42.82E),  
~1600 meters above sea level





- Systematic atmospheric studies at the Abastumani Astrophysical Observation started in 1950-ies: long-term observations of various atmospheric parameters. However, the aerosol studies were only episodic.
- The most comprehensive investigation of aerosols was carried out in 3-27 July 1979 by the American-Soviet joint expedition - AFAEX: study of natural aerosols, their creation, transport, variations under different meteorological conditions and influence of the anthropogenic factor.
- Measurements of Ozone,  $\text{SO}_x$ ,  $\text{NO}_x$ ,  $\text{NH}_4$ , CFCs were made. Physical and optical (scattering and absorption coefficients) parameters of aerosols were determined.



- Chemical composition of aerosols: concentrations of ammonia, sulphates and nitrates.
- High concentration of nitrates on aerosol fractions with the diameters  $> 2 \mu\text{m}$  were detected.
- In situ aerosol measurements: determination of scattering coefficient using  $0.5 \mu\text{m}$  wave, its dynamic change during the day, polarization characteristics and their diffusion.
- Horizontal lidar observations were used to determine the attenuation coefficient: maximal =  $0.2 \pm 0.1$  per km, minimum  $0.07$  per km. These measurements concluded that the atmosphere was homogenous and stable.
- Physical parameters of aerosols were determined. Size distributions were found  $0.01\text{-}0.3 \mu\text{m}$  and  $0.3\text{-}10 \mu\text{m}$ .



## Results of the AFAEX experiment

- Concentration of halocarbons were typical for that of the global background. There changes were smaller than observed in US, which meant that there were no significant sources of them in Abastumani.
- Some absorbing ash was detected in aerosol samples, which pointed on burning source, but light attenuation is <10% less than the extinction coefficient.
- Mass concentration of low mass particles change from 2 to 50 g/m<sup>3</sup>, CO concentration alter in 80-160 ppb.
- The scattering coefficient does not increase considerably during daytime.
- Aerosolic particle distribution is bimodal and have peaks at 0.2 μm and 8 μm.
- in 5-6 July a sudden increase in ozone was observed which was believed due to jet stream intrusion.

# Lidar specifications

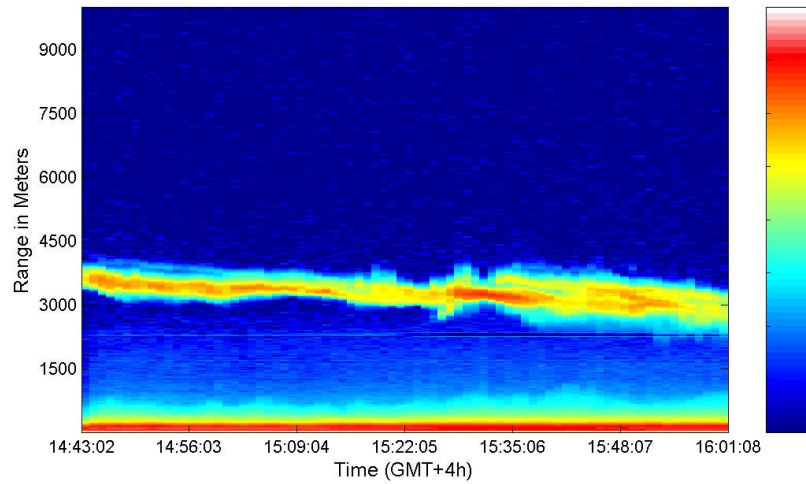


Laser Source	Nd:YAG
Wavelength	1570 nm
Pulse Length	10.9 ns
Laser Beam Divergence	12 mrad
Pulse Energy	70 mJ
Telescope	10" Schmidt-Cassegrain
Telescope Divergence	10 mrad

