Synergistic use of in-situ and remote sensing data for accurate characterization of long range transported aerosol

Anca Nemuc, Jeni Vasilescu,
Luminita Marmureanu , Doina Nicolae, Cristian Radu

Topics

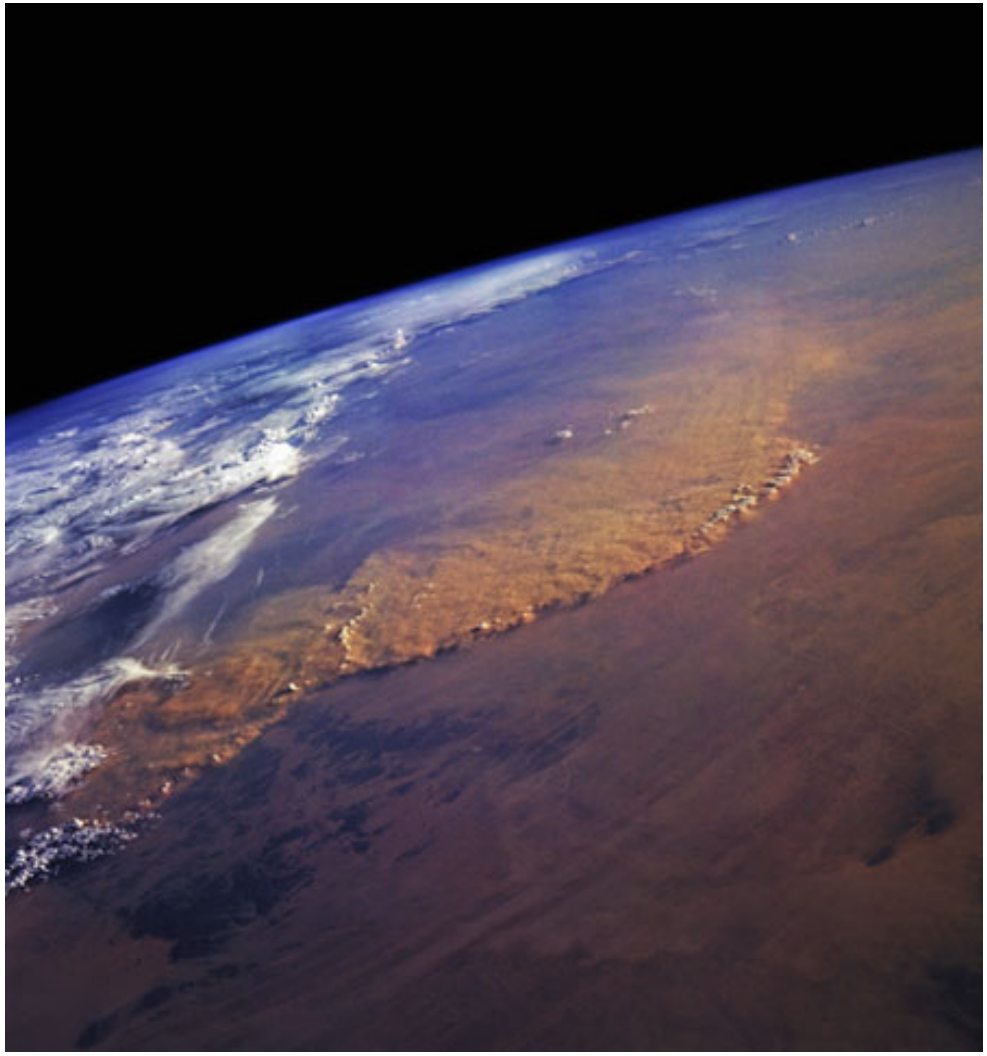
- Motivation
- Instruments
- Case studies
  - May 11th , 2010- volcanic ash influence
  - August 11th ,2010- biomass burning influence
  - June 14th , 2010- Saharan dust intrusion

- Conclusions

Motivation-why is long range transport important?

Biomass burning

DUST storms



RALI-Aerosol multiwavelength lidar

1 instrument – many channels:

- 3 elastic channels (1064, 532 and 355nm) – 3 backscatter profiles
- 2 Raman channels (607 and 387nm) – 2 extinction profiles
- 1 depolarization channel (532s / 532p) – asphericity

1 instrument – many data:

- Layers altitude and dynamics
- Layers optical properties:
- scattering, extinction, particle size, particle asphericity

