In The Name of God

Joint Workshop On

"Strategies for Clean Air in Tehran"

10-12 June 2006

Proceeding Of Abstracts

Islamic Republic of

Iran Meteorological Organization (IRIMO)

JOINT WORKSHOP ON "STRATEGIES FOR CLEAN AIR IN TEHRAN"

10-12 June2006

Timetable of workshop ***(SATURDAY , 10 June 2006)***

Time	*Lecturer*	*Subject*
9-9:15	-	Inauguration and Recitation from Holy Qran
9:15-9:45	**Dr. Noorian** President of IRIMO	Opening Speech on the Strategic plan for Tehran Air pollution
9:45-10	**Dr. Sodoudi** Free University of Berlin	Workshop Introduction and Objectives
10-10:40	**Dr. Reimer** Free University of Berlin	European Strategy, Air Quality Management in Berlin
10:40-11	-	Tea Break
11-11:40	**Dr. Rashidi** Air Quality Control Co.	Tehran Air Pollution Resolutions and Hindrances
11:40-12:20	**Dr. Moller** Cottbus University	History of Air pollution in Germany and Control Strategies
12:30-14	-	Lunch Break
14-14:40	**Dr. Soltanieh** Sharif University of Technology	Photochemical Modeling of Air pollution in Tehran
14:40-15:20	**Dr. Braun** Free University of Berlin	Control and Management of Air Pollution in Industrialized Cities
15:20-16	**Dr. Ganji Doust** Tarbiat Moddares University and IRIMO	Control and Manage cut of Air Pollution in Industrial Cities
16-16:20	-	Tea Break
16:20-17	**Dr. Reimer** Free University of Berlin	Emissions:Today and Tomorrow
17-17:40	**Dr. Zandnia Pour** Advisor of IRIMO	Air Pollution Model for Tehran

JOINT WORKSHOP ON
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Timetable of workshop ***(SUNDAY , 11 June 2006)***

Time	*Lecturer*	*Subject*
9-9:40	**Dr. Moller** Tech. University of Cottbus	PM10 Aerosol Mass and Composition in and Around Berlin
9:40-10:20	**Dr. Esfahanian** University of Tehran	Determination of the Number and Location of New Air Pollutant Monitoring Station Over Great Tehran
10:20-10:35	-	Tea Break
10:35-11:45	**Dr. Reimer** Free University of Berlin	Regional and Urban and Street Modelling and Future Scenarios
11:45-12:10	**Dr. Sodoudi** Free University of Berlin	High Resolution Regional Model, Definition and Verification
12:10-13	-	Visiting IRIMO
13-14:30	-	Lunch Break
14:30-15:10	**Dr. Bidokhti** Institute of Geophysics University of Tehran	Air Pollution Meteorology in Urban Areay
15:10-15:40	**Dr. Moller** Tech. University of Cottbus **Dr. Braun** Free University of Berlin	Introduction of Co-operation Development among Berlin University and Cottbus and IRIMO and Iranian Universities
15:40-16:10	**Dr. Sedaghat Kerdar** ASMERC	Introduction of Tehran Atmospheric Science and Meteorological research Center and Co-operation with German Universities
16:10-16:30	-	Tea Break (Well Wishes for German and Iranian Soccer Teams)

JOINT WORKSHOP ON
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Timetable of workshop ***(MONDAY , 12 June 2006)***

Time	***Subject***
9-12	Roundtable Discussion: Discussion on Megacity Project for Tehran Discussion on Modeling and Measurements Discussion on MOU

European Strategy, Air Quality management in Berlin

E. Reimer
Free University of Berlin (FU), Germany

The Sixth Community Environment Action Programme identifies four priority areas, of which one is “Environment and Health and Quality of Life”. The programme aims at a high level of protection which minimizes harmful effects on human health and the environment and as possible to ensure a high level of quality of life and social standards for people.
In order to achieve levels of air quality, particulate matter, nitrogen oxides (NOx) and ozone is of particular interest. The inhalable fraction of particulate matter has a great negative impact on human health and, in principle, there appears to be risks at low concentration levels. There is also evidence that ozone and nitrogen oxides effect human health and vegetation. Similar to particulate matter there seems to be no general threshold concentration. The transboundary transport is important for the small particle fractions of PM as well as for ozone and its precursors.
The EU air quality “framework directive” defines the basic principles of a common strategy as follows:

- to establish future ambient air quality objectives designed to protect human health and the environment as a whole,
- to assess the ambient air quality on the basis of common methods and criteria,
- to obtain adequate information on ambient air quality and to make it available to the public and maintain ambient air quality where it is good and to improve it in other cases.

