Data & photos sustaining the Management activity & Dissemination of the project for 2012

“Novel Tool for Urban Air Quality Monitoring”,

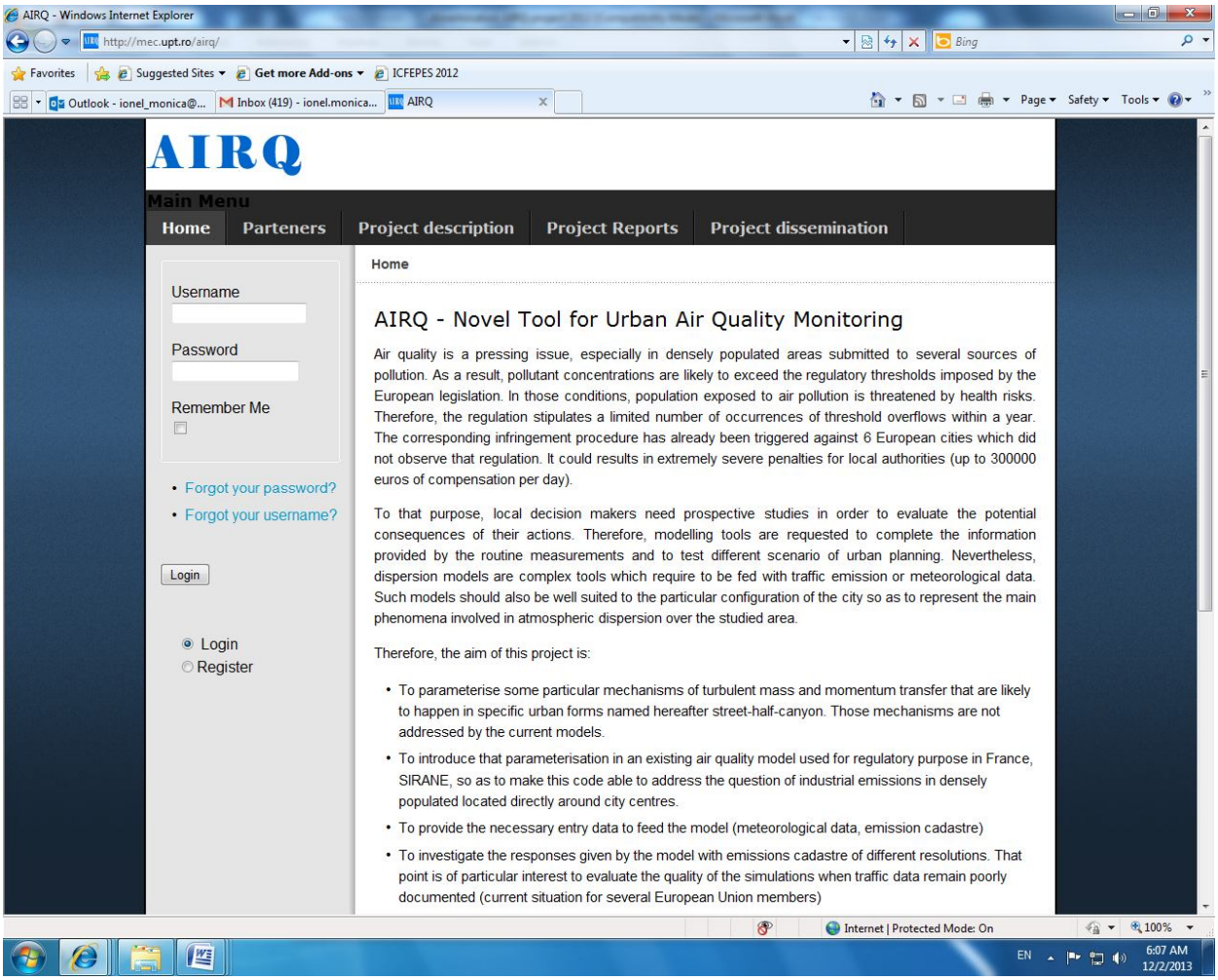
Project code: PN-II-ID-JRP-2011-93/03.01.2012/5 Ro-Fr 2012, launched in between 03.01.2012 and 31.12.2014

Project financing for “Politehnica” University of Timisoara is assured by the UEFISCDI, respectively ANR is financing the two French partners

(http://mec.upt.ro/airq)

