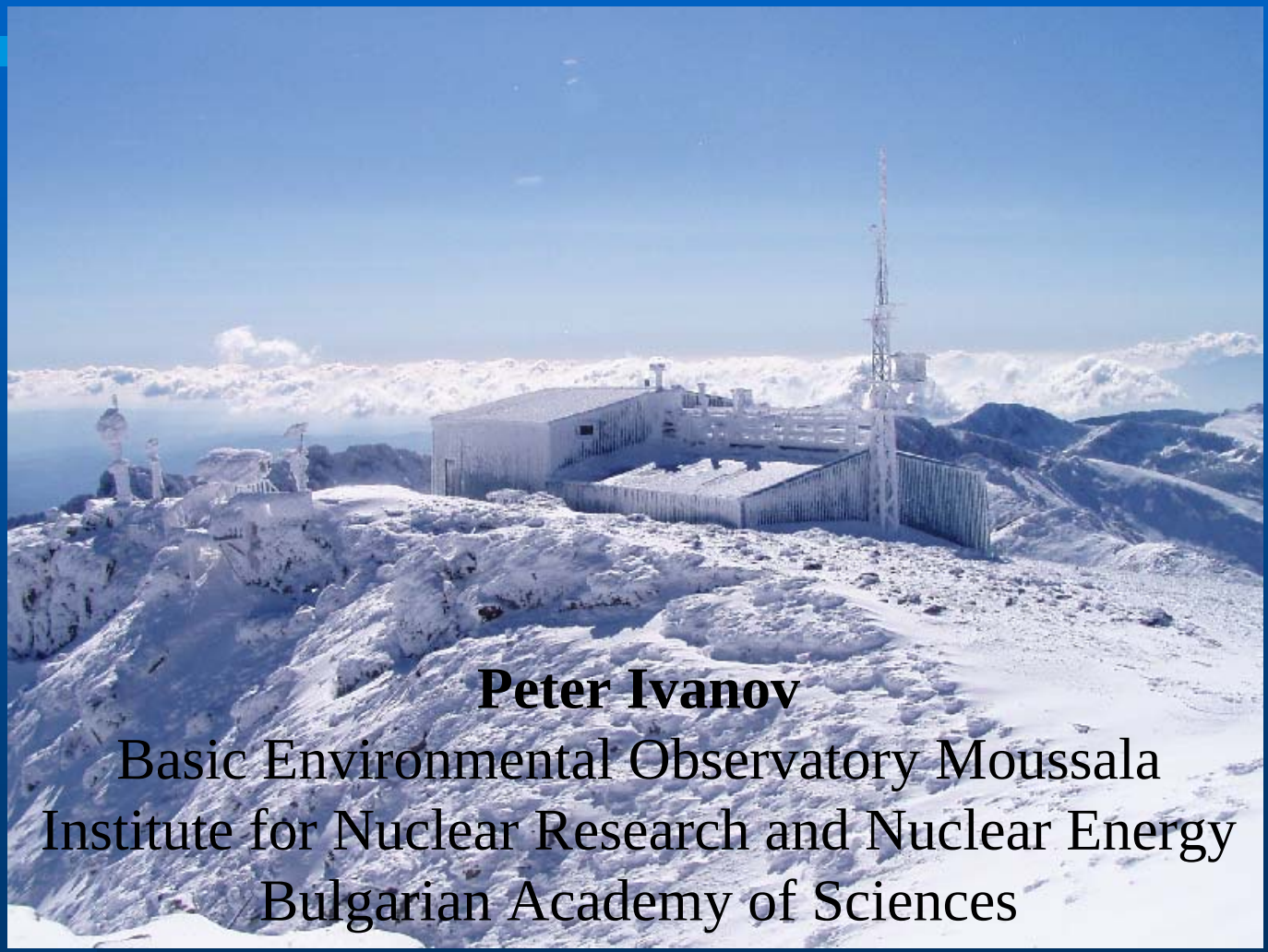
Atmosphere Monitoring at BEO Moussala



Peter Ivanov
Basic Environmental Observatory Moussala
Institute for Nuclear Research and Nuclear Energy
Bulgarian Academy of Sciences

Actual status of atmosphere monitoring at BEO Moussala in real time

1.Gas concentration measurements

1.1. Carbon monoxide

1.2. Sulfur dioxide

1.3. Nitrogen monoxide

1.4. Nitrogen dioxide

1.5. Ozone

1.6. Carbon dioxide

2.Aerosol measurements

2.1. Optical properties – Light scattering coefficient

2.2. Physical properties – Particle size distribution

Automatic System for Gas Concentration Measurements Environnement at BEO

NO and NO2 analyzer AC32M
Method: Chemiluminescence
Sensitivity: 0.4 ppb

CO analyzer CO12M, Method: NDIR
Sensitivity: 0.05 ppm

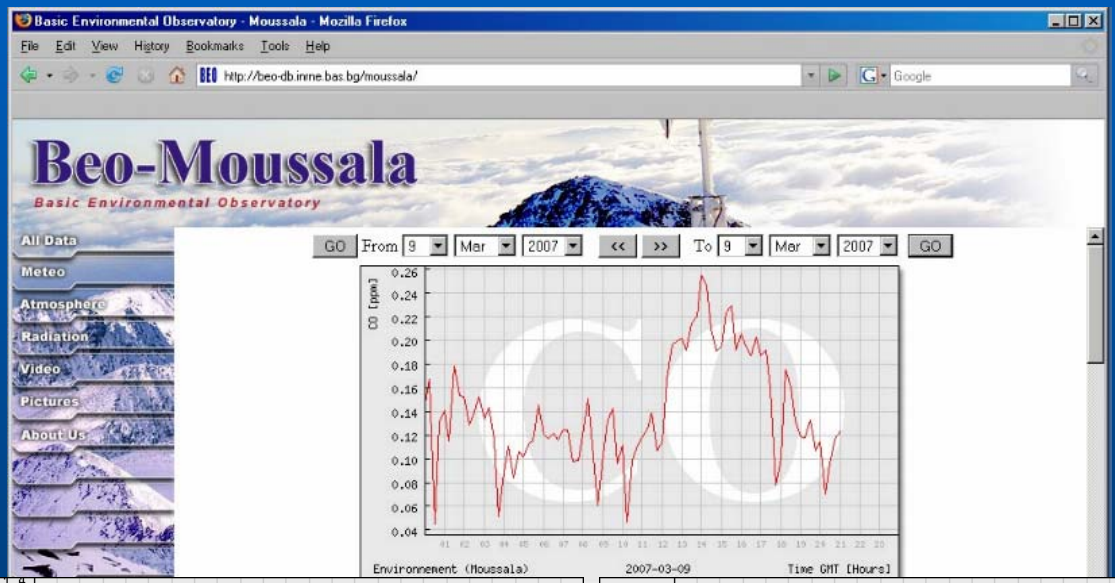
SO2 analyzer AF22M, Method: UV-fluorescence, Sensitivity: 1 ppb

