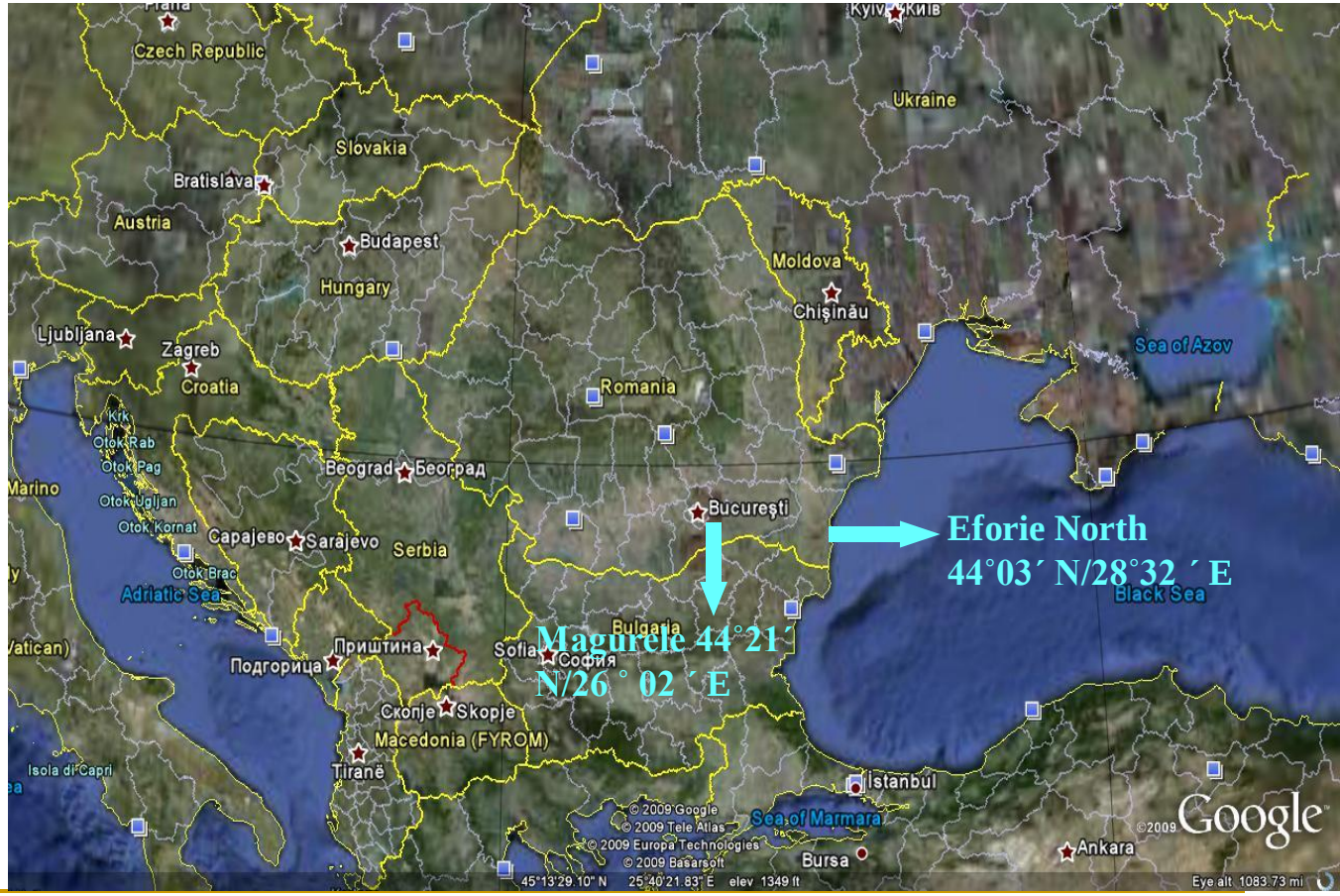
Sea influence on Aerosol Optical Depth (AOD) Sun- photometric data

(1)Sabina ŞTEFAN, (1)Luminita FILIP, (2)Anca NEMUC

(1)University of Bucharest, Faculty of Physics, Dept. of ***Atmospheric and Earth Physics***, P.O.Box MG-11, Magurele, Bucharest, Romania

(2) National Institute for R&D for Optoelectronics, Environment **Remote Sensing Lab.**,Magurele, Romania



OUTLOOK

- **Motivation**
- **Brief description of the sites**
- **Results and discussions**
- ***Spectral-temporal variations in AOD and WVC***
- ***Angstrom exponent and single scattering albedo***
- **Conclusions**

Motivation

The aerosols as important constituents of the atmosphere and of the hydrological cycle have to be studied in their **spatial and temporal variation**. The knowledge of their microphysics and optical properties help researchers to understand the role of aerosols in various studies **on air quality**, and on **climate**. Measurements of aerosol parameters such as aerosol optical depth (AOD), fraction of coarse aerosol (*f*c) and the relative contribution to AOD by fine (ff) and coarse (*f*c) particles, in conjunction with meteorological parameters as wind speed (*w*), provide the means **for continuous, long-term global observations of this complex system.**

The climate of **Magurele** is temperate-continental characterized by pronounced seasonal contrasts especially between winter and summer.

-agriculture region → dust

-southern part of Bucharest with power plants → aerosols and trace gases emissions.

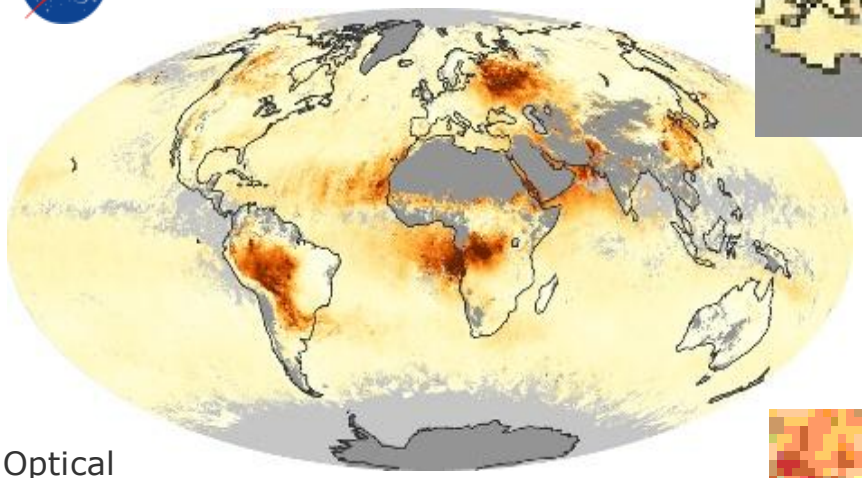
-rapid growth of economic activity → fossil / fuel combustion.