Contents

1 Crearea paginii web a proiectului la adresa şi întreţinerea ei



AIRQ - Novel Tool for Urban Air Quality Monitoring
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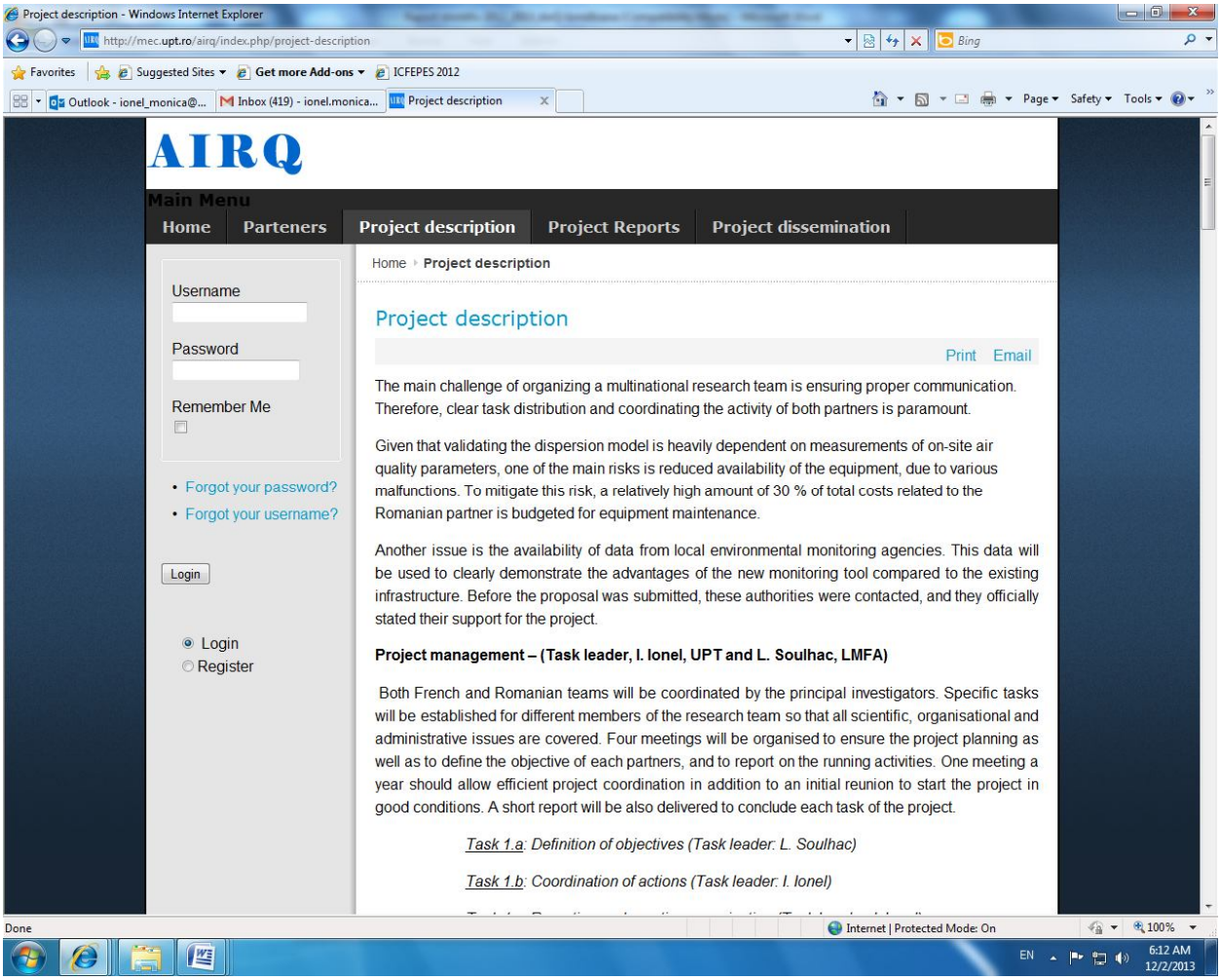

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2 Kick of meeting AIRQ Timisoara 30-31 January, 2012

Kick of meeting AIRQ

Where

Timisoara 30-31 January, 2012, Romania
Location: CASA POLI 2, Conference Room, and UPT Laboratory (first day), UPT Fac of Mechanical Engineering, Room 203 (second day)

Scope

1. To detect the concrete actions for meeting the objectives of the project
2. To finalize the agreement of cooperation, with details

Year	Task	Activities
I	Preparation	Literature review of dispersion models and existing studies of urban air quality monitoring
		Wind tunnel investigations
		Acquiring input data for the dispersion model
		Initial model adaptation
	Project management	Coordination of activities – Initial meeting
	Results dissemination	Dissemination of initial results
II	Dispersion model adaptation	Resolving specific issues of dispersion model adaptation for the application to the city of Timisoara
		On-site measurements for monitoring air quality
	Project management	Coordination of activities
		Control and monitoring
	Results dissemination	Dissemination of intermediate results
III	Model validation	Dispersion model adaptation
		Measurements for monitoring air quality and data analysis
		Validation of the data provided by the dispersion model with measured values
	Project management	Coordination of activities
		Control and monitoring
	Results dissemination	Dissemination of final results

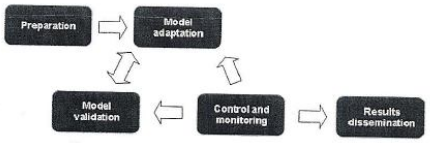

Figure 5. Relation between the different tasks.