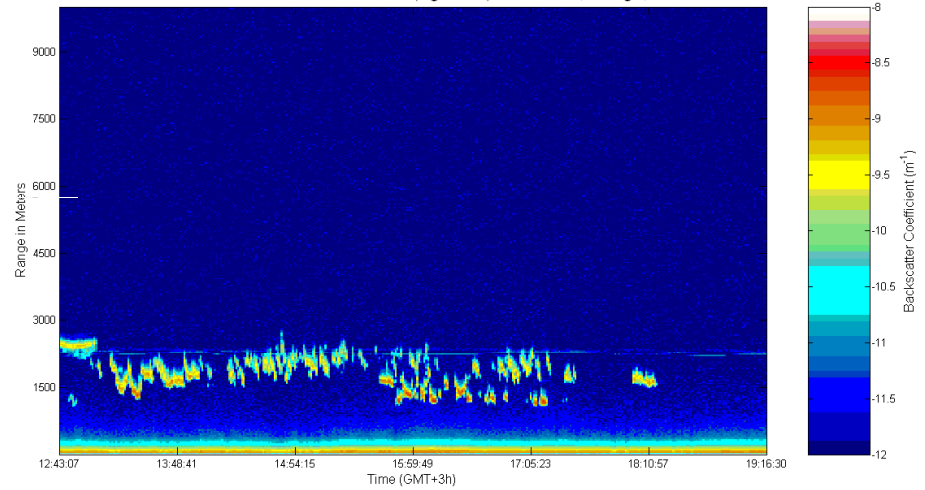
In March - May 2009: joined the correlative measurements with  
CALIPSO

Lidar backscatter coefficients in Tbilisi and Abastumani

LIDAR Backscatter Coefficient Time Series (log values). Tbilisi, Georgia, 03/19/09