Eforie Nord, is in the middle of a natural park and the high cliff.

- In the **Black Sea,** the third largest in Europe, there are no currents no tidal, currents, or dangerous fishes;
- salinity is relatively low:1,7%, and 1% on the Romanian coast;
- the beach is a thick layer of fine sand, without stones and shells and is oriented to the east, which ensure minimum 10 hours of daily light.
- marine aerosols are formed from billions of very fine particles of salt water, loaded with many trace elements.

August 2010

Earth Observatory

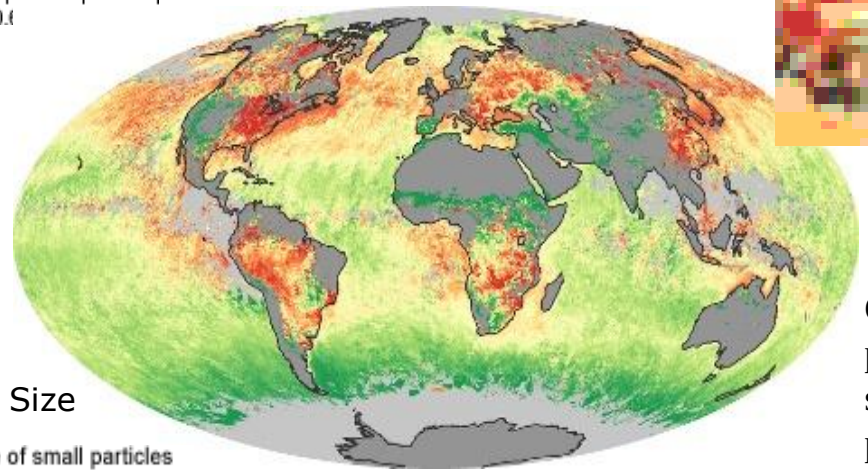


An optical thickness of less than 0.1 (palest yellow) indicates a crystal clear sky with maximum visibility, whereas a value of 1 (reddish brown) indicates very hazy conditions.

Aerosol Optical Depth

0.0 0.2 0.4 0.6

The aerosol maps show average monthly aerosol amounts around the world based on observations from the MODIS sensor on NASA's Terra satellite.



Aerosol Size

percentage of small particles

0 20 40 60 80 100

Green areas show where the aerosols that were present were mostly larger particles. Red areas show where aerosols consisted mostly of small particles. Yellow areas show plumes with an even mix of small and large particles. Gray shows where the sensor did not collect data.

Results & Discussions

Spectral-temporal variations in AOD (1)

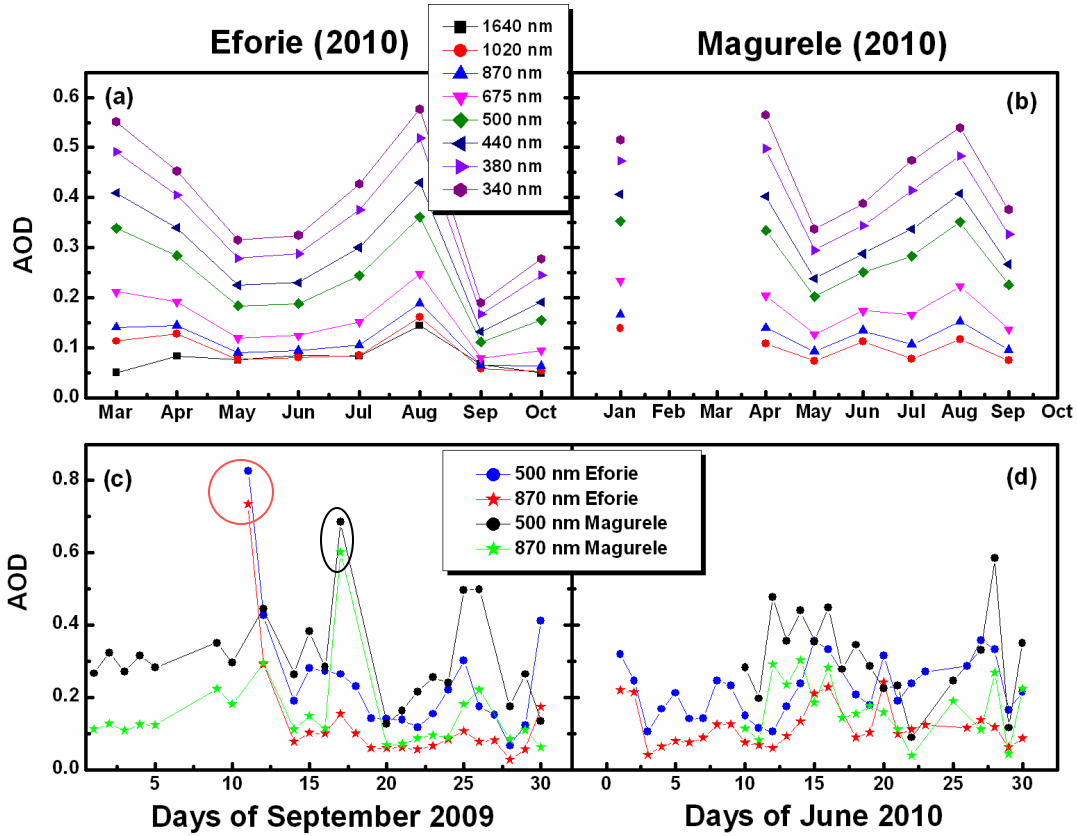


Fig.1 Spectral-temporal variations in monthly averaged AOD values on 2010 at Eforie North (a); the same for Magurele (b);the daily averaged values of aerosol optical depth were represented for months June 2010 (c) and September 2009(d).