PROGRAM

Monday	
January 30, 2012	
10:30 – 11:30,	Laboratory Visit, UPT (compulsory)
15:30 – 16:30,	Lunch (compulsory), Casa POLI 2
17:00 – 20.30	Discussions on the following main issues, Conference Room Casa POLI2 1. Presentation of the research activity of the different groups 2. Establishing the initial conditions of the agreement 3. Presentation of the actions proposed within the project by each group 4. Agreement setup 5. Identification of milestones 6. Elaboration of the detailed schedule of the project 7. Identification of deliverables
20:30 – 21:30	Dinner, Casa POLI 2
Tuesday	
January 31, 2012	
10:30 – 12:30	Closing remarks, Faculty of Mechanical Engineering, Room 203 1. Final discussions 2. Decision on draft–to–final version of the agreement (if possible) 3. Project work plan finalization 4. Future plans (short and medium action plan) 5. Conclusions

Presence list to the Kick off meeting for the AIRQ project

No.	NAME, Surname	Representative of company name	Position in the company	Position in the project	e-mail address	Telephone work and additional if possible	Fax	Skype connection	Signature
1	LONTIS NICOLAE	UPT	Scientific Researcher		lontis_nicolae@yahoo.com	0721605655	—	—	
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10	VETRES ION	UPT	PHD	RESPONSIBLE WITH MEASUREMENTS		vetres.i@gmail.com			

Date: 30.01.2011

Presence list to the Kick off meeting for the AIRQ project

No.	NAME, Surname	Representative of company name	Position in the company	Position in the project	e-mail address	Telephone work and additional if possible	Fax	Skype connection	Signature
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Date: 31.01.2011

3 Presentation and dissemination at the 25-27 April 2012, ENREG – 4-th edition ENREG Energia Regenerabila, Expo Arad International

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4 Realisation of the official flyer of the project-with financing indication

5 Dissemination of the project at University of Szeged, Departament of Climatology and Landscape Ecology, 29.06.2012

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Head of Department: Dr. János Unger, DSc

DECLARATION

We hereby attest that during the Professional Forum organised on 29.06. 2012 in Szeged, with the support of the University of Szeged, Department of Climatology and Landscape Ecology the project AirQ – "Novel tool for urban air quality monitoring - Instrument inovativ de analiză a calităţii aerului în zone urbane" Project Code: 93 / 03.01.2012 / 5Ro-Fr 2012 was presented and disseminated by Professor Ioana IONEL and her team from the POLITEHNICA University of Timisoara.

Faculty of Science and Informatics
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Dr. János Unger
Head of Department

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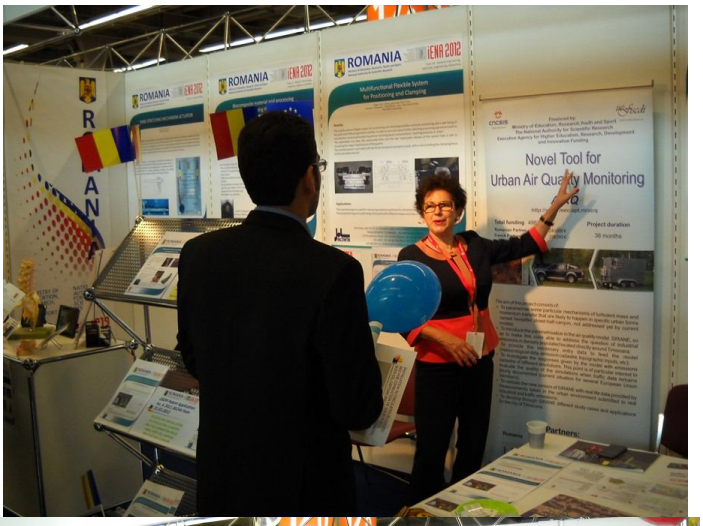
6 Dissemination of the project in Timisoara with colleagues from Szeged University, September, 2012



Link: http://www.youtube.com/watch?v=BbNfPQsD_qk&feature=player_embedded

8 Dissemination of the project at Conference LIDAR - Sistems and Applications, Magurele, 5-7 December, 2012

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9 Management meetings between the partners/ of working groups/ from "POLITEHNICA" University of Timisoara and French team, 2012