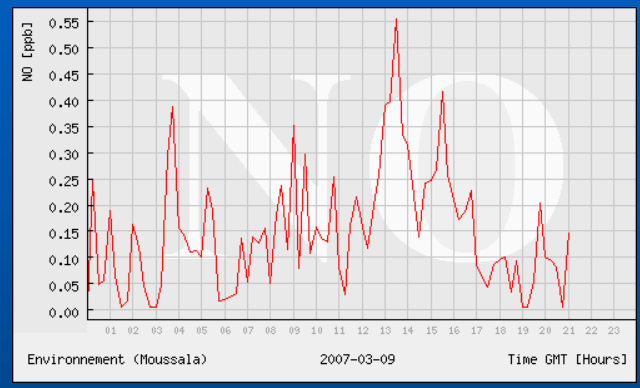
O3 analyzer O342M
Method: UV-Photometry
Sensitivity: 0.4 ppb

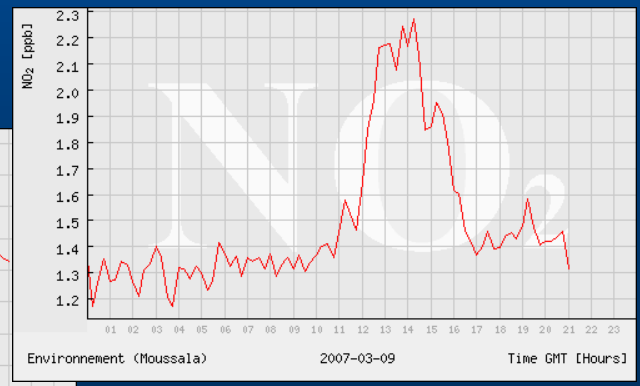
BEO Moussala

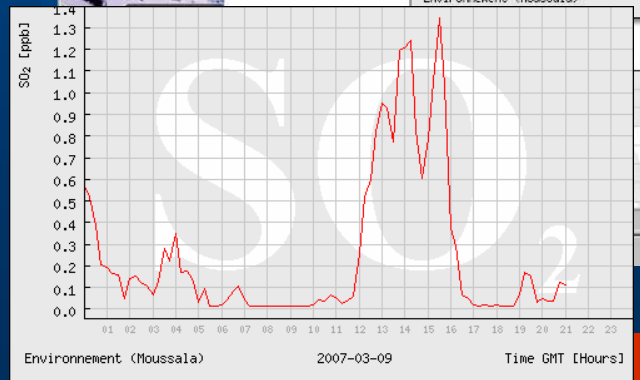
Data Acquisition Software and Data Access

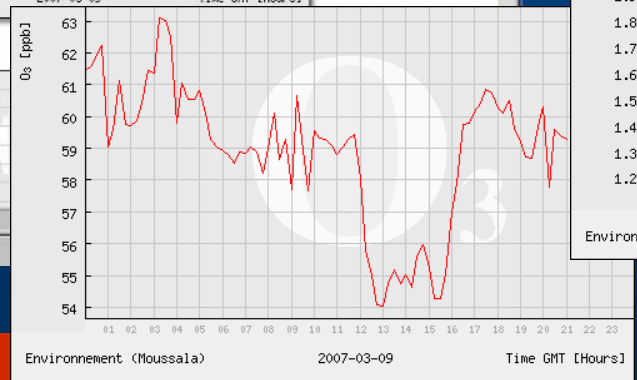
Measured data is stored into Ms SQL database at local PC. There are records for average concentrations and status of each analyzer at every 1, 15 and 60 min. At every 15 min. the data is imported into the main My SQL data base and is available via internet as a plot on the web page. The access to detail row data is available by some data base client as Navicat - access authorization by username and password is required.