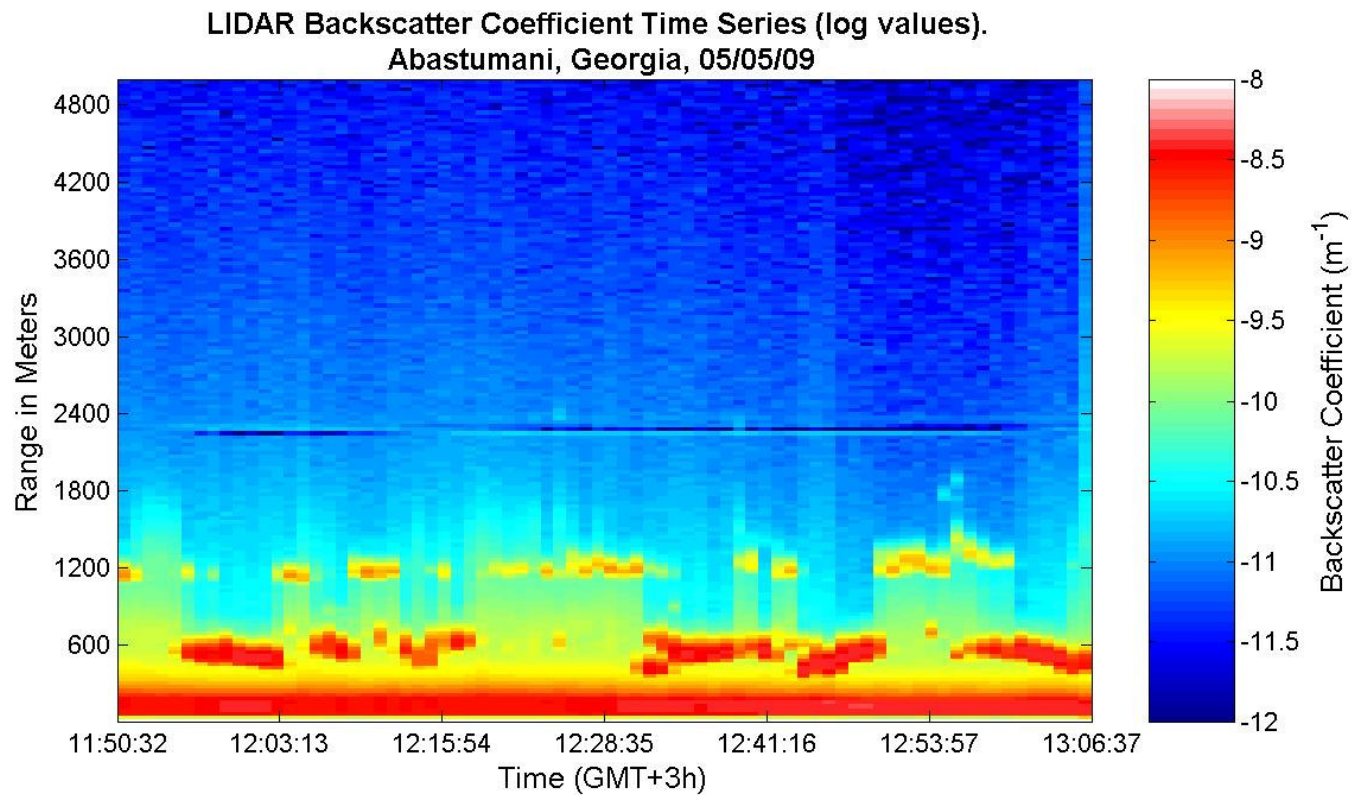


LIDAR Backscatter Coefficient Time Series (log values). Abastumani, Georgia, 05/01/09





# 5 May 2009: intrusion of mineral dust particles from Sahara over Abastumani and South Caucasus

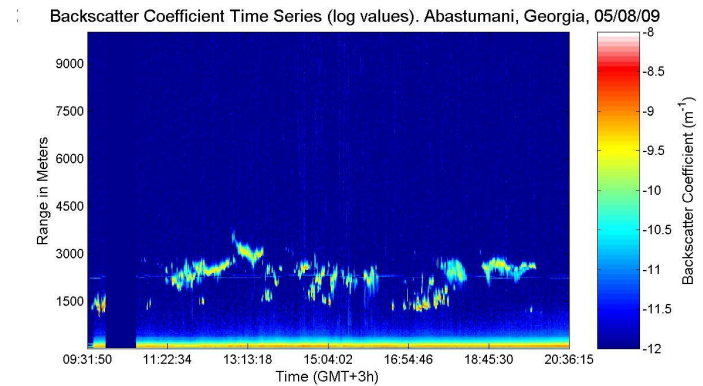
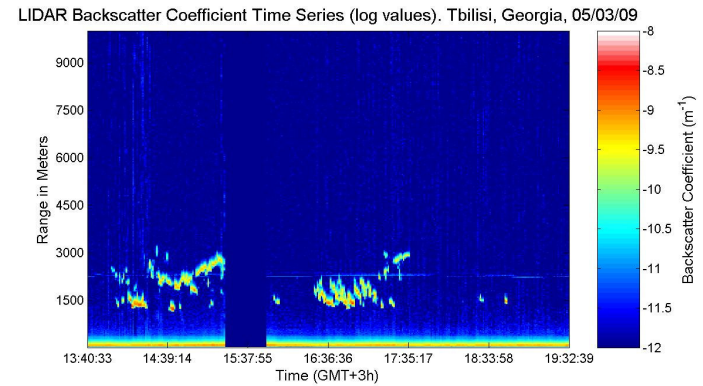
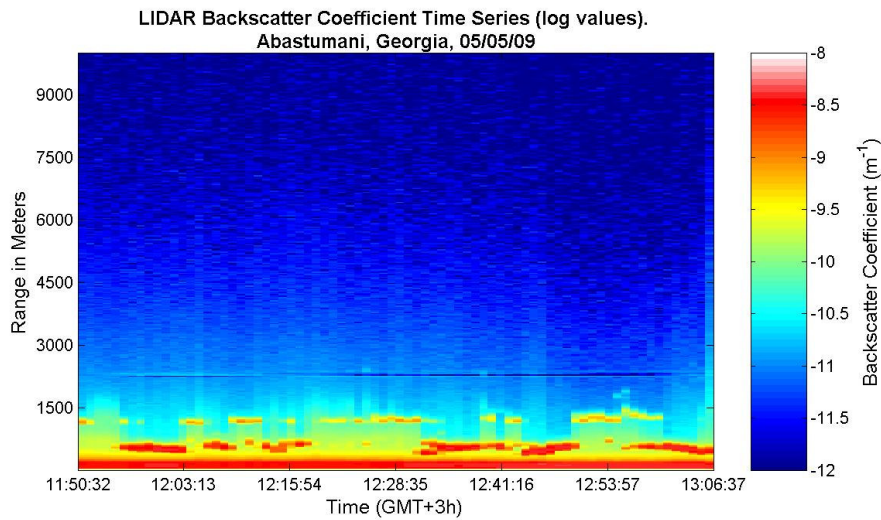