 particle type

EARLINET-European Aerosol Lidar Network

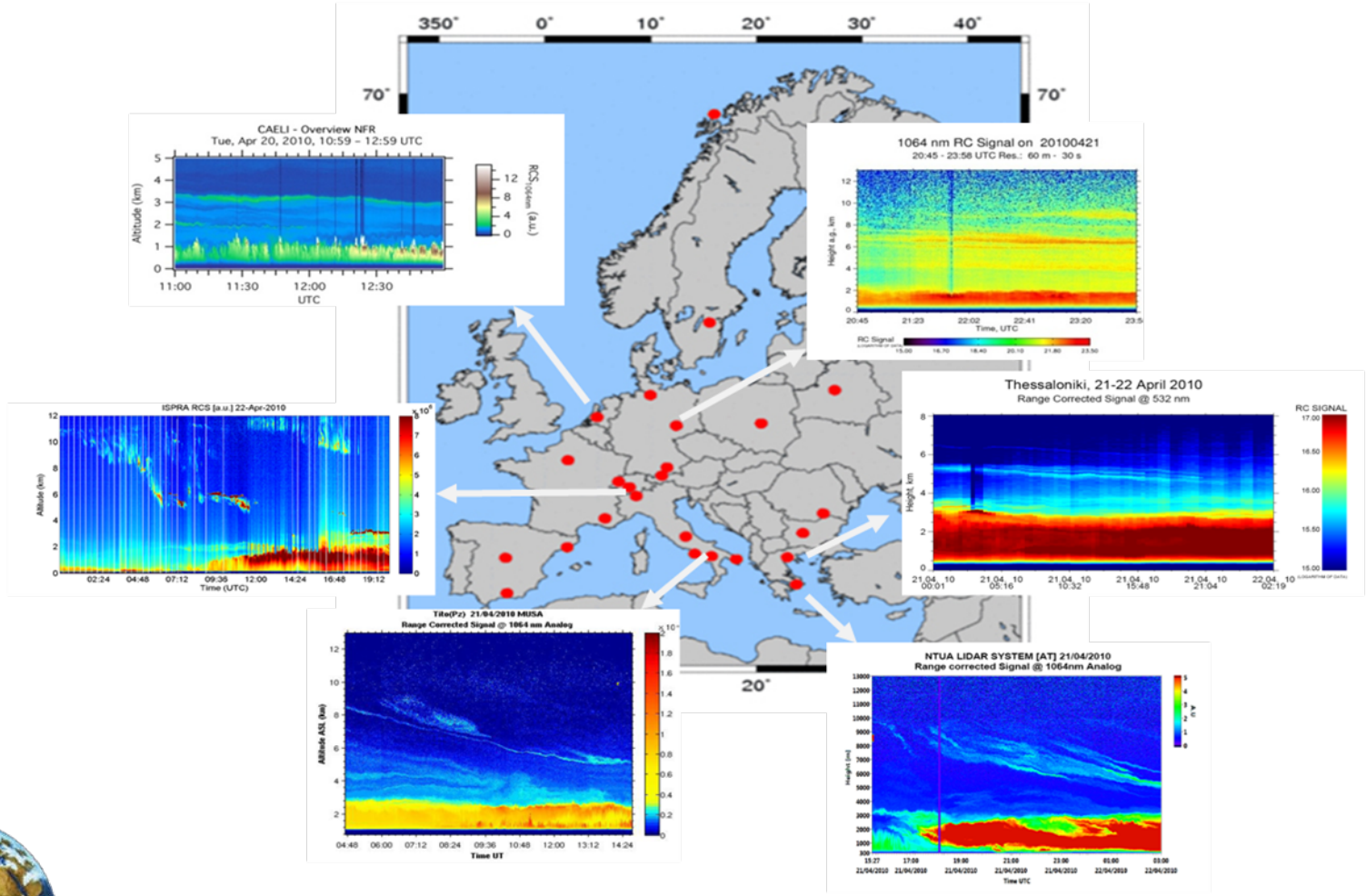
Aerosol Mass Spectrometer

- Aerodyne C-ToF-AMS measures size-resolved chemical composition of non-refractory submicron particles
- Output parameters:
  - Average mass concentration for:
    - » Organics
    - » Sulfate
    - » Ammonium
    - » Nitrate
    - » Chloride
  - Mass range distribution

  of aerosols up to 800 m/z;
  - Concentration time series,
  - Aerodynamic size distribution of aerosols.

Case study- volcanic ash influence

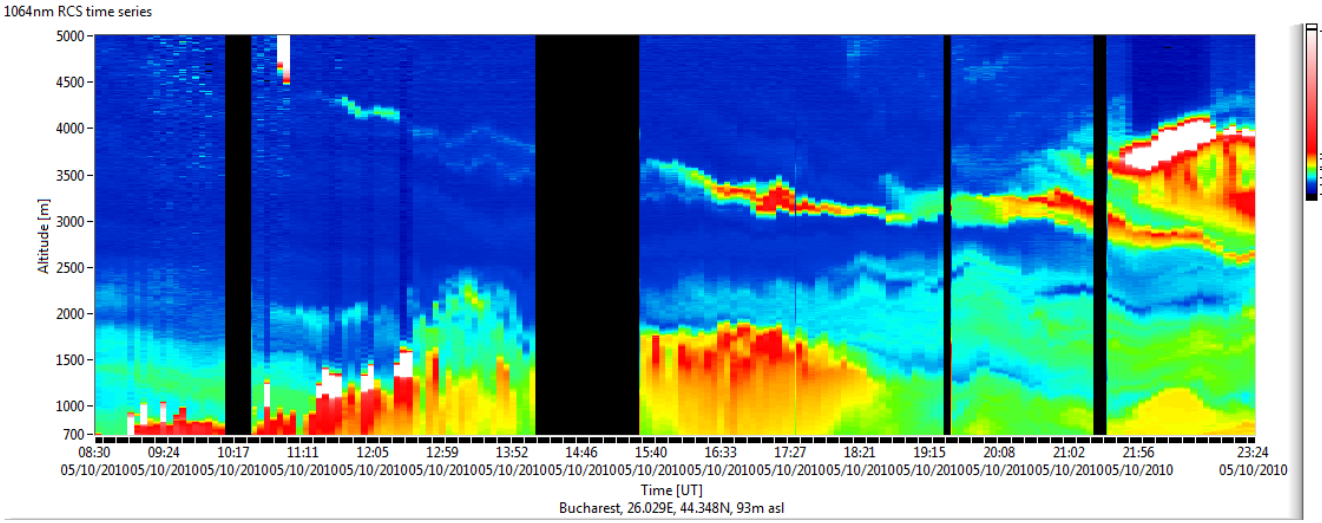
Observations of the volcanic ash layers at other EARLINET sites