Spectral-temporal variations in AOD (2)

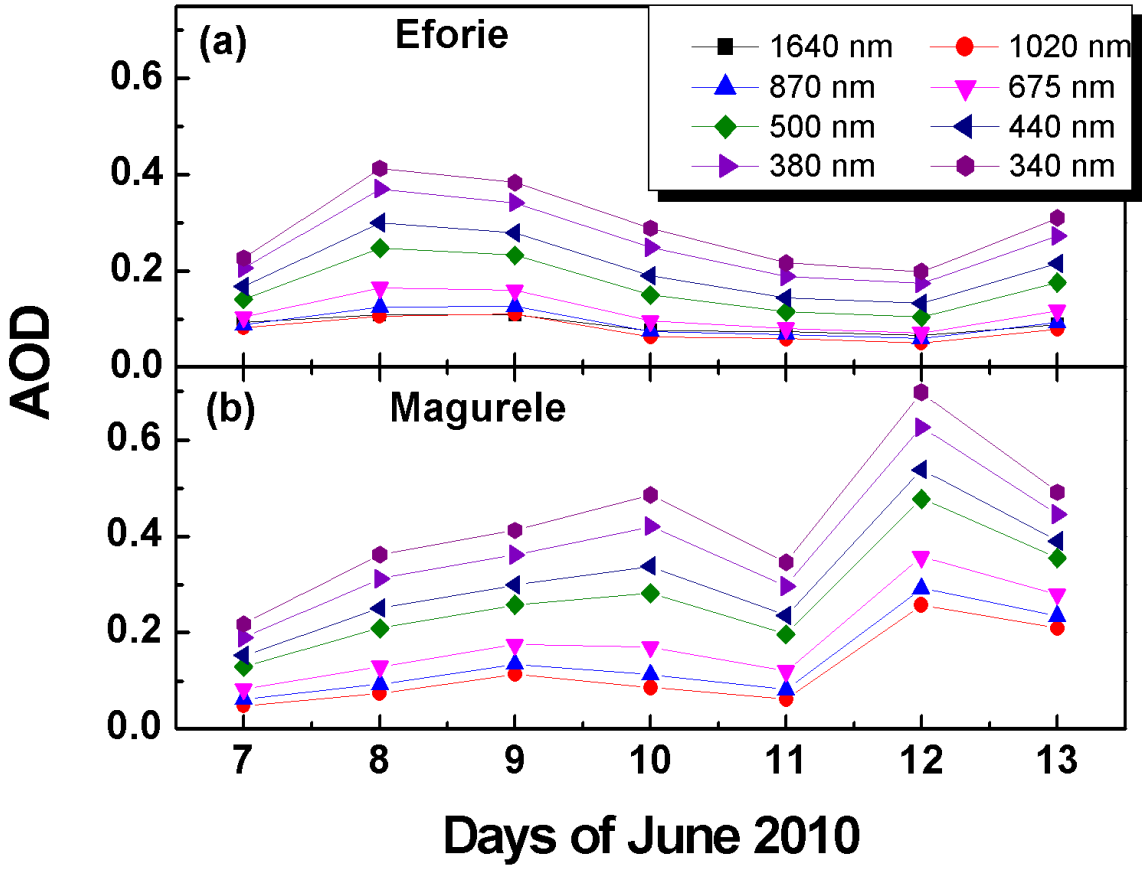


Fig. 3 The spectral AOD daily variation for 7-13 week for Eforie North (a) and Magurele (b).

Spectral-temporal variations in AOD and WVC and meteorological parameters (1)

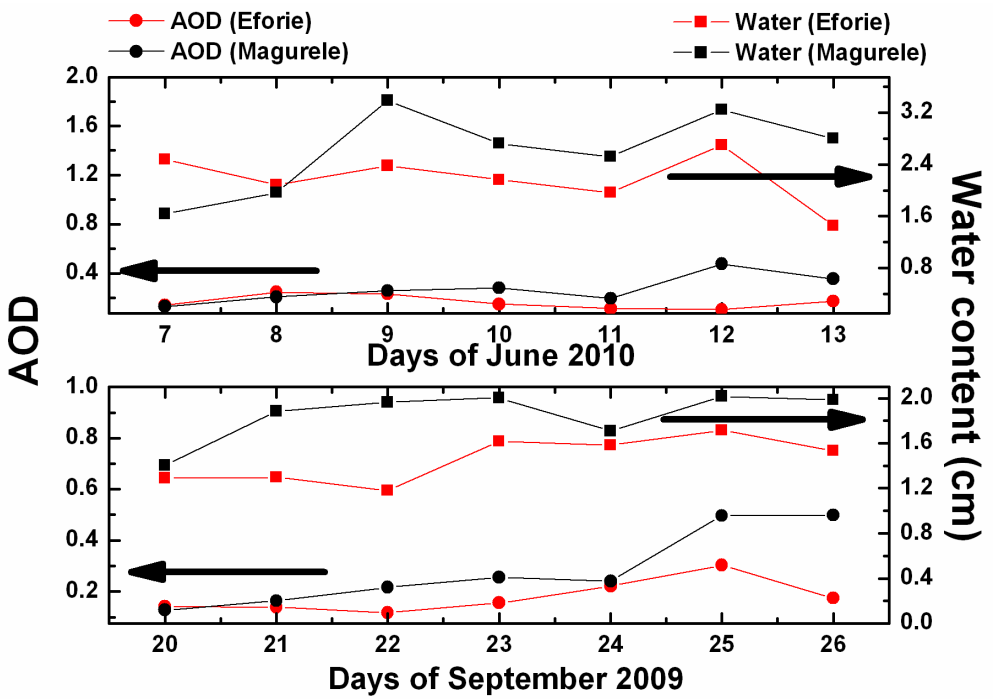
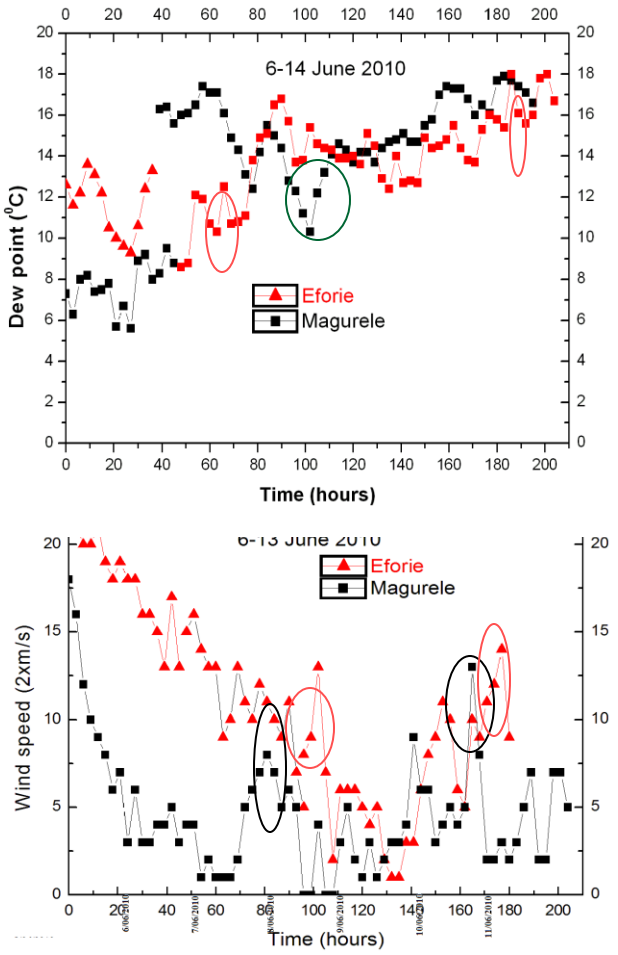