AIRQ - Novel Tool for Urban Air Quality Monitoring
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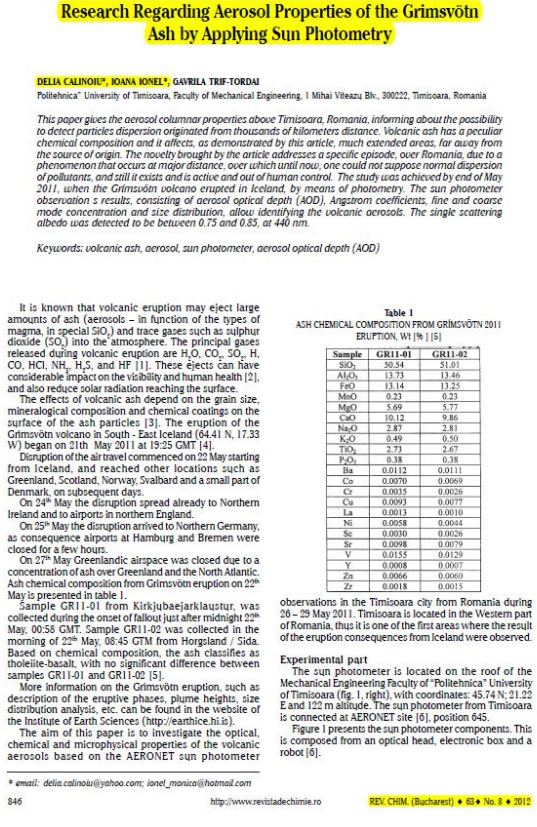
10 Publication of articles in ISI journals

1) ***Delia Calinoiu***, ***Ioana Ionel***, Gavrila Trif – Tordai, ***Research Regarding Aerosol Properties of the Grimsvötn Ash by Applying Sun Photometry***, REV. CHIM. (Bucharest), Vol. 63, No. 8, p. 846 -850, 2012.

2) **Gh. C. NISULESCU, Ioana IONEL**, Francisc POPESCU, Research concerning emissions monitoring by means of UV cameras, Optoelectronics and Advanced Materials – Rapid Communications, Vol. 6, No. 9-10, p. 935 – 940, September - October 2012.



Research Regarding Aerosol Properties of the Grimsvötn Ash by Applying Sun Photometry

DELIA CALINOIU*, IOANA IONEL*, GAVRILA TRIF-TORDAI
Politehnica" University of Timisoara, Faculty of Mechanical Engineering, 1 Mihai Viteazu Blv., 300222, Timisoara, Romania

This paper gives the aerosol columnar properties above Timisoara, Romania, informing about the possibility to detect particles dispersion originated from thousands of kilometers distance. Volcanic ash has a peculiar chemical composition and it affects, as demonstrated by this article, much extended areas, far away from the source of origin. The novelty brought by the article addresses a specific episode, over Romania, due to a phenomenon that occurs at major distance, over which until now, one could not suppose normal dispersion of pollutants, and still it exists and is active and out of human control. The study was achieved by end of May 2011, when the Grimsvötn volcano erupted in Iceland, by means of photometry. The sun photometer observation s results, consisting of aerosol optical depth (AOD), Angstrom coefficients, fine and coarse mode concentration and size distribution, allow identifying the volcanic aerosols. The single scattering albedo was detected to be between 0.75 and 0.85, at 440 nm.

Keywords: volcanic ash, aerosol, sun photometer, aerosol optical depth (AOD)

It is known that volcanic eruption may eject large amounts of ash (aerosols – in function of the types of magma, in special SiO_2) and trace gases such as sulphur dioxide (SO_2) into the atmosphere. The principal gases released during volcanic eruption are H_2O, CO_2, SO_2, H, CO, HCl, NH_3, H_2S, and HF [1]. These ejects can have considerable impact on the visibility and human health [2], and also reduce solar radiation reaching the surface.

The effects of volcanic ash depend on the grain size, mineralogical composition and chemical coatings on the surface of the ash particles [3]. The eruption of the Grimsvötn volcano in South - East Iceland (64.41 N, 17.33 W) began on 21th May 2011 at 19:25 GMT [4].

Disruption of the air travel commenced on 22 May starting from Iceland, and reached other locations such as Greenland, Scotland, Norway, Svalbard and a small part of Denmark, on subsequent days.

On 24th May the disruption spread already to Northern Ireland and to airports in northern England.

On 25th May the disruption arrived to Northern Germany, as consequence airports at Hamburg and Bremen were closed for a few hours.

On 27th May Greenlandic airspace was closed due to a concentration of ash over Greenland and the North Atlantic. Ash chemical composition from Grimsvötn eruption on 22th May is presented in table 1.

Sample GR11-01 from Kirkjubaejarklaustur, was collected during the onset of fallout just after midnight 22th May, 00:58 GMT. Sample GR11-02 was collected in the morning of 22th May, 08:45 GTM from Horgsland / Sida. Based on chemical composition, the ash classifies as tholeiite-basalt, with no significant difference between samples GR11-01 and GR11-02 [5].

More information on the Grimsvötn eruption, such as description of the eruptive phases, plume heights, size distribution analysis, etc. can be found in the website of the Institute of Earth Sciences (http://earthice.hi.is).