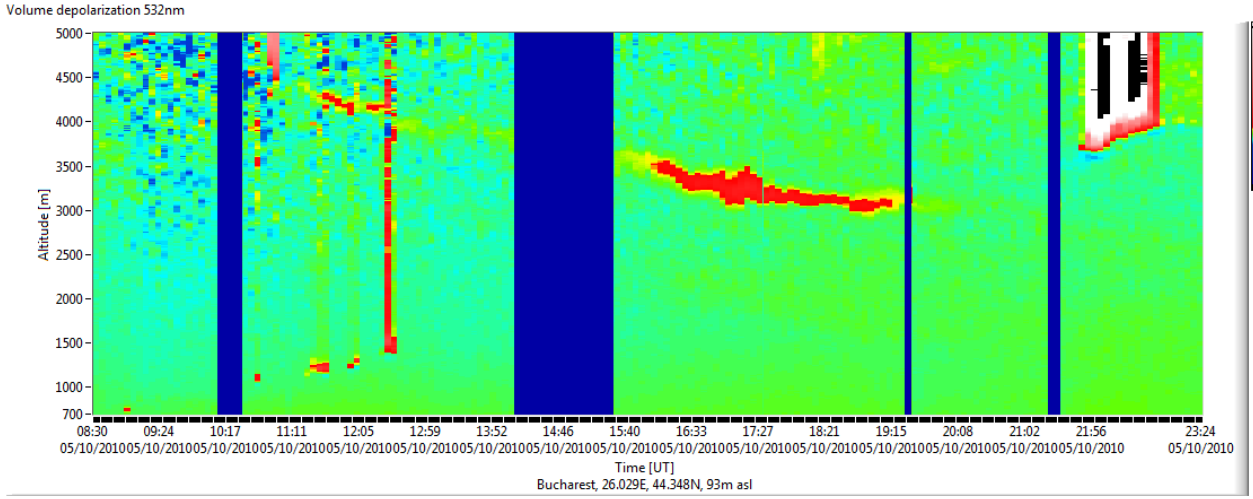


May 10th, 2010

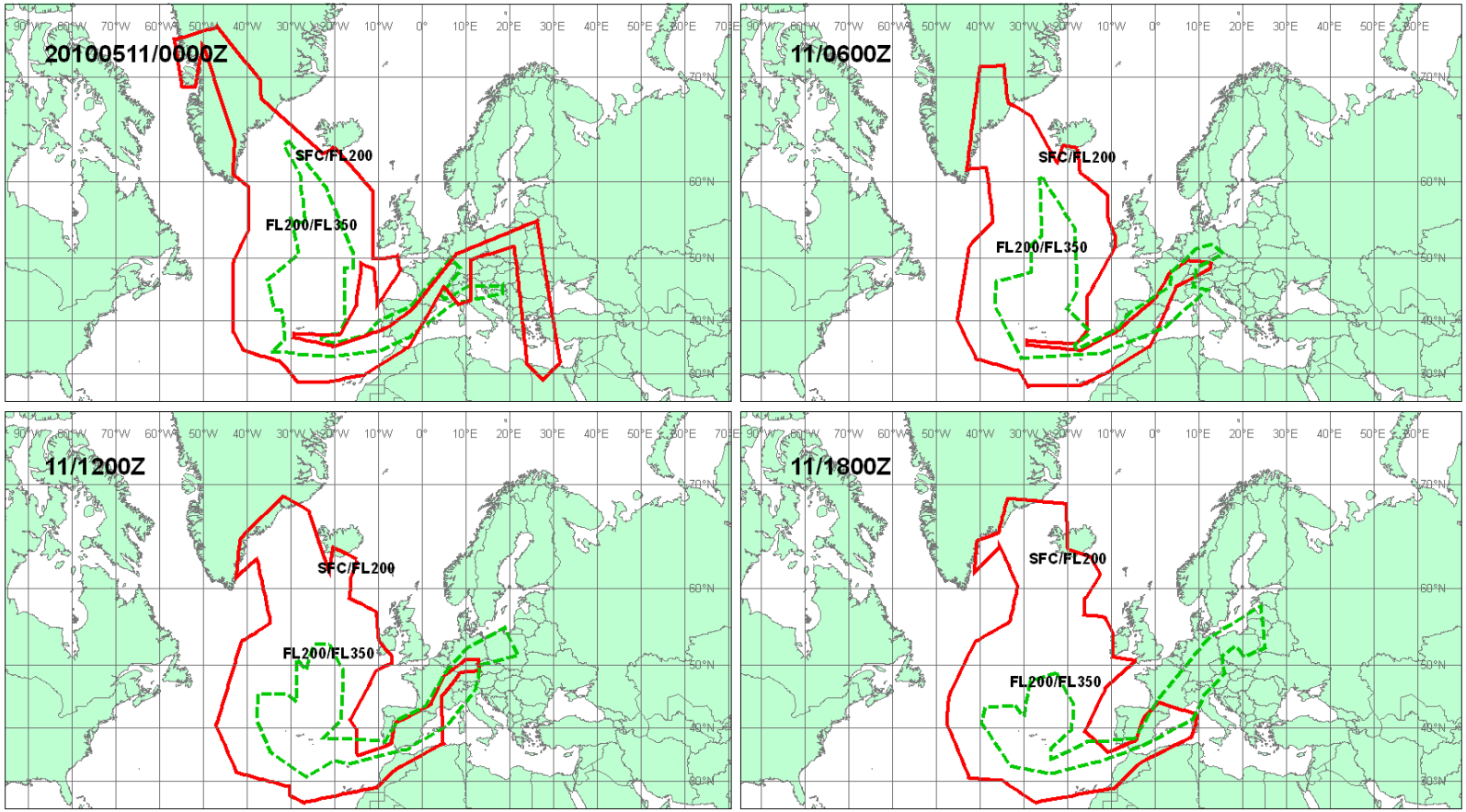
LIDAR:

- descending plumes, dispersed (filaments)
- increased depolarization whole altitude range
- clouds on top of the PBL and above the layers