Fig. 4. The AOD (500nm) daily and water vapor content variation in the week 7-13 June 2010 (a);the same but for the period between 20-26 September 2009.



Meteorological conditions

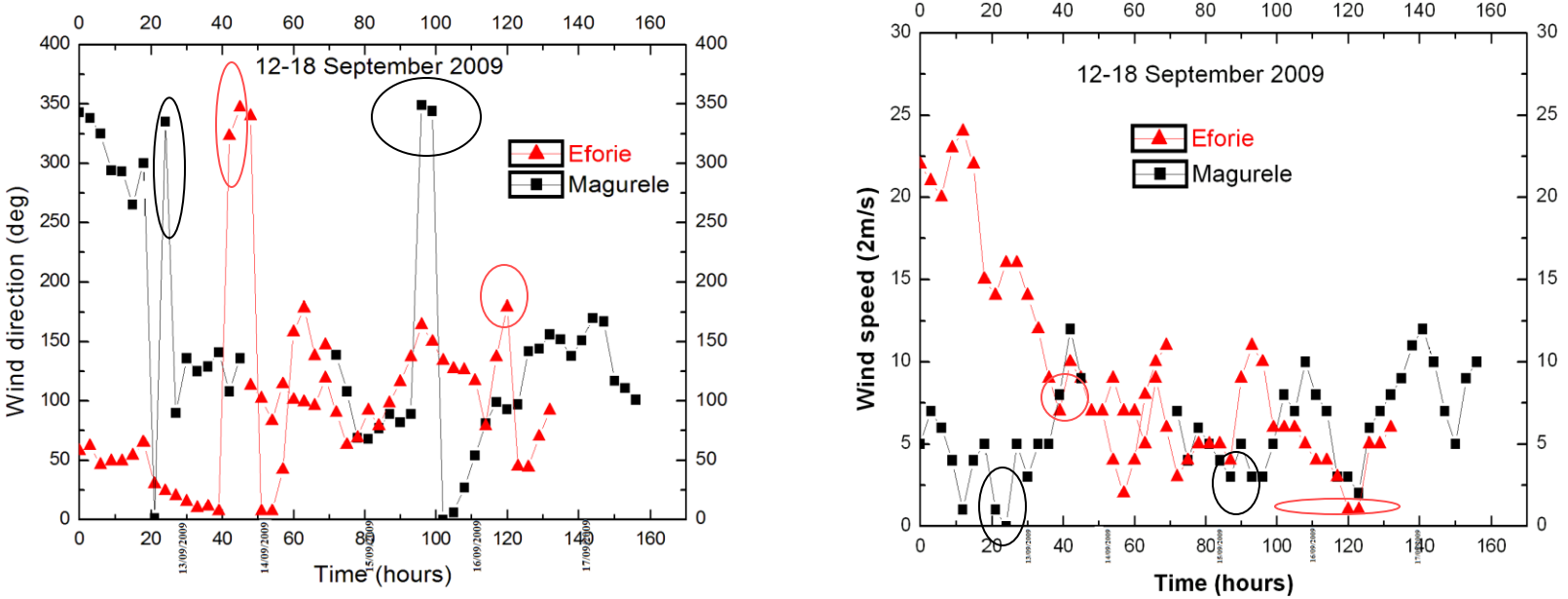
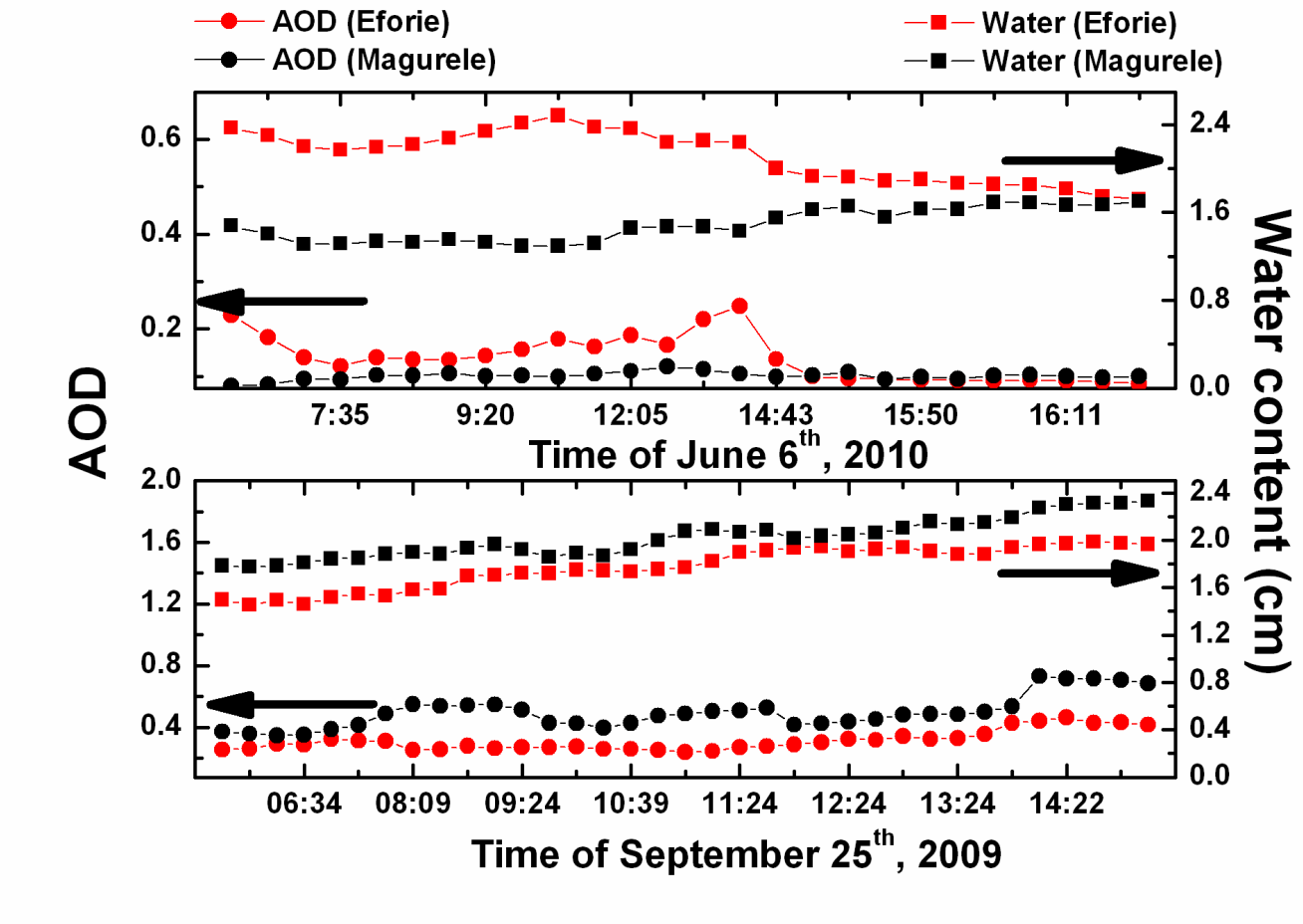