The aim of this paper is to investigate the optical, chemical and microphysical properties of the volcanic aerosols based on the AERONET sun photometer observations in the Timisoara city from Romania during 26 – 29 May 2011. Timisoara is located in the Western part of Romania, thus it is one of the first areas where the result of the eruption consequences from Iceland were observed.

Table 1
ASH CHEMICAL COMPOSITION FROM GRÍMSVÖTN 2011 ERUPTION, Wt [%] [5]

Sample	GR11-01	GR11-02
SiO_2	50.54	51.01
Al_2O_3	13.73	13.46
FeO	13.14	13.25
MnO	0.23	0.23
MgO	5.69	5.77
CaO	10.12	9.86
Na_2O	2.87	2.81
K_2O	0.49	0.50
TiO_2	2.73	2.67
P_2O_5	0.38	0.38
Ba	0.0112	0.0111
Co	0.0070	0.0069
Cr	0.0035	0.0026
Cu	0.0093	0.0077
La	0.0013	0.0010
Ni	0.0058	0.0044
Sc	0.0030	0.0026
Sr	0.0098	0.0079
V	0.0155	0.0129
Y	0.0008	0.0007
Zn	0.0066	0.0060
Zr	0.0018	0.0015

Experimental part

The sun photometer is located on the roof of the Mechanical Engineering Faculty of "Politehnica" University of Timisoara (fig. 1, right), with coordinates: 45.74 N; 21.22 E and 122 m altitude. The sun photometer from Timisoara is connected at AERONET site [6], position 645.

Figure 1 presents the sun photometer components. This is composed from an optical head, electronic box and a robot [6].

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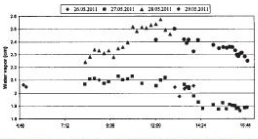

Fig. 8. Water vapor, as observed in Timisoara, during the analyzed episode

From figure 7 it can be observed that the value of ω decreases with increasing wavelength. On 27th May the single scattering albedo was high (0.85 at 440 nm around 16:07 UTC).

Figure 8 presents the results of continuous measurements of aerosol optical properties from whence is extracted amount of water vapour over Timisoara. On 27 May the water vapour of atmosphere decreases.

Average imaginary part of the refractive index was 0.007 at 440 nm, this value is corresponding for a strong absorption (0.06). The refraction index is dependent on the chemical composition of the particle, the wavelength and relative humidity.

Other model was concerning and prepossessing for concentration prediction of inorganic airborne pollutants (particle matter with an aerodynamic diameter of 10 μm or less) from a risk area (two industrial areas) and an urban area from Constanta [16]. For Bucharest area was analyzed air pollution (NO_2) using an other method [17].

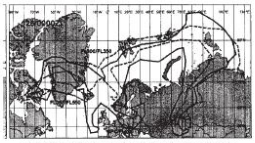

Fig. 9. Forecast model: Met Office London VAAC on 26.05.2011, 00:00GMT [18]

The Met Office London Volcanic Ash Advisory Centre (VAAC) is responsible for the calculation of the ash dispersion by means of atmospheric models and provides forecast guidance up to 24 h for flight. This used a range of technologies (Lidar, Radar) and expertise to predict the movement of volcanic ash [18].

Met Office predicts ash cloud intrusion in North - West Romania at FL 200 (Flight Level) at 00:00 GMT (fig. 9).

SiO_2 concentration on 26 and 27th May had values between 0.6 – 0.8 D.U (Unit Dobson) and was calculated with IASI model [19].

SiO_2 and SO_2 concentration for Grimsvötn area is 14.94 mg / L and respectively 223.79 mg / L reported by [5]. Also it contains a high concentration of Na 47.25 mg / L, Ca 32.17 mg / L and Mg 11.56 mg / L. For Timisoara area it can be observed that accumulation mode is predominant. This mode is specific to atmospheric gases. Due to loading with aerosols can be formed acid rain. Relationships between major ion concentrations and for different ionic constituents and precipitation depth was analyzed for urban and mountain site from Romania [20].

A similar study was completed by Cazacu [21] for the city of Iasi, and Vetres [22] for the Timisoara city.

Based on the experimental data and the analysis, one concludes that on 26-29.05.2011; at the Timisoara station, a special episode occurred, as fine dust of fine volcanic ash was present, dispersed from far away by meteorological conditions.

Conclusions

Volcanic ash intrusion from Grimsvötn volcano in South - East Iceland (64.41 N, 17.33 W) over Timisoara has been analyzed. One demonstrated that by means of sun photometry investigation of the optical, chemical and microphysical properties of volcanic aerosols is possible, generating information about the momentum dispersion situation of a volcanoes plum, originated in the far West of Europe.