Eyjafjallajökull ash cloud: May 11, 2011



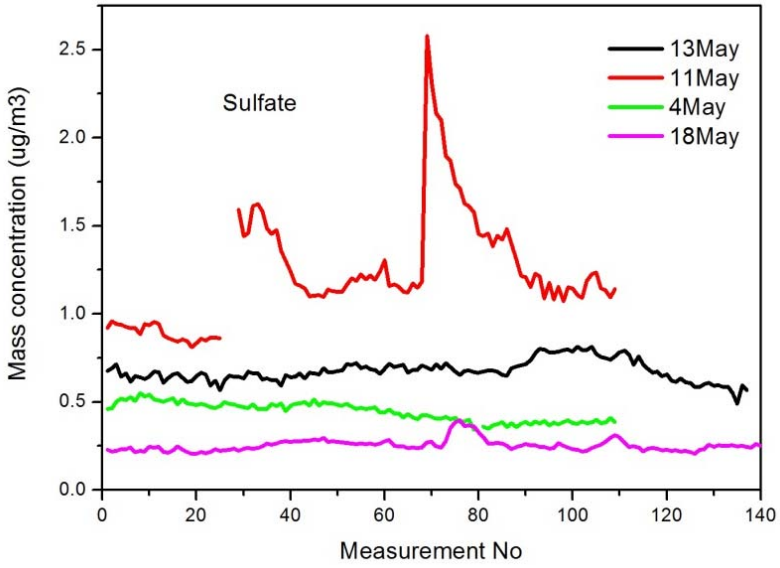
VA ADVISORY
DTG: 20100511/0000Z
VAAC: LONDON
VOLCANO:
EYJAFJALLAJOKULL1702-02
PSN: N6338 W01937
AREA: ICELAND

SUMMIT ELEV: 1666M
ADVISORY NR: 2010/102
INFO SOURCE: ICELAND MET OFFICE
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION CONTINUES WITH PLUME HEIGHT TO FL140 TO FL160 AND ISOLATED PLUME HEIGHT TO FL200.

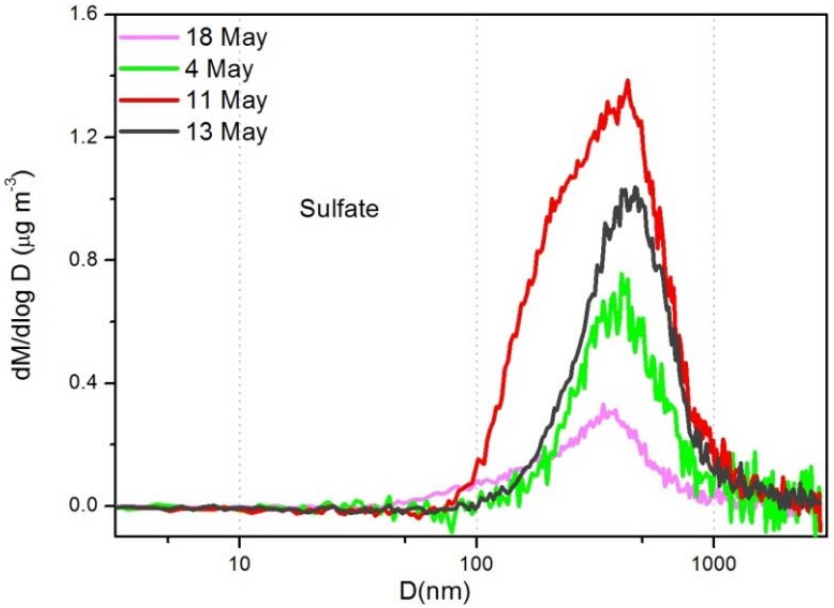
RMK:
NXT ADVISORY: 20100511/0600Z

AMS measurements

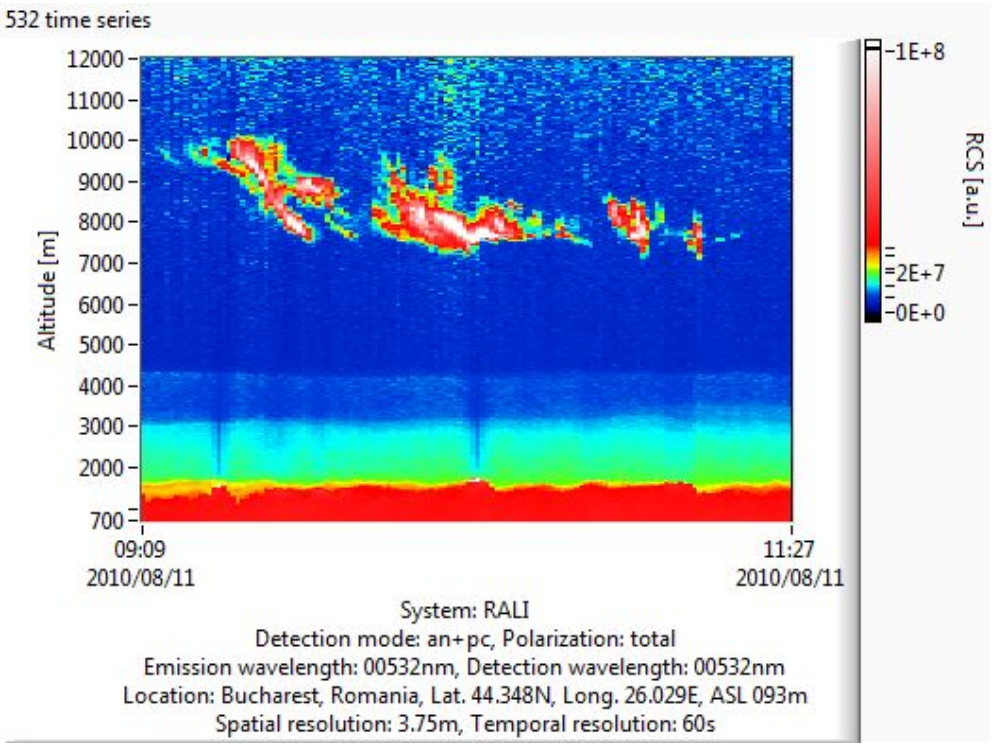
Increased sulfates mass concentration at ground (May 11)