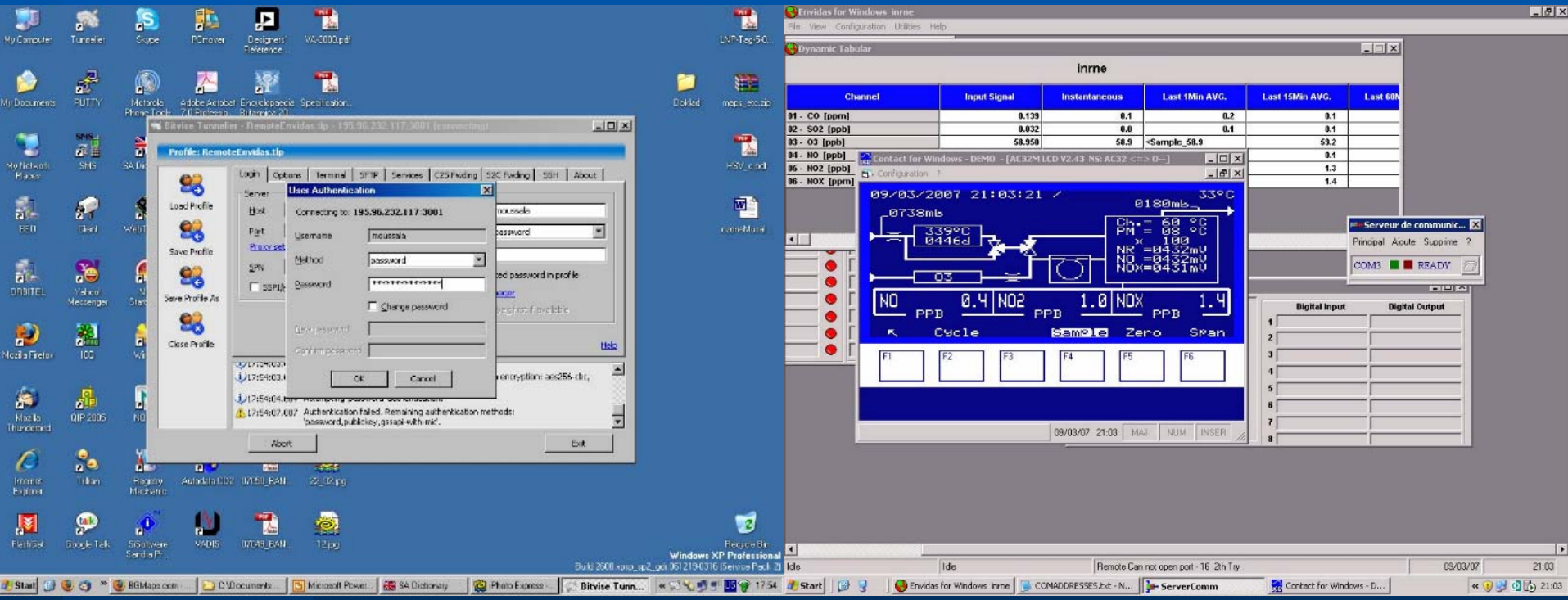




BEO Moussala

Remote access and remote calibration possibilities

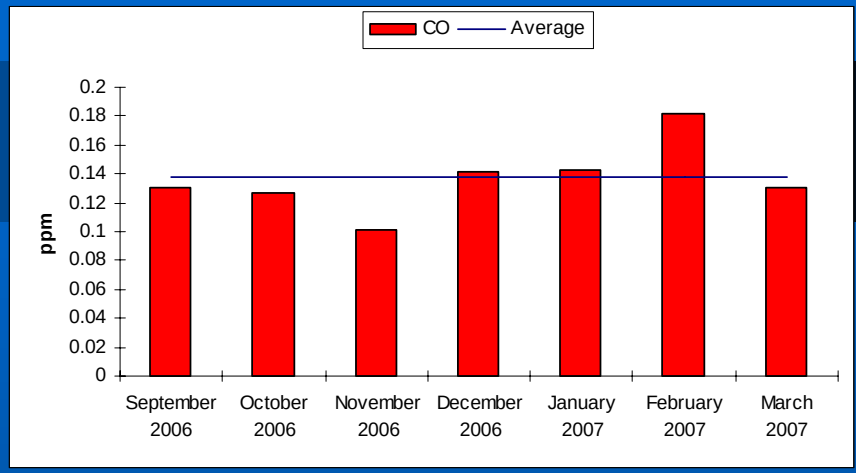
The sophistical software gives flexible possibilities for remote access to the acquisition PC. Each analyzer has an intelligent communication interface and is accessible for remote control checks, diagnostics and calibrations. The remote operator can log in directly to each of analyzers via Internet, to browse through the menus to check zero drift, calibration drift or test control signals; to start reference zeroing, calibration cycle or whatever it is necessary.

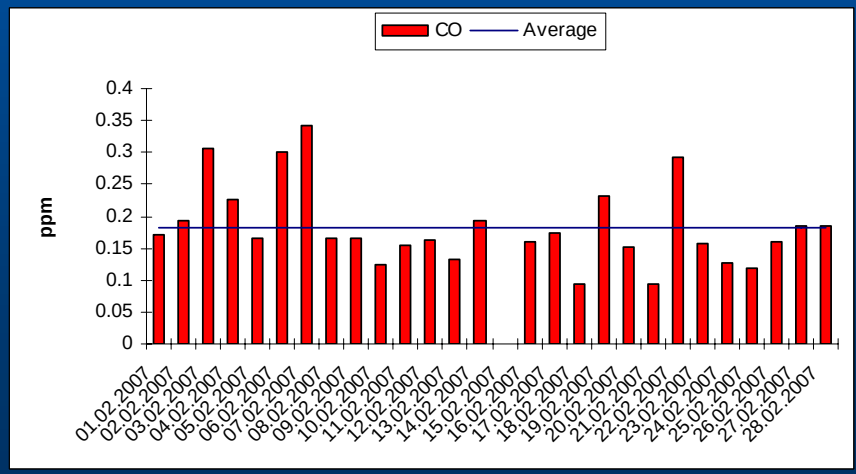


Some results of CO measurements

The average concentration of CO for last six months is about of 0.14 ppm. The maximum is in February 2007 – 0.18 ppm.

There are several days (3, 6, 7, 19, 22 of February) with concentrations higher than average for the month. The direction of the wind on 3 has been from E-NE – direction of the largest thermo-electricity power plant in Bulgaria “Maritza-Iztok”. On 6, 7 and 22 February there has been a strong wind from W-NW with velocity of about 15-20 m/s. That wind has been transporting polluted air from thermo-electricity power plant “Bobovdol”.