The episode is known as generating main disturbances in the air traffic. The results indicted clearly that the data generated by the measurements are informing about the event and the presence over Romania, of different particles (episode on 26th and 28th of May 2011). In the second part of the 28th of May 2011 precipitations occurred, and this is the reason for less recorded data. Values of single scattering albedo < 0.9 lead to warming, while single scattering albedo > 0.9 indicate a cooling of the climate system.

Acknowledgement: The article is based partially also on the strategic grant POSDRU/88/1.5/S/50783, Project ID 50783 (2009), co-financed by the European Social Fund-Investing in People, within the Sectoral Operational Programme Human Resources Development 2007-2012. Also the projects AirQ and TRANSAIRCULTUR are acknouledged.

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OPTOELECTRONICS AND ADVANCED MATERIALS – RAPID COMMUNICATIONS Vol. 6, No. 9-10, September - October 2012, p. 935 - 940

Research concerning emissions monitoring by means of UV cameras

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Sulfur dioxide is one of the most abundant pollutants known in the world. It is emitted by antropic sources, especially due to the combustion of S containing fossil fuels, from both stationary and mobile sources. SO_2 emissions produce heavy pollution over areas with notioeable adverse health effects, especially in gaseous form or through reaction with condensed vapors, forming the acid rain. Volcanoes are responsible for a large amount of SO_2 natural degassing in the atmosphere, as well. Remote sensing measurement of pollution plume from distance is a new and challenging technique for air pollution monitoring. Thus stack emitted SO_2 plumes may be monitored without relying on the cooperation of the industrial facilities that generate the pollution. The SO_2 camera is a novel device developed using solar radiation scattered in the atmosphere as a light source for the measurements. The method is based on measuring the ultra-violet absorption of SO_2 in a narrow wavelength window around 310 nm, by applying a band-pass interference filter and a two dimensional UV - sensitive charge coupled device (CCD) detector. The paper is foousedon real results accomplished in parallel at a Romania power plant, by using an UV camera for SO_2 emission, and the comparison with results obtained with a standard in stack measuring method. Based on the evaluation program developed using the measured values, the conclusion driven from the study is that the SO_2 concentration data delivered by remote sensing using UV cameras are appropriate to be used for stack emission evaluations. Still for getting an optimal correlation between emissions measured with standard methods, in stack, and remote sensing by UV cameras, one has to multiply the results, thus enabling to perform better corrections factors for the mathematical model used.

(Received June 5, 2012; accepted September 20, 2012)

Keywords: Ultraviolet (UV) camera, Remote sensing, Sulfur dioxide, Pollution, SO_2 monitoring

1. Necessity of SO_2 monitoring

Presently, air quality is an important and global issue for all nations. The choice of a measuring process for air pollutants depends on the substance to be measured, the properties it has, and the information to be gained from the measured values. Measurements of main air pollutants must be carried out both at the location of its formation , thus determining the emissions' level and at different location, where the effect of the pollutant must be known, thus speaking about air quality, in respect to the particular pollutant' concentration in air. Sulfur dioxide (SO_2) is one of the most critical gases for the air pollution monitoring [2]. Sulfur oxides represent a major air pollutant and have significant impacts upon human health. SO_2 is considered also as a prounent greenhouse gas that contributes to global warming. The sulfur based oxides are responsible for a lot of respiratory and cardiovascular problems. Also sulfur oxides are known as precursor to acid rain and other atmospheric effects, with major toxicity and effects towards soil and vegetation [11]. The concentration of sulfur dioxide in the atmosphere influences the habitat suitability for plant communities as well as animal life, not at last upon human health. Anthropogenic SO_2 is almost exclusively formed during the combustion of fossil fuels with sulfur content and the most important representative energy source is fossil coal, because the sulphur content of other fuels, such as liquid and gaseous fossil fuels, can be easily removed before combustion [7] or is missing. Sulphur dioxide is an important gas for geologists and environmentalists, as it is known as having natural sources, as well, such as natural phenomena, of non-antropic origin. Volcanic SO_2 flux has been correlated with eruptions, but also explosions, forest burning, accidents, etc.

Different fuels are characterized by a wide range of sulfur content, most of which is released as sulfur dioxides, developed through combustion [5]:

- Oil and its by-products contain between 0.1 % by mass sulfur (paraffin) and 3-4 % by mass (heavy fuel oil) in the form of sulfides and thiols. Presently there are special commercial techniques to extract the sulfur and reduce its amount, thus the chance to generate SO_2 (ex. diesel) as well.
- Coal contains 0.1–4 % sulfur by mass, mainly as flakes of iron pyrites (FeS_2). The average sulfur content of European coal reservoirs is 1.7 % by mass, in Romania even more.
- Natural gas (known as being mainly methane CH_4) is normally sulfur free, but some gaseous fuels, according to their special origin or as byproducts of industrial processes, may contain also, up to 40 % by volume, hydrogen sulfide H_2S, that is generating SO_2 through combustion.