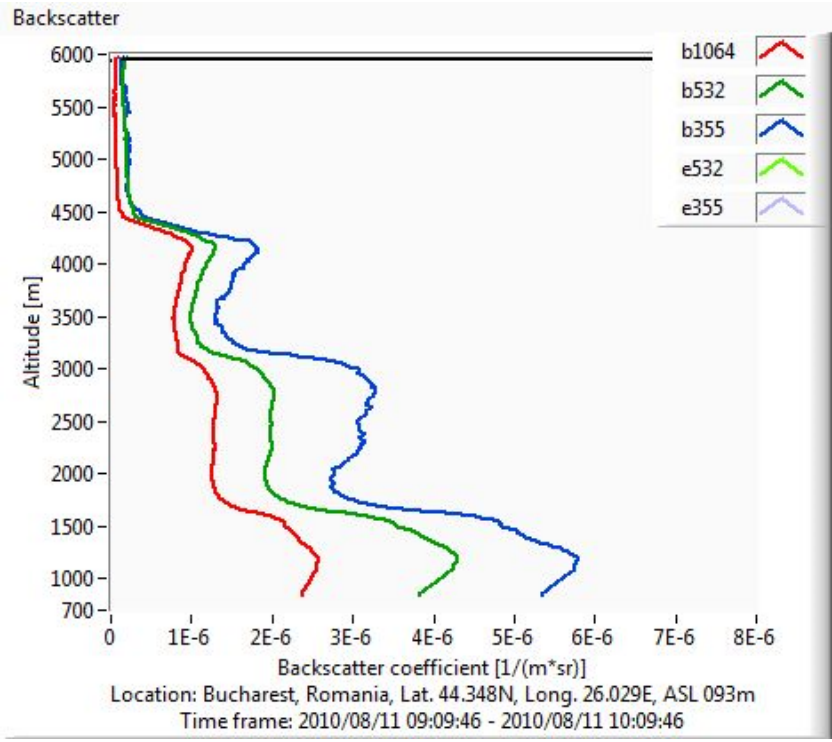


Increased accumulation mode (aged) at ground (May 11)