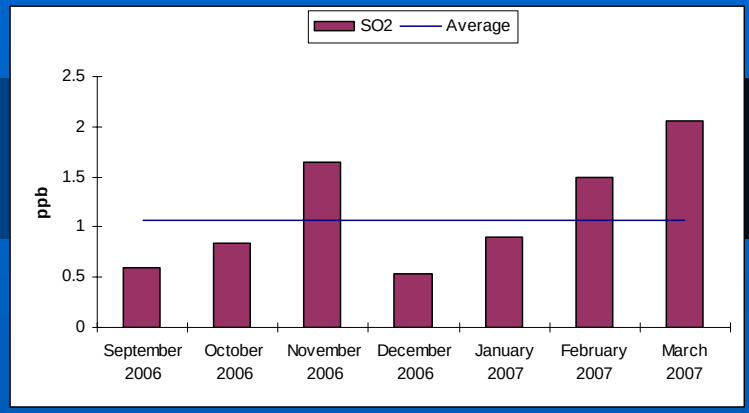


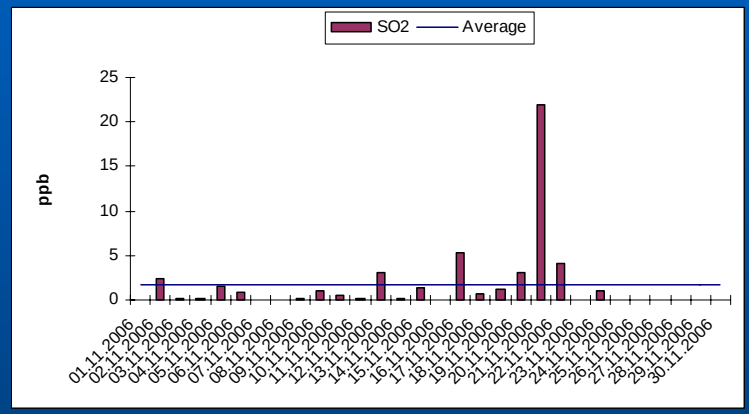


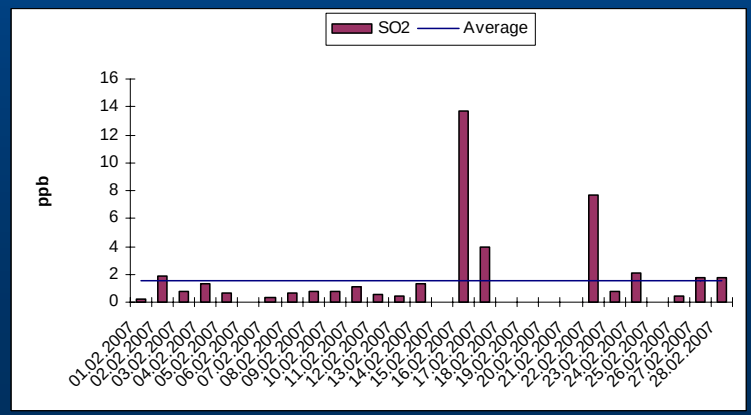
BEO Moussala

Some results of SO2 measurements

The average concentration of SO2 for last six months is about of 1.07 ppb. There are peaks in November 2006 (3.10 ppb), February2007 (1.50 ppb) and March 2007 (2.05 ppb). There is only one day November 21 with extremely higher concentrations than average for the month–21.90 ppb. The direction of the wind on 21 has been mainly from N-NW. There has been several days in February 2007 with extremely higher concentrations than average for the month–16 (13.66 ppb), 17 (3.91 ppb) and 22 (7.72 ppb). The direction of the wind on 16 and 17 has been mainly from E-NE. This is the direction of the largest thermo-electricity power plant “Maritza-Iztok” in Bulgaria. The wind on 22 has been transporting polluted air from W-NW - direction of another thermo-electricity power plant “Bobovdol”.



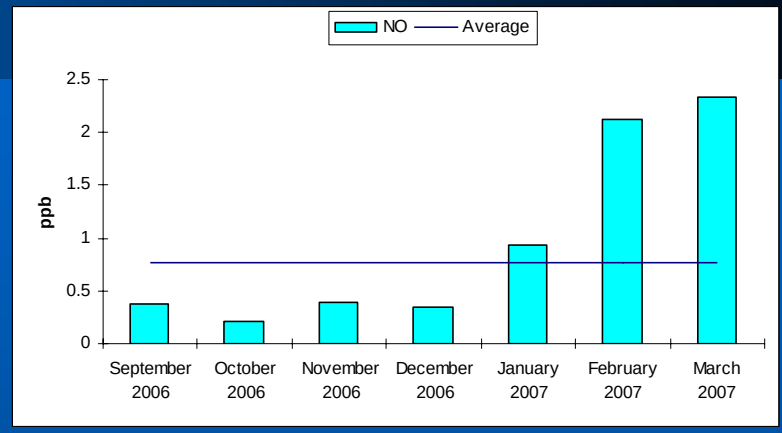


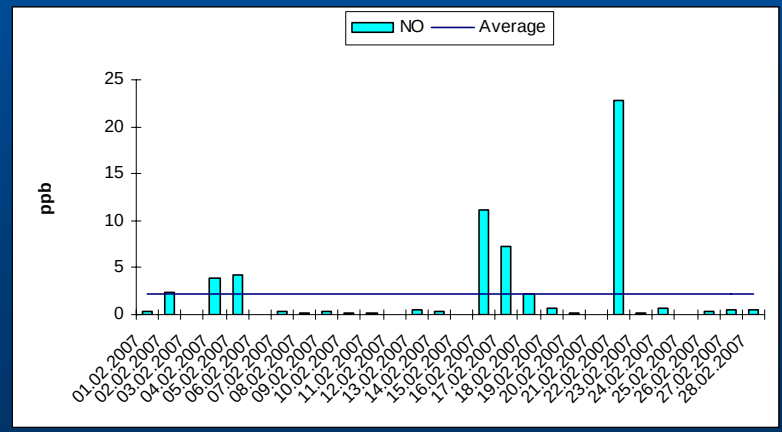


Some results of NO measurements

The average concentration of NO for last six months is about of 0.76 ppb. The maximums of measured concentrations are in February and March 2007 – 2.12 ppb and 2.34 ppb.