Fig.2. Wind direction and speed for 12-18 September 2009

Spectral-temporal variations in AOD and WVC (2)



Angstrom exponent and Single Scattering Albedo (SSA)

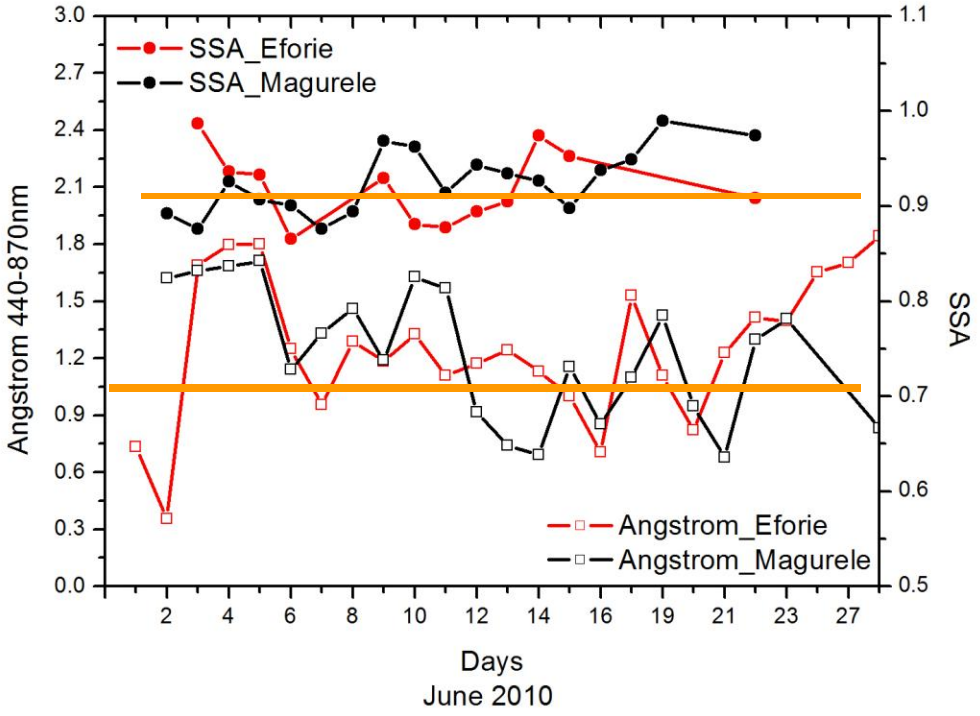
Consistent information on the atmospheric aerosol can be obtained from the value of the so-called *Ångström coefficient*, defined as

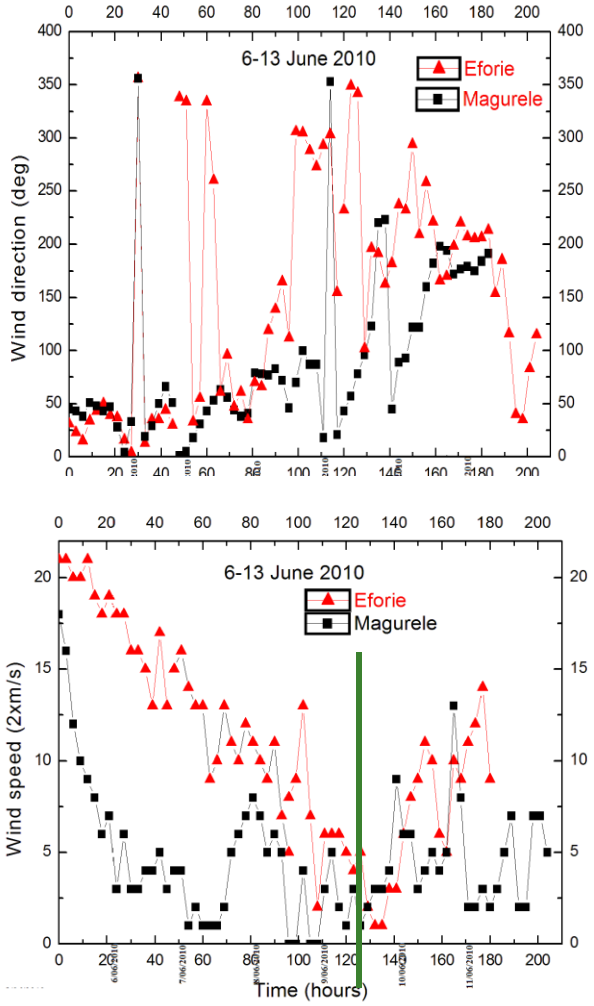
$$\tau_a = \beta \lambda^{-\alpha}$$

which is to be distinguished from the usual exponent of the approximate Ångström's power law of extinction.