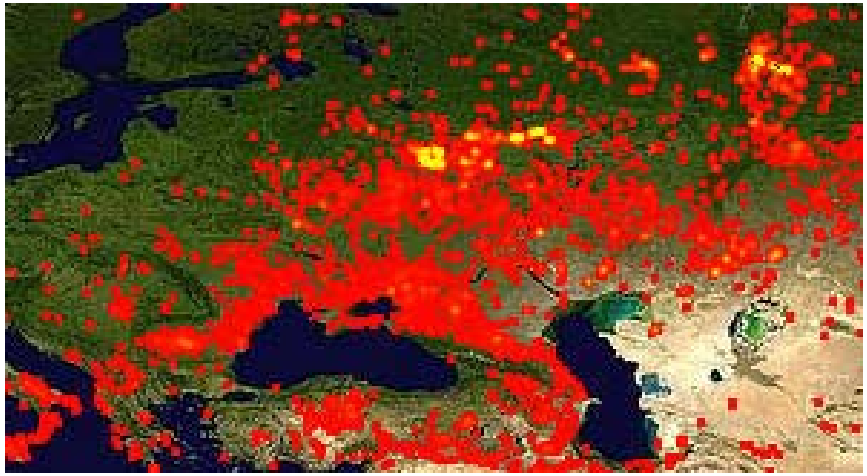
August 11-12, 2010

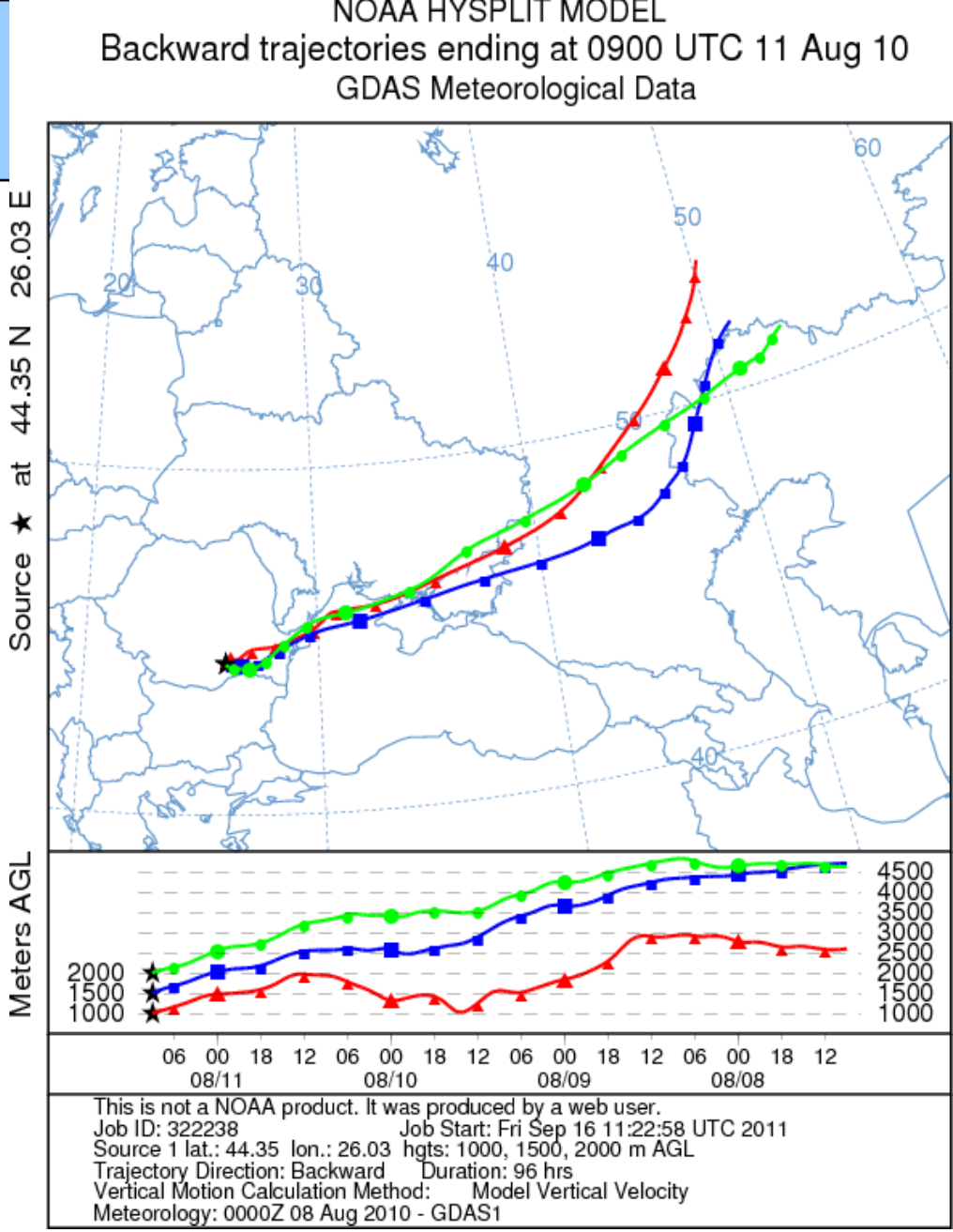




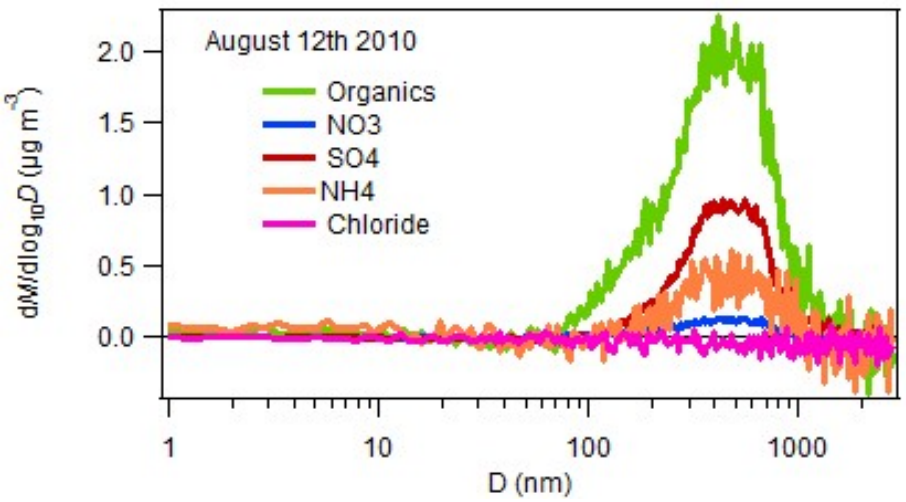
Layers sources ?

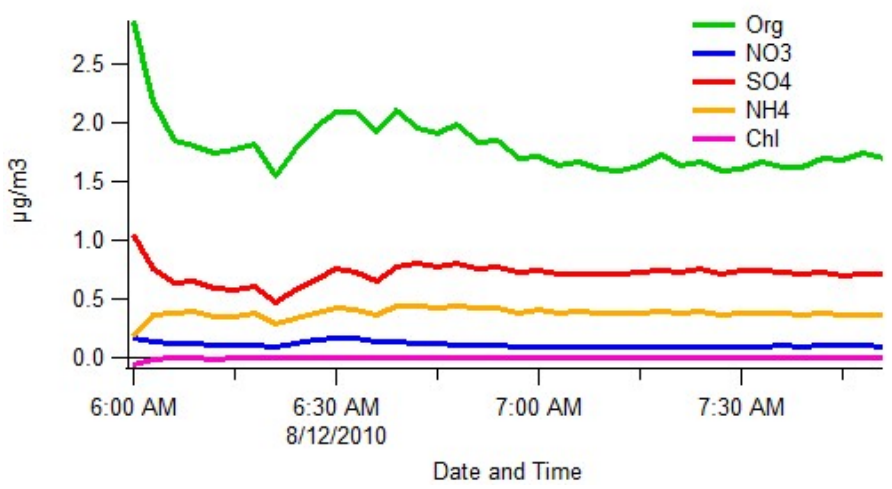
Modis Fire map Europe-Asia
the first two weeks of August 2010