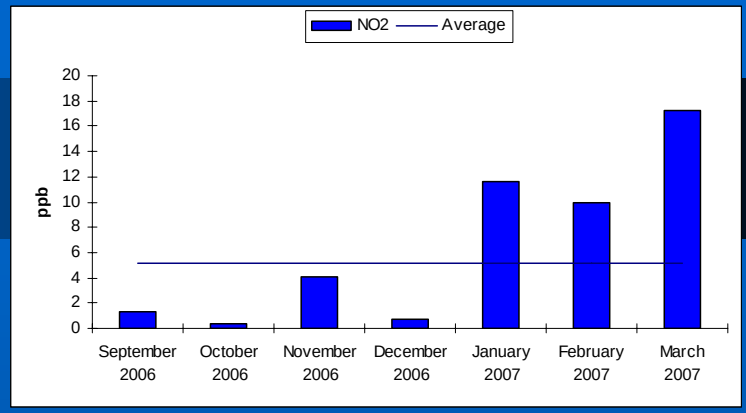
There are some days (16, 17, 22 of February) with concentrations higher than average for the month – 11.15 ppb, 7.26 ppb and 22.85 ppb respectively. The direction of the wind on 16 and 17 has been mainly from E-NE. This is the direction of the largest thermo-electricity power plant “Maritza-Iztok” in Bulgaria. On 22 the wind has been blowing from W-NW mainly – direction of another one thermo-electricity power plant “Bobovdol”

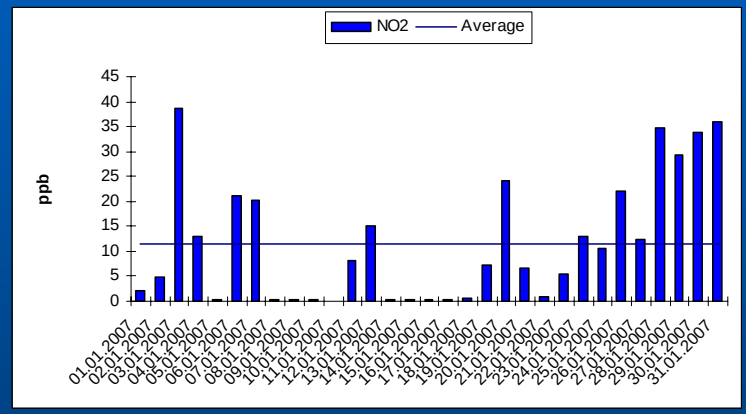


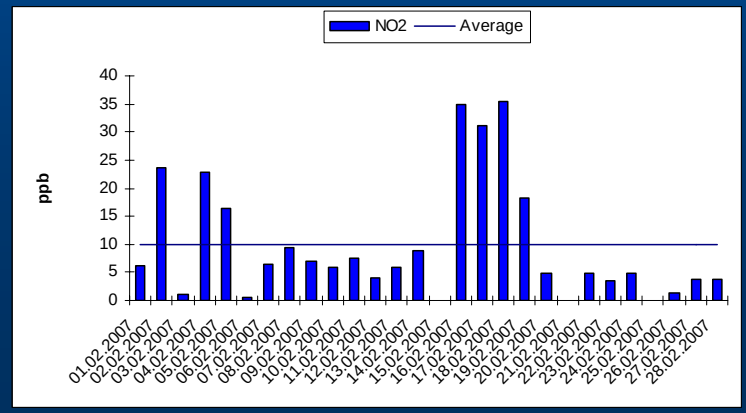


Some results of NO2 measurements

The average concentration of NO2 for last six months is about of 5.11 ppb. There are peaks in January (11.56 ppb), February (9.93 ppb) and March 2007 (17.28 ppb). In January there are several days with high concentrations – 3 (38.72 ppb), 6 (21.24 ppb), 7 (20.17 ppb), 20 (24.27 ppb), 26 (22.12 ppb), 28 (34.80 ppb), 29 (29.25 ppb), 30 (33.76 ppb), 31 (39.93 ppb); in February – 2 (23.51 ppb), 4 (22.93 ppb), 16 (34.77 ppb), 17 (31.01 ppb), 18 (35.38 ppb); in March – 2 (24.26 ppb), 4 (22.28 ppb), 5 (19.43 ppb). The direction of the wind on 3, 6, 20, 28, 29, 30 and 31 January has been from E-NE. On 26 January has been from W-NW. On 2, 4, 16, 17, 18 February the wind has been blowing from E-NE.