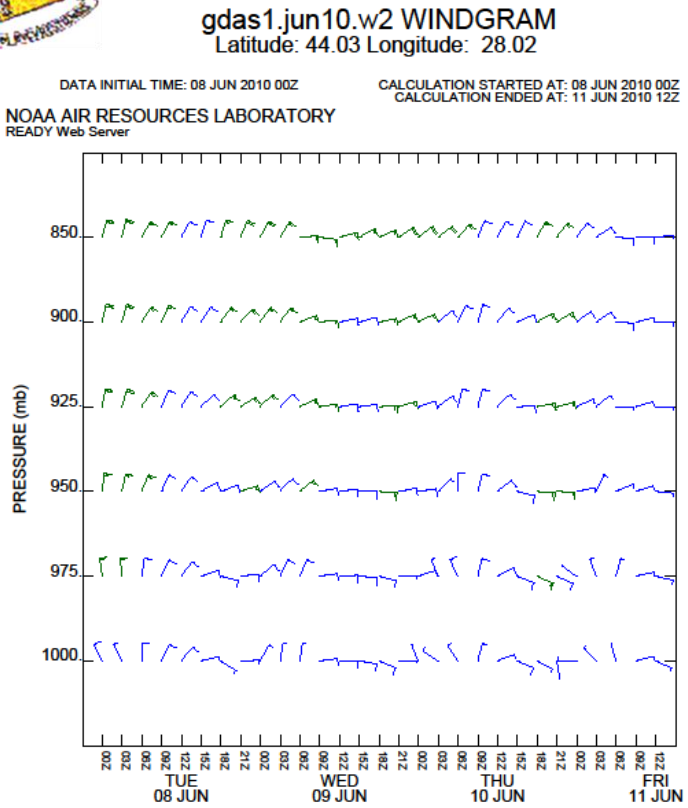
$$\alpha = \ln(\tau_{a1}/\tau_{a2})/\ln(\lambda_2/\lambda_1)$$

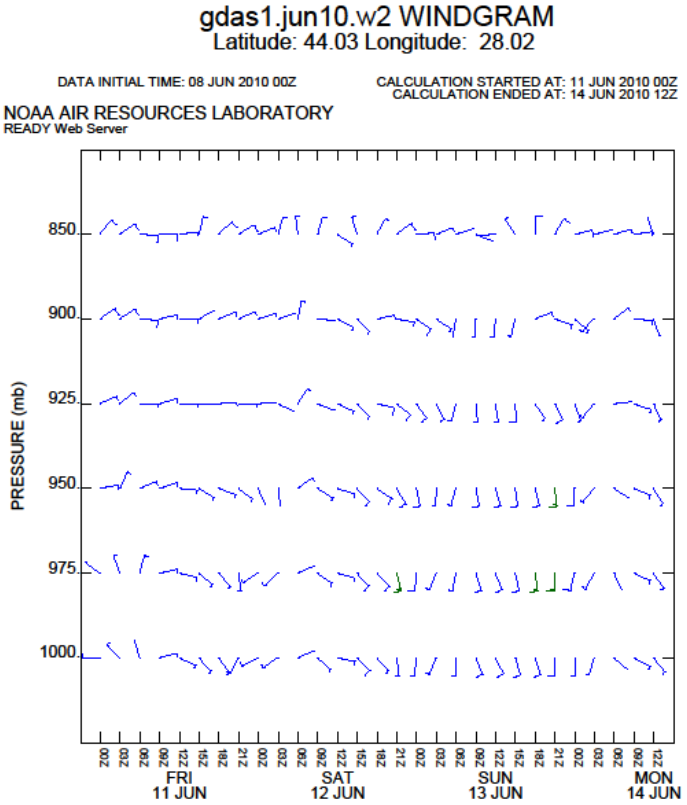
Angstrom exponent and Single Scattering Albedo (SSA)