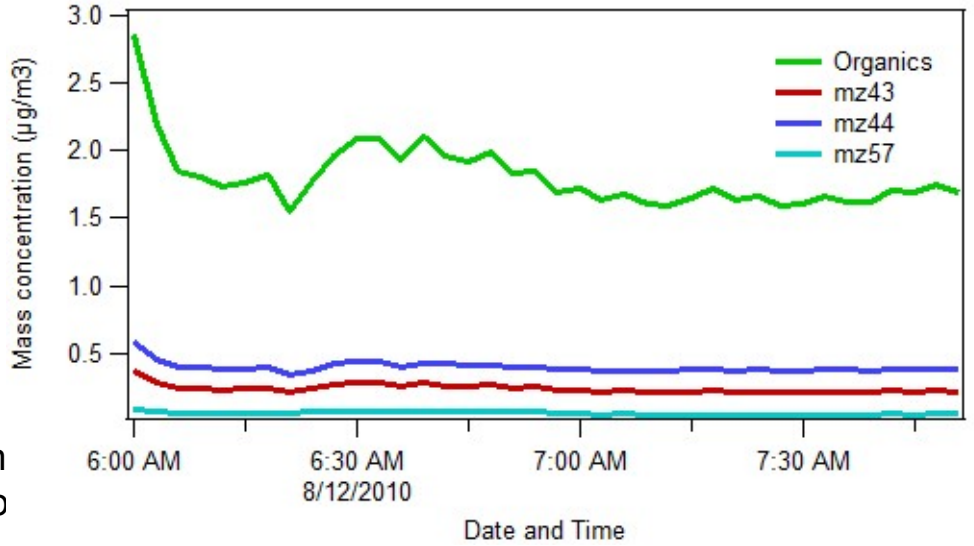
AMS measurements-August 12th , 2010





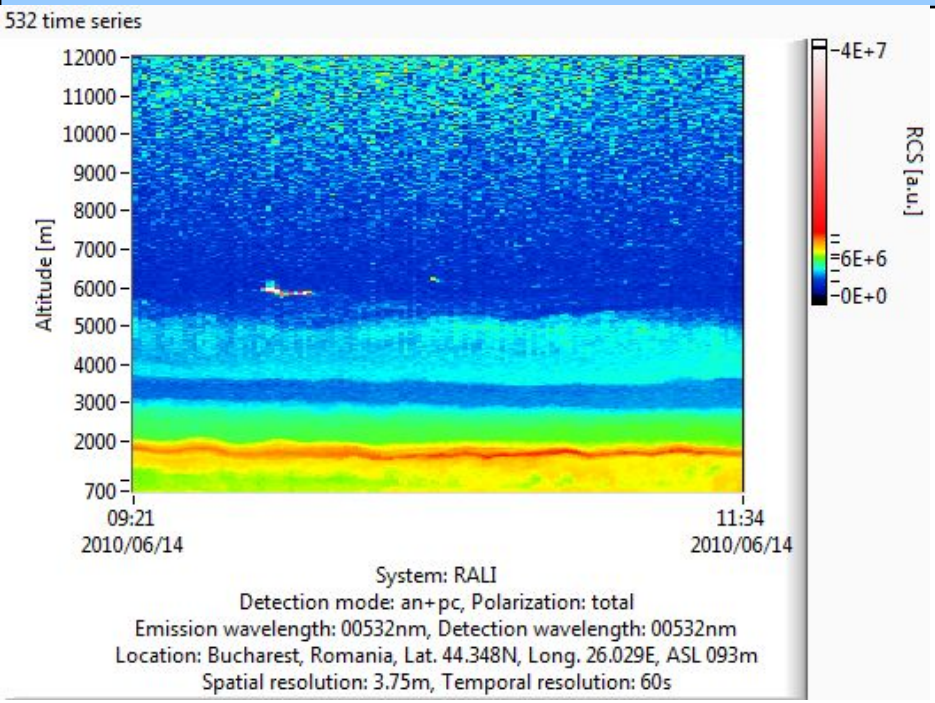
Unimodal size distribution, with peaks heights varying depending upon species

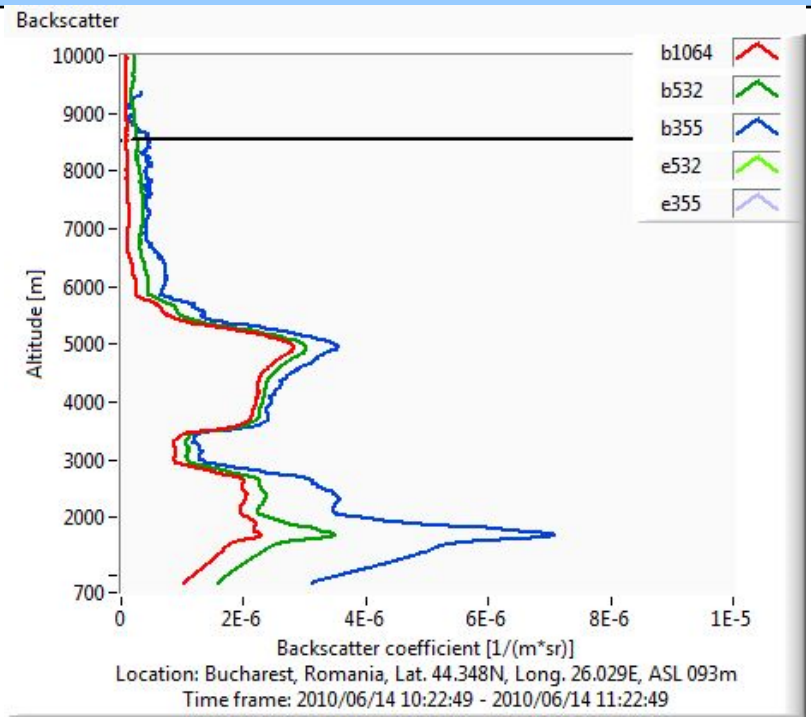
Increased organics mass concentration at ground