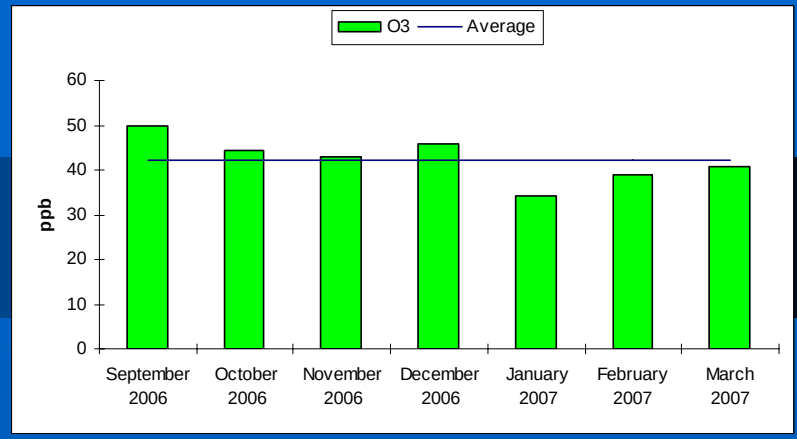


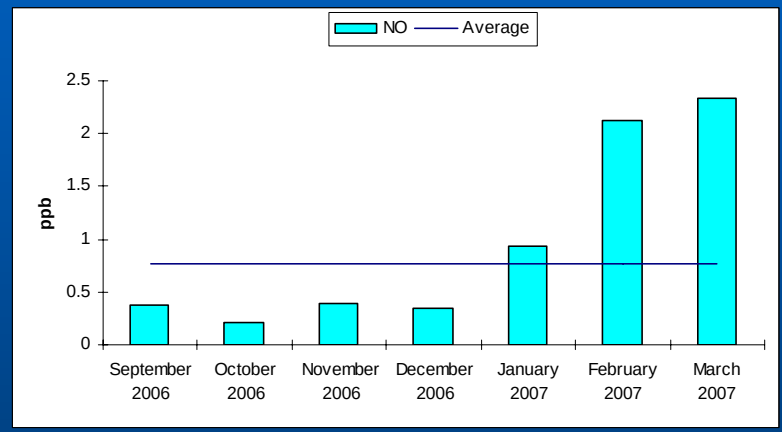


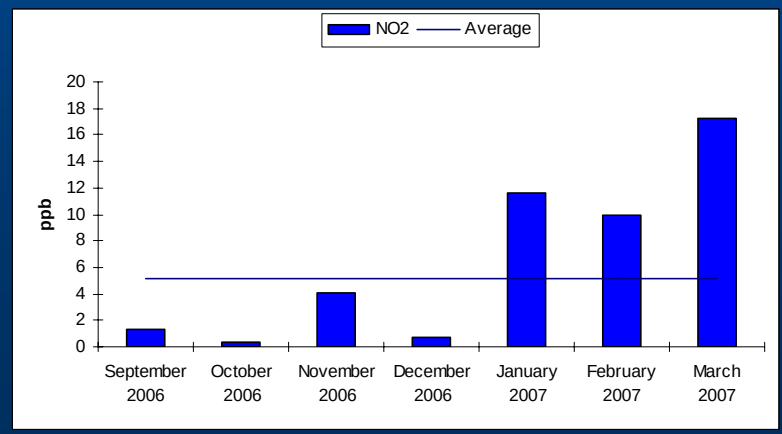


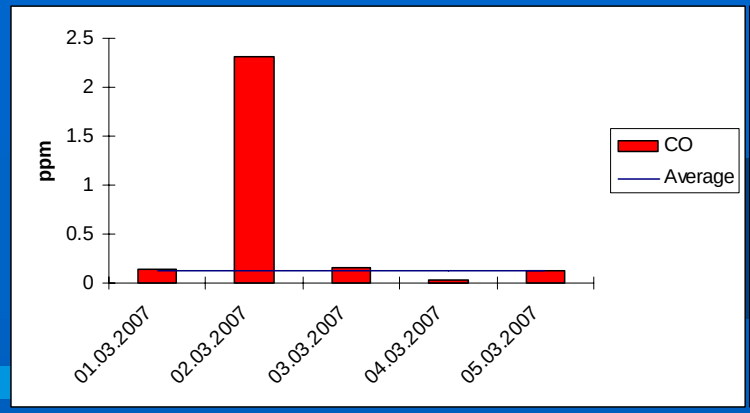
Some results of O3 measurements

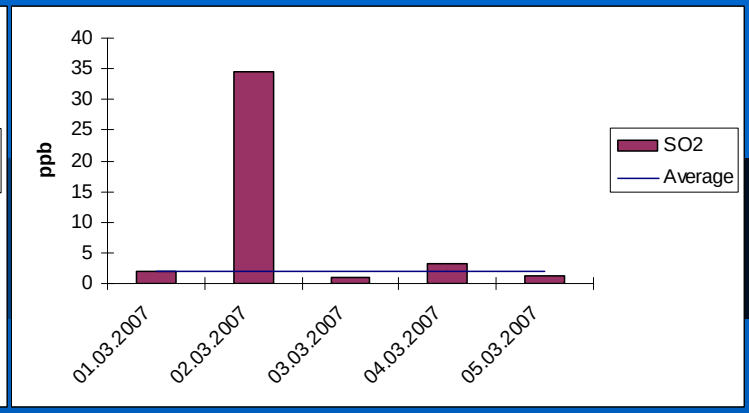
The average concentration for last six months is about of 42.12 ppb. The highest concentration has been in September 49.92 ppb. The minimum has been in January – 34.36 ppb. In February and March the average concentrations have been also lowest than average. For this months the concentrations of NO and NO2 have had maximums.