One notices, that by using different filter combinations for the cameras, no different results have been determined. The SO_2 concentration variation in this graph is thus concluding the existence of a quite important different for the case study selected, especially between the cameras' results and the stack monitoring technique. One considers that for getting camera data of comparative level with the stack measurements, a coefficient of multiplication (correction), in the used computational formula must be developed, so that the values generated by both techniques, in comparative simultaneous measurements should, at least, have the same, comparative level of ppm level of SO_2 concentration, meaning the same range with data measured with both Testo and UV camera. In order to verify the proposal, one appreciates that measurements and comparative analysis should be further accomplished. In the present case the coefficient is proposed to be around 4.

5. Conclusions

The paper focuses on results obtained with UV camera by remote sensing and the comparison with results obtained with stack continuous emission measurements. The conclusion is that both are offering data, but remote sensing is an option that is much more simple to be used, not being connected to the stack and offering thus a mobility and much more accessibility for external monitoring, as well.

Remote sensing technique is more and more becoming a future option for pollution measurement, not only for volcanoes, but also for man made emissions generated by power plants.

Up to now, UV cameras provided numerous benefits, such as high time resolution, which enables the capture of transient explosive events (such as volcanoes), the possibility to spatially resolve heterogeneous operations, e.g., fumaroles field sources and single-pount operations. Furthermore, the camera images can be used to directly measure the plume transport velocity, potentially a major source of uncertainty in these measurements.

One concluded that, in this beginning stage, one has to introduce a correction factor for the data generated by the camera remote monitoring, in order to meet the expectations and range of the emission generated by standard methods, meaning in stack measured emissions. This necessity relies on several main causes, (i) the amount of SO_2, (ii) the dispersion of the plume, that does not always enable a correct centered remote control for the camera monitoring, meaning directly in the middle of the flue gas effluent, and (iii) also the variation by diffusion of the pollutant, in three directions, depending on the wind direction, turbulence and climate conditions. Both compared techniques are definitively based on different bases and phenomena; even they refer to the same pollutant, both have advantages and disadvantages. Remote controlling is applicable, with appropriate calibrated technique, as this novel method is presently developed by the authors, for external control as well, achieved not in stack, but from distance and might be used also as an alarming technique and/or included in a territorial accident prevention program.

Not at least artifact in the classic measuring techniques must be taken into account. Generally speaking, the proposed methods, even at beginning, must be further developed, but it is for sure that it might be used as alarming from distance method and a possibility to investigate from remote the sources of pollution, in this case the SO_2 flue gases emitted by antropic power plants that are running on sulfur containing fuels, with or filtering systems for the SO_2.

Acknowledgments

This work was partially supported by the strategic grant POSDRU/88/1.5/S/50783, Project ID50783 (2009), co-financed by the European Social Fund-Investing in People, within the Sectoral Operational Program Human Resources Development 2007-2013. Also the authors wish to acknowledge the Norway Grants for the RADO contract STVES 115266 (http://inoe.inoe.ro/RADO), not at least a special thank is directed to the coordination and the partners in the project.

Also the paper is supporting the projects AirQ and TRANSAIRCULTUR, that are presently under progress.

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11 Dissemination of a project in the Research Report 2012 of the "Politehnica" University

Research Report 2012

Novel Tool for Urban Air Quality Monitoring – AIRQ

Universitatea Politehnica din Timişoara

Goal of the project:
The aim of the project is to parameterise some particular mechanisms of turbulent mass and momentum transfer that are likely to happen in specific urban forms named hereafter street-half-canyon. Another goal is to introduce that parameterisation in an existing air quality model used for regulatory purpose in France, SIRANE, so as to make this code able to address the question of industrial emissions in densely populated located directly around city centres, together with the validation of the new version of SIRANE with real life data provided by measurements taken in an urban environment submitted to industrial emissions. And also to install SIRANE in the city of Timisoara for air quality monitoring.

Short description of the project:
The team in Romania provides the data required for running the software and perform measurements for validation of the calculated data. Expected results include an environmental cadastre of emissions, including anthropogenic and natural pollution sources. Three dimensional maps of pollutant species concentrations would be available as a result of the research developed in this project. The new version of SIRANE developed during the project would allow decision factors to identify the most likely reason for exceeding imposed limits. Also, based on the results provided by this new tool, a better urban planning would be possible, so that a higher air quality can be ensured.

Project implemented by:
The department for Mechanic Machines, Equipment and Transportation from Politehnica University of Timisoara in partnership with Ecole Centrale de Lyon from France.

Main activities:
- parameterization of turbulent mechanisms responsible for pollution dispersion in specific urban forms;
- implementation of that parameterization in an existing urban air quality model;
- validation of the entire modeling chain by measurements in the city of Timisoara;
- quantification of uncertainty in the results resulting from the quality of the emission cadastre;
- development of a warning system that identifies episodes of exceeding imposed concentrations limits;
- development of improved urban planning strategies.