Environmental Rem
Septemb

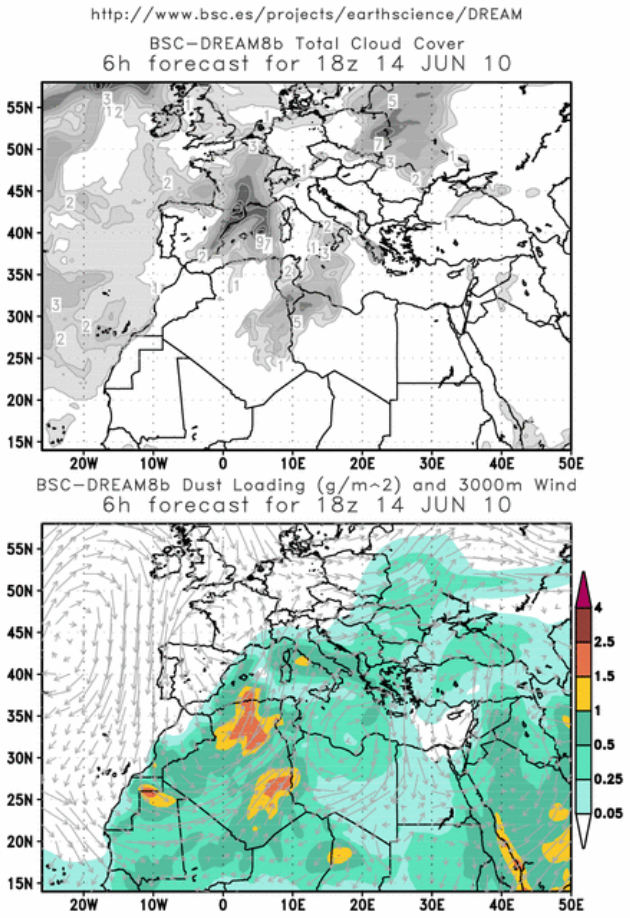
Case Study –June 14th 2010

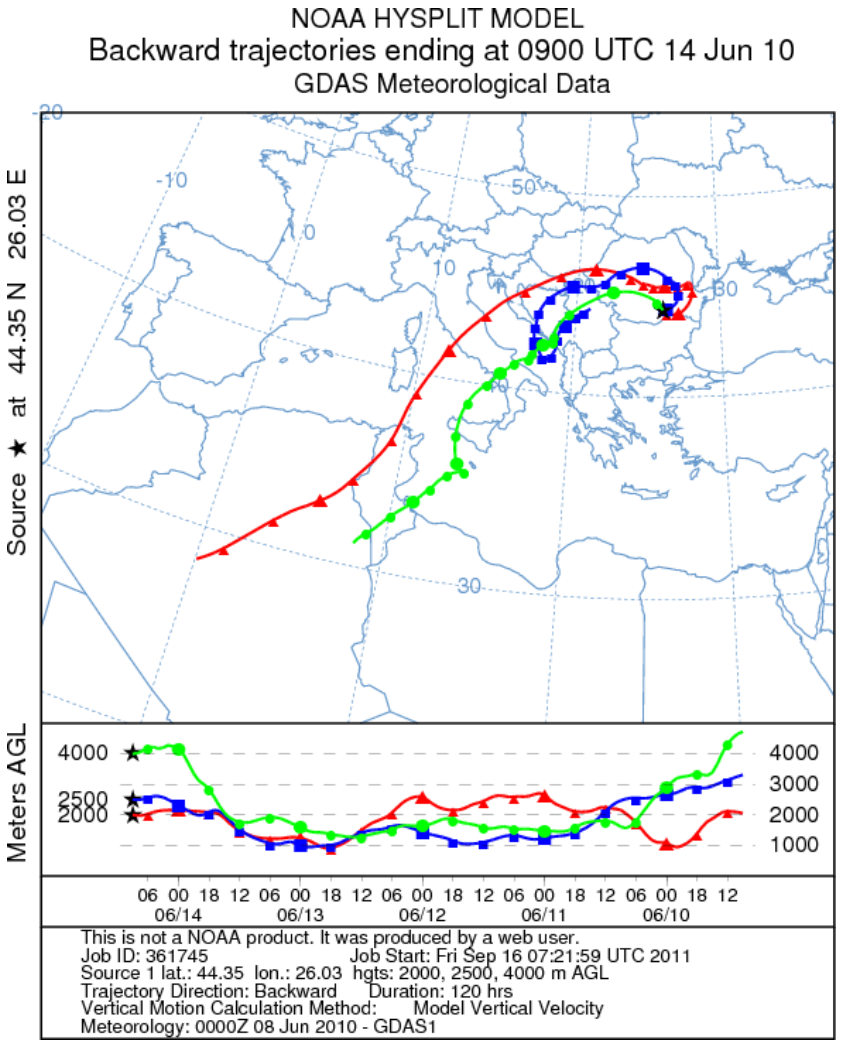


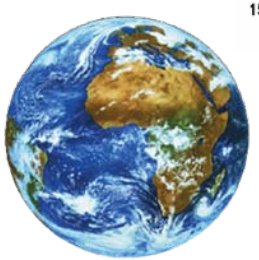


Layers sources ?

DREAM-Regional Dust Forecast model







Conclusions

- A mix of local and long-range transported particles was measured by various techniques (lidar, mass spectrometry) in Romania during 2010

- Increased depolarization, both in upper layers and in PBL was measured by lidar for the entire period with volcanic ash intrusions

- AMS measurements indicate that volcanic ash particles were present on May 11 2010
  - ❑ Sulfate particles reaching the ground influences regular aerosol size distribution: accumulation mode increasesthe peak translates to higher radius (from ~ 450nm to ~ 600nm)

Conclusions

- Biomass burning influence seen at the ground by AMS
  - ❑. Organics and sulfate were the dominant species representing over 60% of the total mass
  - ❑ The predominant aged organics acids and aged oxidized organic aerosol.

- Confirmation from HYSPLIT and DREAM when Saharan dust layers are detected above our lidar station

- During the next years we will be able to analyse a detailed data base for both seasonal characterization of local aerosol and special cases of long range transported aerosols.

THANK YOU !

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