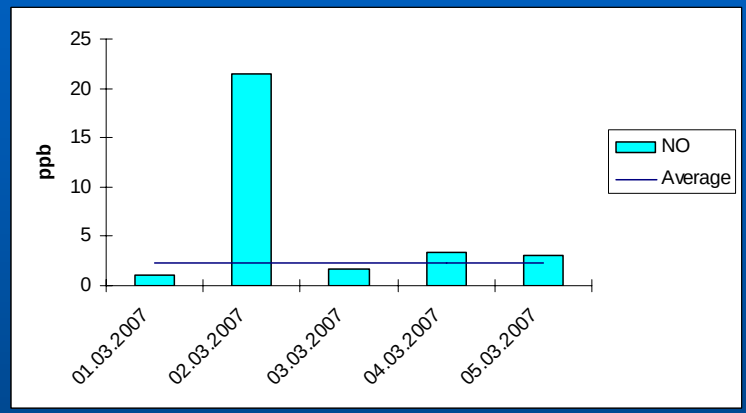


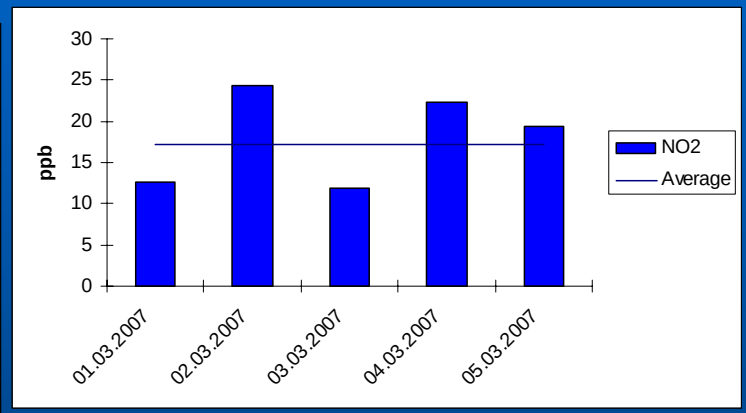


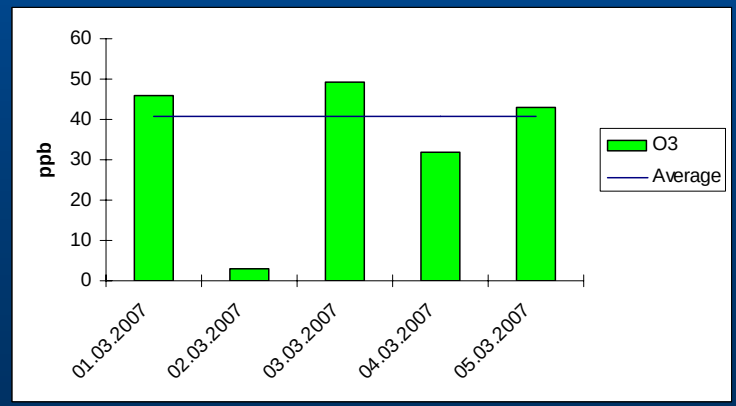


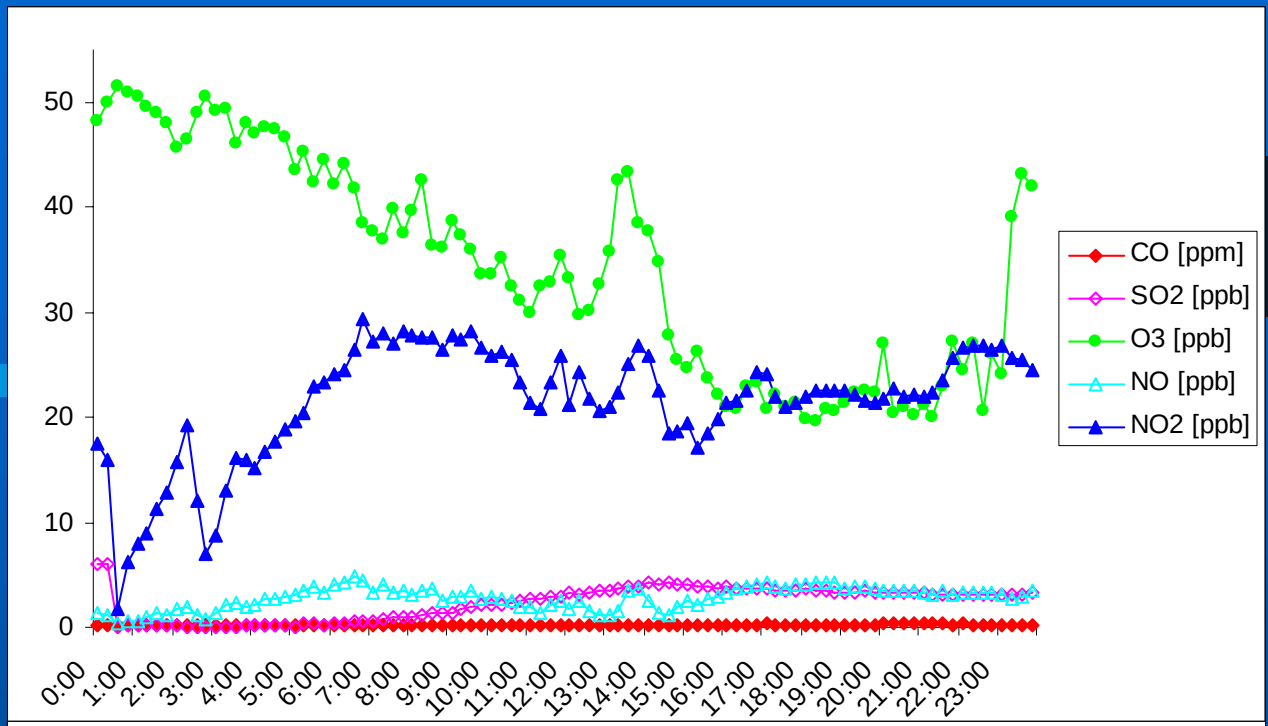

ppm
2.5
2
1.5
1
0.5
0
CO
Average
01.03.2007
02.03.2007
03.03.2007
04.03.2007
05.03.2007