Results: a new dispersion model, new air quality monitoring tool for urban air quality, database containing pollutants concentrations.

Research team:
UPT team: Prof. Dr. Eng. Ioana IONEL, Assist. Prof. Dr. Eng. Luisa Izabel DUNGAN, Assist. Prof. Dr. Eng. Francisc POPESCU, Dr. Eng. Nicolae LONTIS, Dr. Eng. Ion VETRES, Dr. Eng. Adrian IRIMESCU, Dr. Phys. Delia CALINOIU, Dr. Eng. Catalin NISULESCU, Phys. Doina NICOLAE, Camelia TALIANU, Silviu MEGAN, Lavinia-Alina CALUSERU.

Research centre for Thermal Machines and Equipments, Transportation and Environmental Pollution Control

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"Our most basic common link is that we all inhabit this planet. We all breathe the same air."
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12 Creation of the project roll up and dissemination of the project ideas & objectives and results

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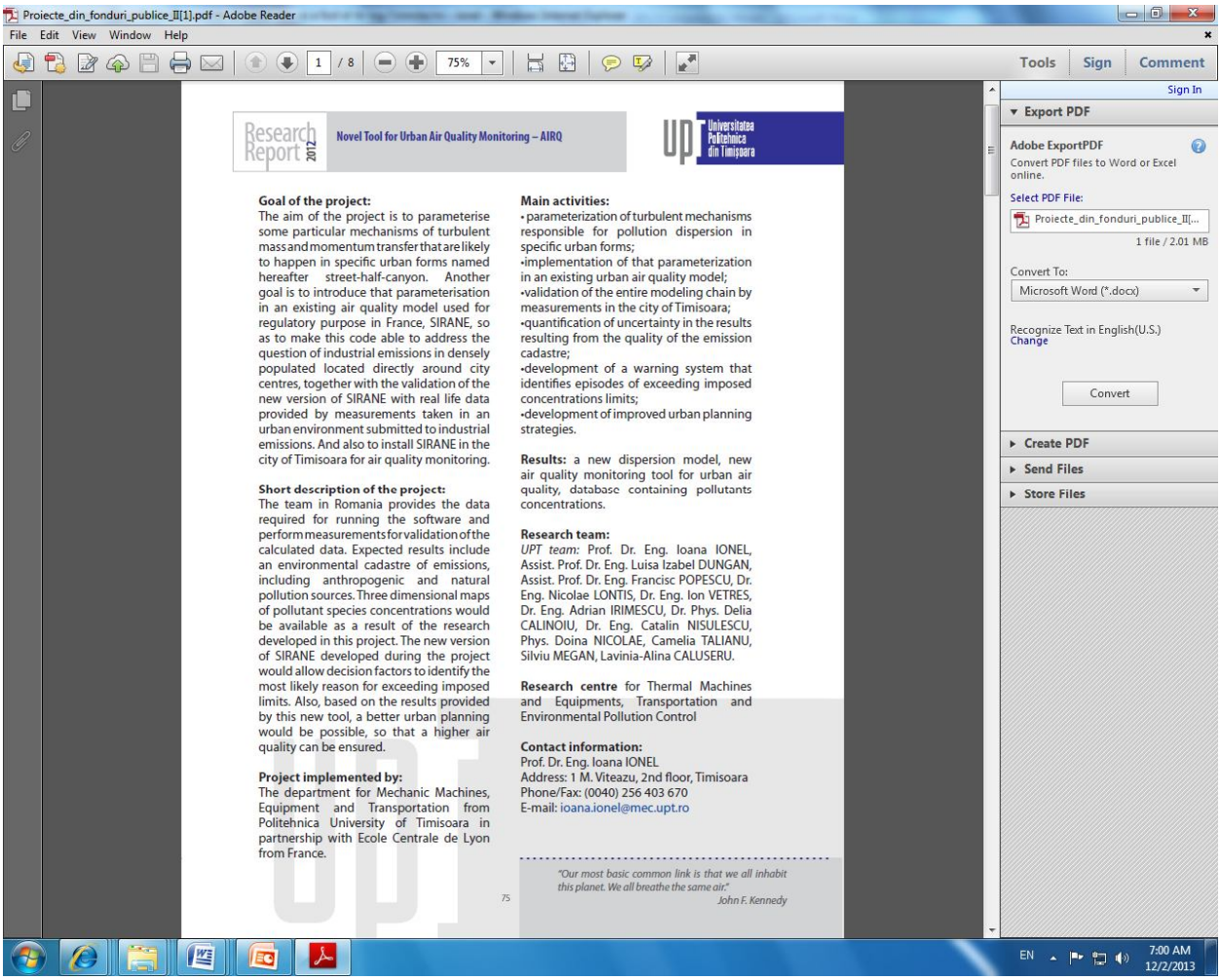

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