5 May 2009: intrusion of mineral dust particles from Sahara  
over Abastumani and South Caucasus



# 5 May 2009: intrusion of mineral dust particles from Sahara over Abastumani and South Caucasus

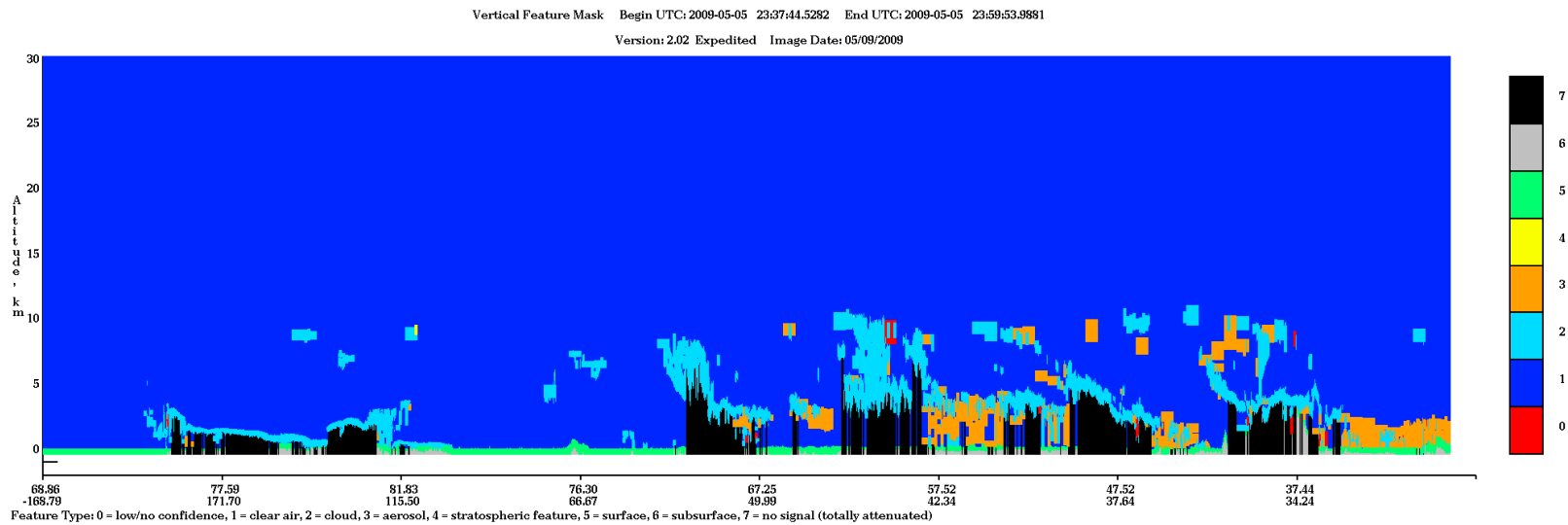
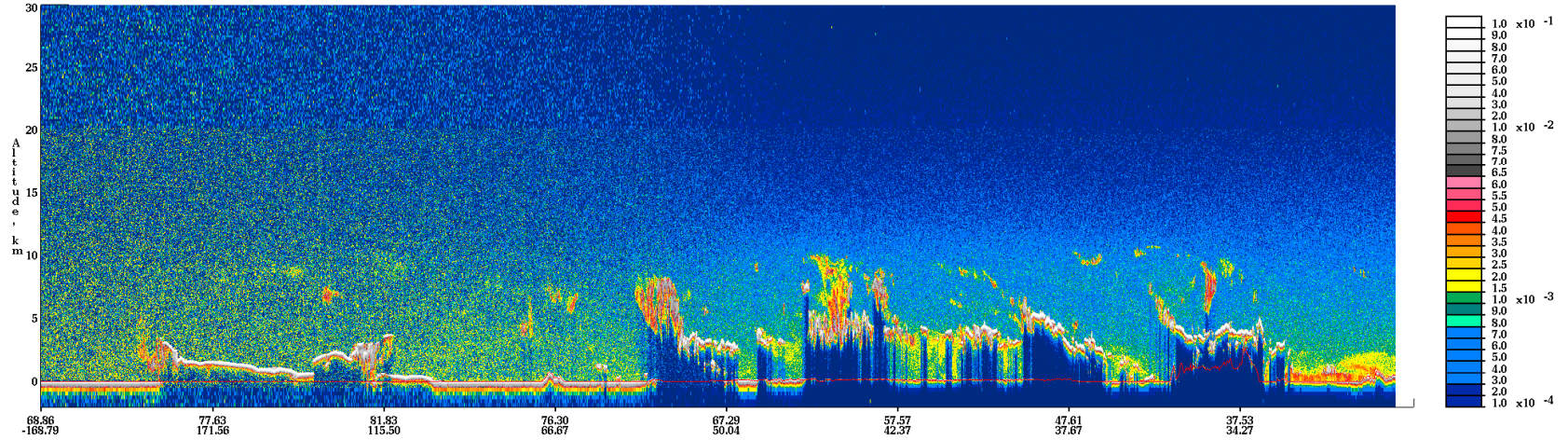
Before and after the dust event: 3 and 8 May