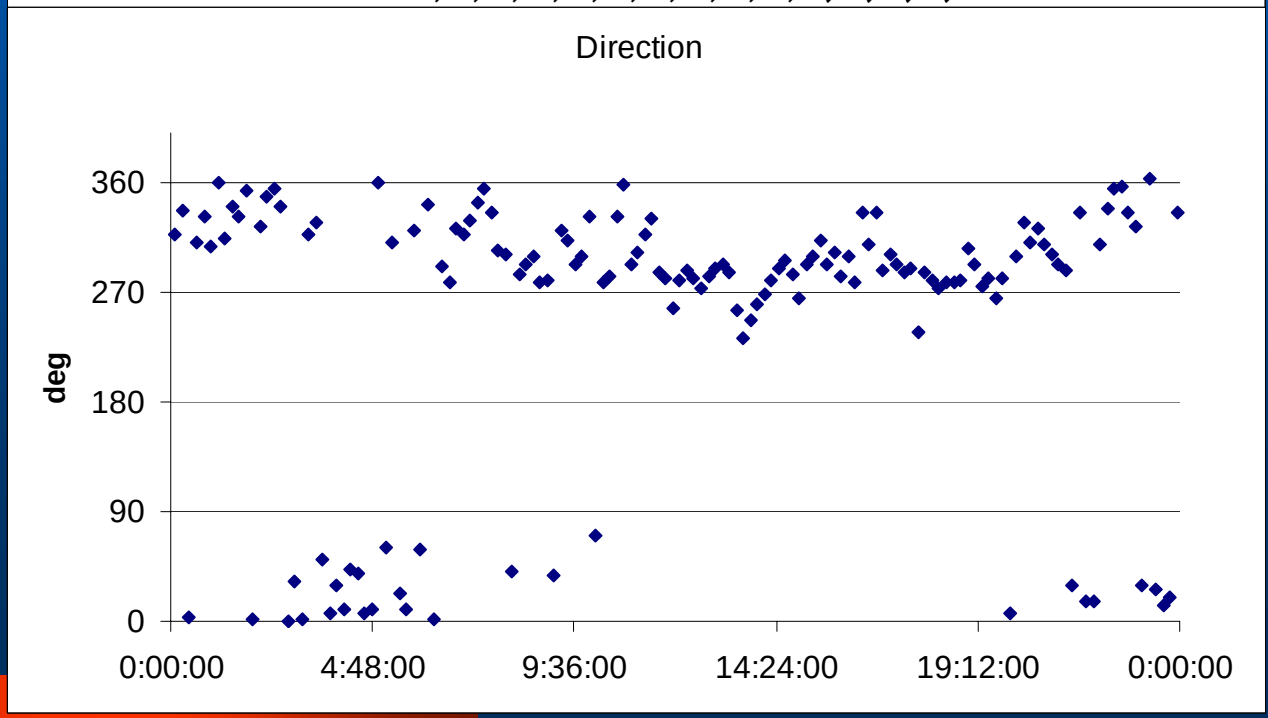

ppb
40
35
30
25
20
15
10
5
0
SO2
Average
01.03.2007
02.03.2007
03.03.2007
04.03.2007
05.03.2007


ppb
25
20
15
10
5
0
NO
Average
01.03.2007
02.03.2007
03.03.2007
04.03.2007
05.03.2007


ppb
30
25
20
15
10
5
0
NO2
Average
01.03.2007
02.03.2007
03.03.2007
04.03.2007
05.03.2007


ppb
60
50
40
30
20
10
0
O3
Average
01.03.2007
02.03.2007
03.03.2007
04.03.2007
05.03.2007


50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
CO [ppm]
SO2 [ppb]
O3 [ppb]
NO [ppb]
NO2 [ppb]

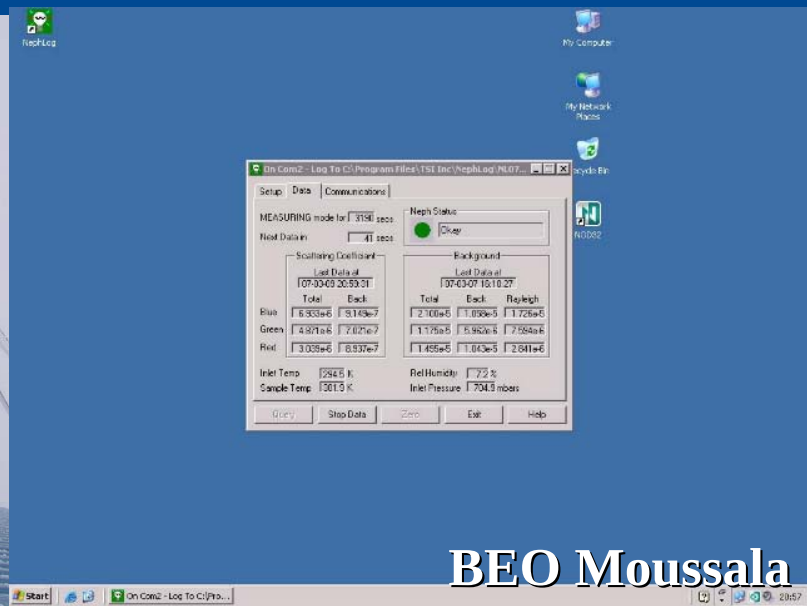

Direction
deg
360
270
180
90
0
0:00:00
4:48:00
9:36:00
14:24:00
19:12:00
0:00:00

Summary of Gas Concentration Measurements

- There has been several extremely high peaks for measured concentrations of CO, SO2, NO and NO2 on 16, 17 and 22 of February.
- The wind direction on those days has been mainly from regions with thermo-electricity power plants – the largest in Bulgaria “Maritza-Iztok” and “Bobovdol”.
- The average monthly concentrations for SO2, NO and NO2 increase after January 2007 – the day of stopping of 3 and 4 reactors of nuclear power plant “Kozloduy”.

Measuring of optical parameters of aerosols

Measurements of light scattering coefficient and back-light scattering coefficient of aerosols are provided by TSI Integrating Nephelometer model 3563. TSI Integrating Nephelometer is designed specifically for studies of direct radiative forcing of the Earth's climate by aerosol particles.The light-scattering coefficient is a highly variable aerosol property. Integrating Nephelometer measures the angular integral of light scattering that yields the quantity called the *scattering coefficient*, which is used in the Beer-Lambert Law to calculate total light extinction. Model 3563 includes three-wavelength and back-scatter features – wavelengths 450 nm (blue); 550 nm (green) and 700 nm (red). TSI Integrating Nephelometer has been operating at BEO Moussala since 21-th of February 2007. The creation of the software for data-import from measurements into a database is in progress. The inlet for aerosol measurements is designed to sample total air without any size cuts. It has heating control system to reduce relative humidity of sampled air. The inlet is made by Institute of Tropospheric Research of Leipzig (IFT) according with GAW requirements of WMO.



Planned atmosphere monitoring measurements

Continuous Measurement in real time

Gas concentration measurements of CO_2

Aerosol size distribution

Concentration of aerosols

Intermittent Measurement

Detailed size fractionated chemical composition

BEO Moussala contacts:

Prof. D.Sc. Jordan Stamenov
e-mail: jstamen@inrne.bas.bg
tel: +359 2 9743761
fax: +359 2 9753619
Mobile: +359 88 8874333

Peter Ivanov
e-mail: petkoiv@inrne.bas.bg
tel/fax: +359 2 9746310
Mobile: +359 88 9218156

http://beo-db.inrne.bas.bg