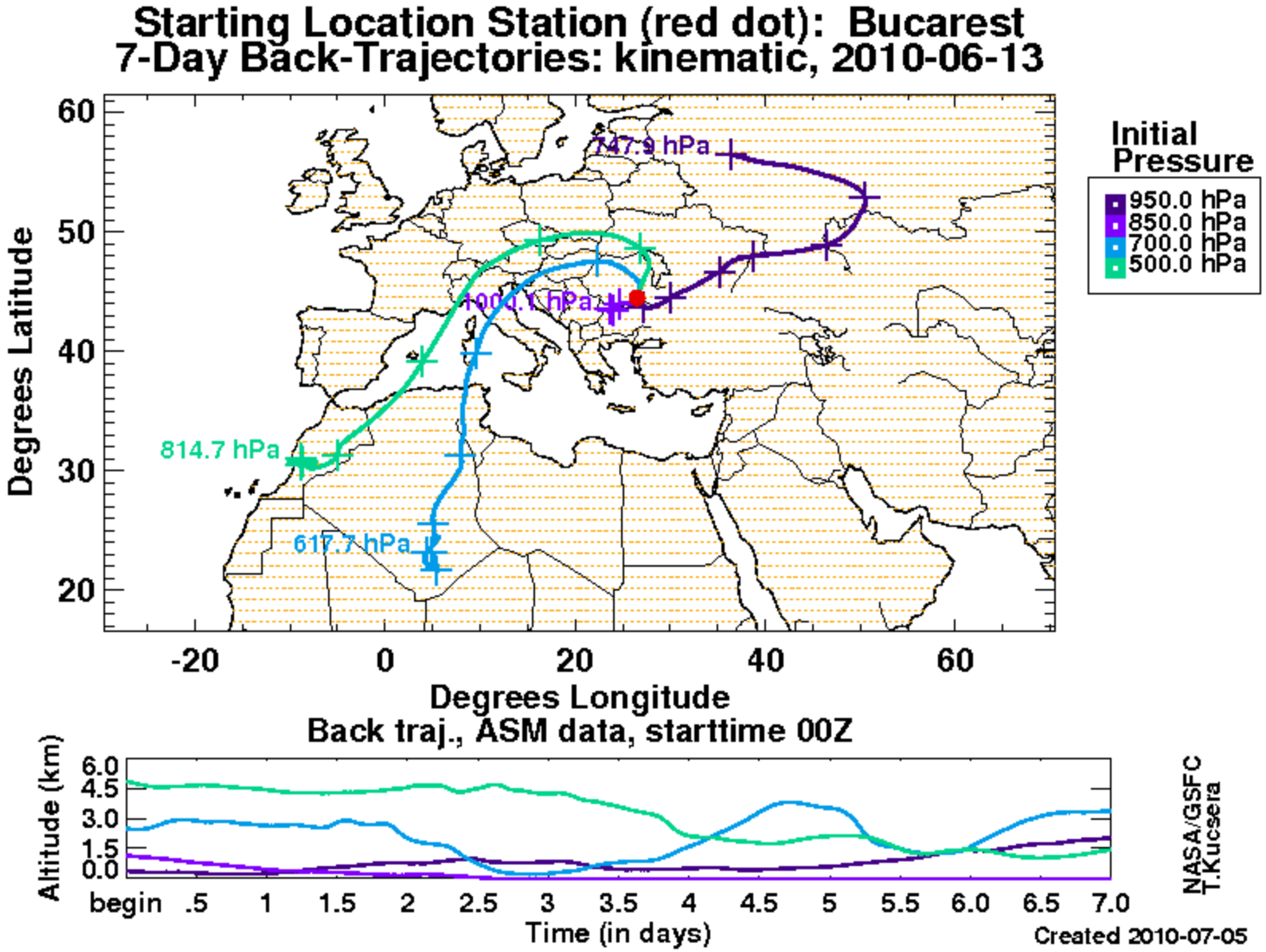




4-th OTEM2010 Cluj 19-21 October 2010

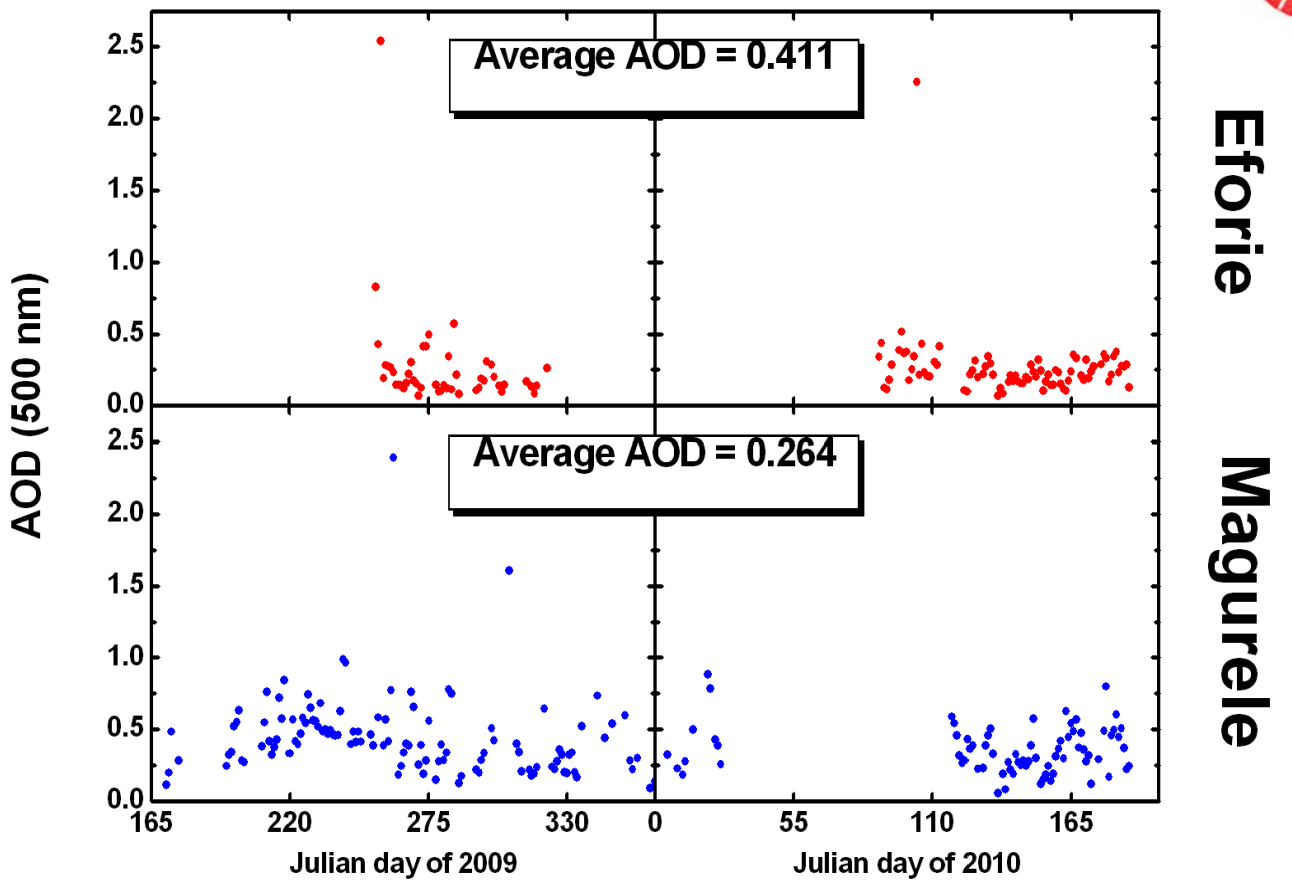

gdas1.jun10.w2 WINDGRAM
Latitude: 44.03 Longitude: 28.02
DATA INITIAL TIME: 08 JUN 2010 00Z
CALCULATION STARTED AT: 08 JUN 2010 00Z
CALCULATION ENDED AT: 11 JUN 2010 12Z
NOAA AIR RESOURCES LABORATORY
READY Web Server
PRESSURE (mb)
850
900
925
950
975
1000
TUE 08 JUN
WED 09 JUN
THU 10 JUN
FRI 11 JUN