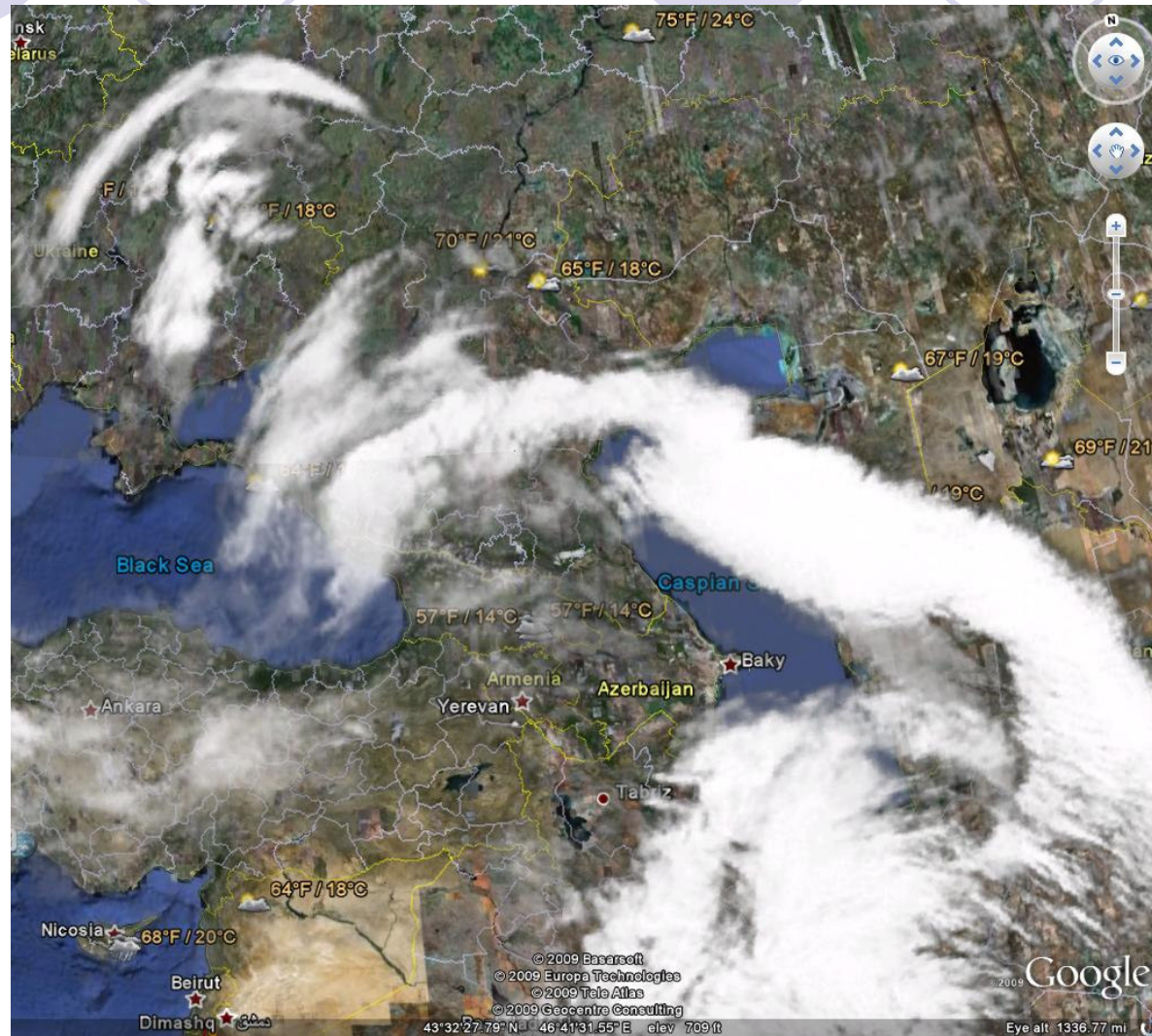
# 5 May 2009: intrusion of mineral dust particles from Sahara over Abastumani and South Caucasus

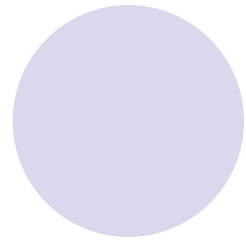
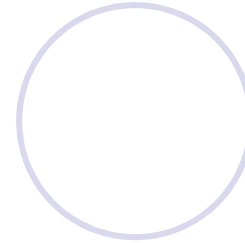
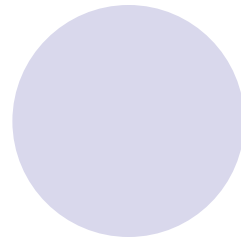
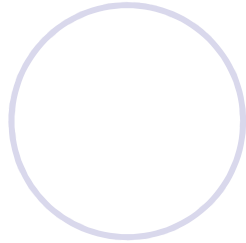
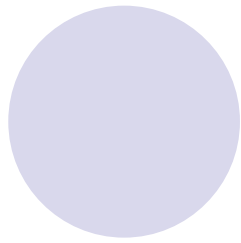
## CALIPSO passed 40km near Abastumani

532 nm Total Attenuated Backscatter, /km /sr Begin UTC: 2009-05-05 23:37:44.5281 End UTC: 2009-05-05 23:59:59.9392  
Version: 2.02 Expedited Image Date: 05/09/2009