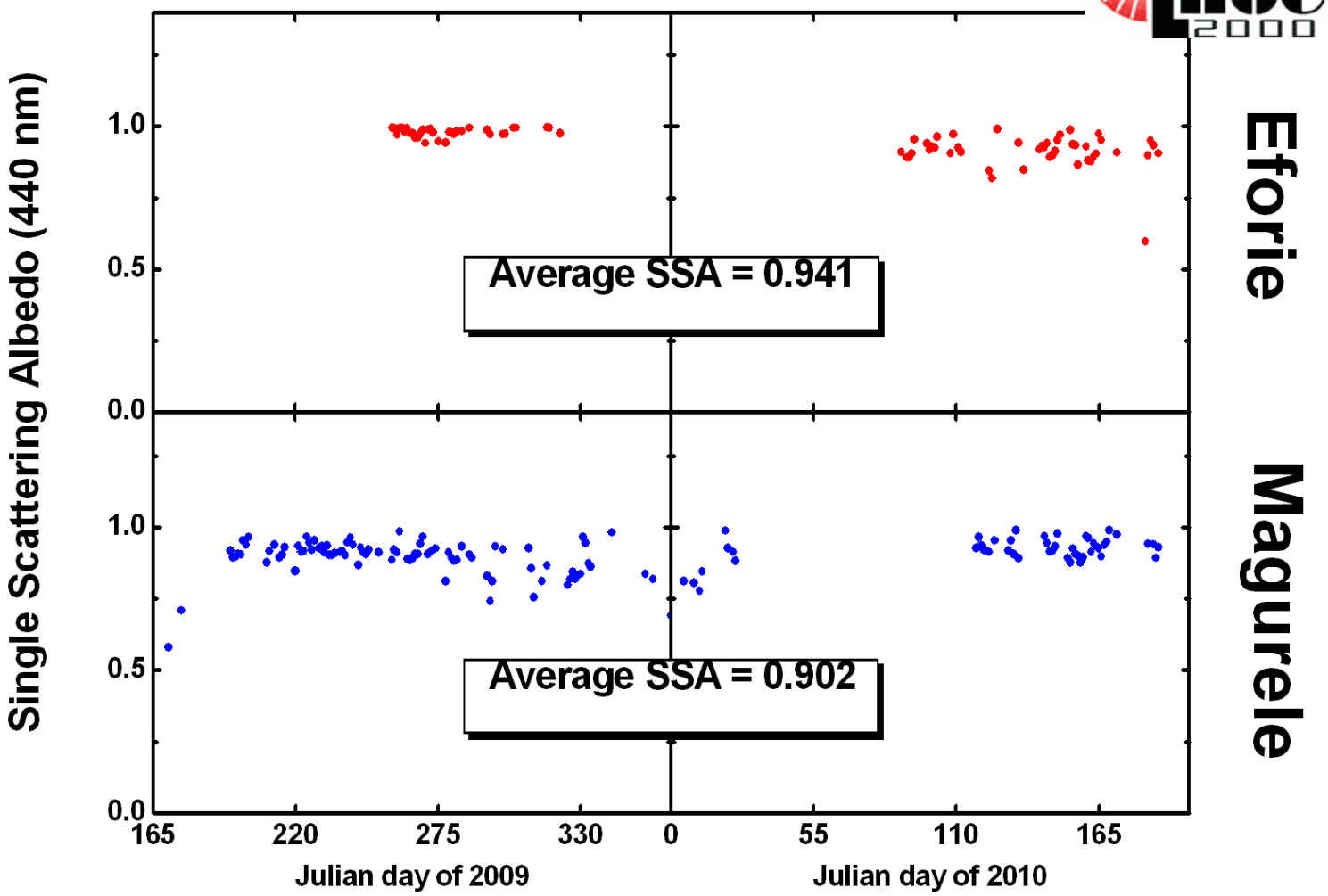

gdas1.jun10.w2 WINDGRAM
Latitude: 44.03 Longitude: 28.02
DATA INITIAL TIME: 08 JUN 2010 00Z
CALCULATION STARTED AT: 11 JUN 2010 00Z
CALCULATION ENDED AT: 14 JUN 2010 12Z
NOAA AIR RESOURCES LABORATORY
READY Web Server
PRESSURE (mb)
850
900
925
950
975
1000
FRI 11 JUN
SAT 12 JUN
SUN 13 JUN
MON 14 JUN


Starting Location Station (red dot): Bucarest
7-Day Back-Trajectories: kinematic, 2010-06-13
Degrees Latitude
60
50
40
30
20
-20
0
20
40
60
Degrees Longitude
747.9 hPa
1000.1 hPa
814.7 hPa
617.7 hPa
Initial Pressure
950.0 hPa
850.0 hPa
700.0 hPa
500.0 hPa
Back traj., ASM data, starttime 00Z
Altitude (km)
6.0
4.5
3.0
1.5
0.0
begin .5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6.0 6.5 7.0
Time (in days)
NASA/GSFC
T.Kucsera
Created 2010-07-05

Statistics of the AOD, Angstrom exponents and Single Scattering Albedo computed for summer month - June 2010

Location	Aerosol Optical Depth (λ nm)							α	SSA(550) nm
	340	380	440	500	675	870	1020		
Eforie North	0.362	0.326	0.268	0.224	0.153	0.118	0.101	1.290	0.920
Magurele	0.392	0.354	0.299	0.262	0.181	0.140	0.118	1.268	0.926


Average AOD = 0.411
Average AOD = 0.264
AOD (500 nm)
2.5
2.0
1.5
1.0
0.5
0.0
165
220
275
330
0
55
110
165
Julian day of 2009
Julian day of 2010
Eforie
Magurele


Single Scattering Albedo (440 nm)
Eforie
Magurele
Average SSA = 0.941
Average SSA = 0.902
1.0
0.5
0.0
1.0
0.5
0.0
165
220
275
330
0
55
110
165
Julian day of 2009
Julian day of 2010

Conclusions

The results of the analysis of optical and meteorological parameters for the two sites indicate the following:

- Spectral dependence of AOD with higher values at smaller wavelengths and vice-versa are more evident at Eforie North than at Magurele.
- Greater values of AOD in the days 9,12 and 26 June indicate air-mass exchange, or pollution episodes. These variations have been explained by performing the back trajectory analysis.
- A smaller wavelength exponent indicating an abundance in larger aerosol particles, has greater extinction during summer at Eforie North.
- Daily values of single-scattering albedo at Eforie North larger than those at Magurele show that aerosol particles at Eforie North have mineral composition (dust).

Acknowledgements

The authors are grateful to B. N. Holben, from NASA, to Ph. Goloub (University of Lille, France) and to their teams for support in AERONET-related activities.

This work was supported by a grant from Norway through the Norwegian Co-operation Programme for Economic Growth and Sustainable Development in Romania.

The authors wish to acknowledge DELICE grant contract FP7 REGPOT-2008-1 Contract no. 229907.

Thank you for your attention!