# 5 May 2009: intrusion of mineral dust particles from Sahara over Abastumani and South Caucasus



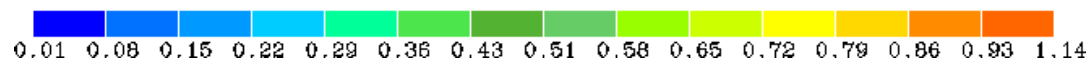
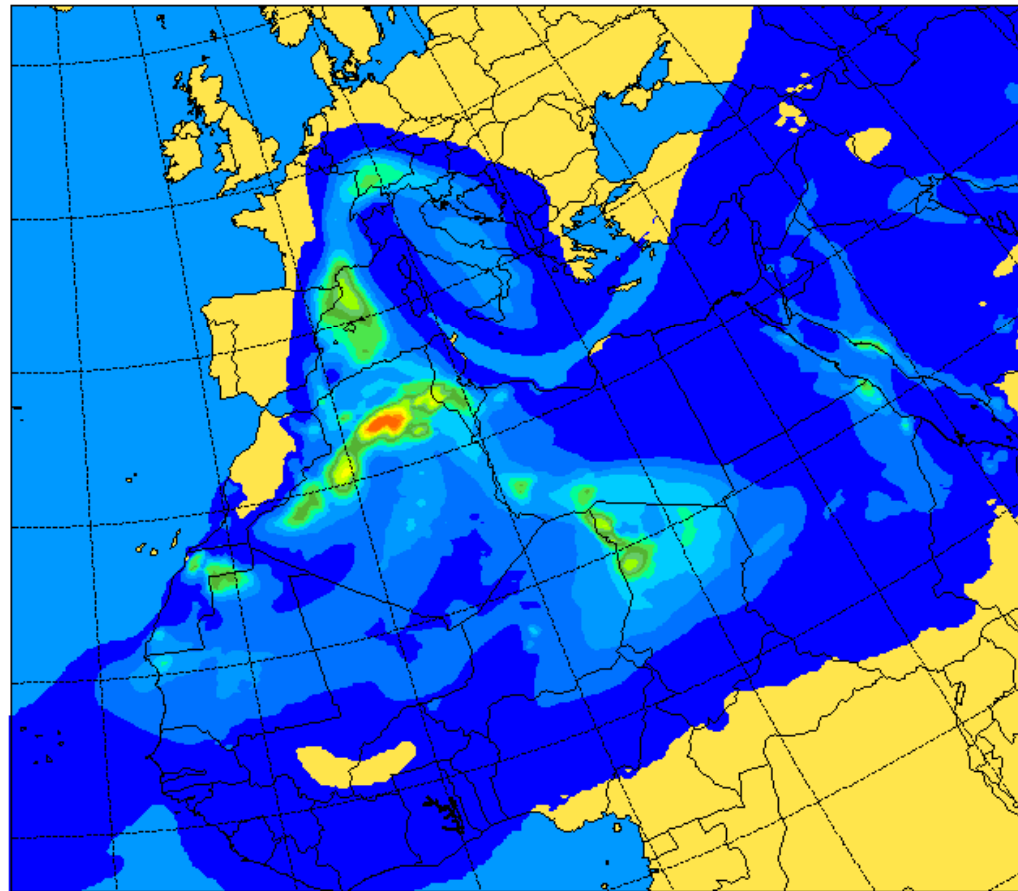


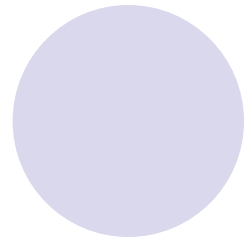
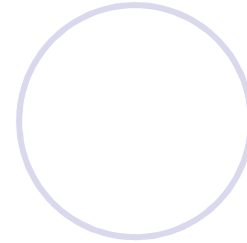
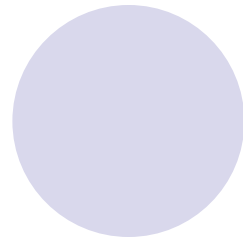
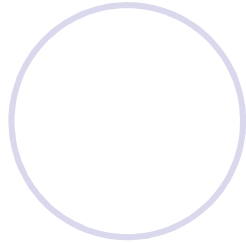
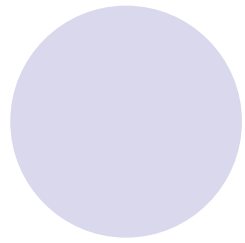
University of Athens (AM&WFG)

SKIRON Forecast

Aerosol Optical Depth at 532 nm

Thu 14/05/09 at 12 UTC





Thank you.