The EU “daughter directives” define concrete environmental objectives in terms of limit values, alert thresholds, target values and long-term objectives. It provides concrete information and requirements on the assessment of air pollutants (assessment regimes, determination of exceedances, assessment methods, network criteria, and data quality objectives). It also sets up requirements for the public information.
The concept includes thresholds and dates, i.e. 2005 and 2010, when Member States are obliged to present plans and programs to explain what they are going to do in order to meet the threshold values. In relation to particulate matter PM10 the 2010 values are 20 µg/m^3 as annual mean and 50 µg/m^3 as 24h-mean, not to be exceeded more than 7 times per year.
The Clean Air for Europe (CAFE) programme was initiated

- to develop, collect and validate scientific information about the effects of air pollution, emission inventories, air quality assessment, emission and air quality projections, integrated assessment modelling to develop and update air quality and deposition objectives and indicators,
- to ensure that the measures that will be needed to achieve air quality and deposition objectives cost-effectively are taken at the relevant level and with effective structural links to the relevant policy areas.

These proven procedures will be applied to Tehran.

History of Air Pollution in Germany and Control Strategies

D. Möller
Technical University of Cottbus, Germany

Since the industrial revolution 130 years ago the development of German emissions is presented and the crucial environmental problems (winter smog, summer smog, forest decline, acid rain) will be briefly characterized. Due to the complex releationship between emissions ("air pollution") and environmental impacts, including many other non-atmospheric relationsships (resulting in non-linear behaviour), it seems better to focus the control targets on the effects, calling it "intelligent air pollution control". Reduction in emissions due to German law results into different response of atmospheric concentrations, despite of hardly to described changes (improvements) of the environmental status. Trends including future prognosis are given and control strategies are discussed in the background of its efficiency. Because now being at the final state of the end-of-pipe-technologies, only complete changes in technology (transfer to "solar age") could provide a sustainable development.

The compatibility of sustainability with urban development

G. Braun
Free University of Berlin (FU), Germany

Urban regions are by definition and function sustainable. Present urban processes endanger this potential because cities sprawl into the semi-urban and rural periphery – despite population loss in some advanced economies. The weakening balance between growth and development is not only at risk for land use consumption and structures but also for the increase of the spatial and functional split of urban structures and the increasing demand for individual and economic transport. The future urban structure only can be seen as a functioning complex adaptive system when new models of governance allow to re-establish the conditional framework of sustainability.

Emissions today and tomorrow

E. Reimer
Free University of Berlin (FU), Germany

A gridded emission inventory, based on the information of 1994, exists for the Greater Tehran area. This was used for air pollution modelling with non-complex models. Corresponding to WP2 and WP3 these data have to be updated for current situation by the Iranian partner and within the project. This step is necessary, because the chemical transport models used here are medium and more complex with the obligation to develop the necessary emission data to an optimal degree. This step includes the coordination of procedures to retrieve emissions.
Available information in Tehran concerning anthropogenic emissions will be analysed and assessed using European experience from CORINAIR/EMEP as well as the global emission inventory GEIA. Specific attention will be paid to biogenic and natural emission sources, especially dust. In the first phase WP1 the existing information will be collected and in the first year reviewed, leading to a list of weak points and missing data which will be studied in the next phases of this project. Gaps will be filled by satellite information.
In cooperation with the Iranian authorities and according to the official plans or cooperative discussions, scenarios will be developed for population growth and transport system and traffic change hypotheses as well as for landuse and industry and energy consumption changes.
These changes will be analysed in relation to ecological, economical and to less extent social sustainability.

PM_{10} AEROSOL MASS AND COMPOSITION IN AND AROUND BERLIN

D. Möller
Technical University of Cottbus , Germany

In city of Berlin (Germany) and in the surrounding area an one year measuring program was designed and carried out from September 2001 to September 2002 to identify the daily PM_{10} aerosol mass concentration and its chemical composition. This program was organised by the Berlin government, department of urban development in the background of the new EU air quality directive for the PM_{10} pollution limits. These limits were fixed at 50 µg/m^3 for the daily PM_{10} average and at 30 µg/m^3 for the yearly average. From the Berlin Environmental Measurement Network (BLUME) three sites in the city centre and two sites near the city border as well as three sites in the rural environment (Brandenburg) were selected to investigate the PM10 pollution situation. Identical equipment (High Volume Samplers (Digitel DHA 80), quartz fibre filters QF 20 preconditioned at 850° C) was used at all these sites for daily (24 hours) sampling. After exposition the aerosol mass as well as the chemical composition (organic carbon (OC), elemental carbon (EC), Cl^-, NO_3^-. SO_4^{2-}, NH_4^+, Na^+, K^+, Mg^+, Ca^{2+}, Fe, Pb, Cd, Ni, As) were detected. Some additional information like meteorological conditions, traffic counts, trace gases and soot measurements were available from the BLUME-Network.

Regional and Urban and Street Modelling and Future Scenarios

E. Reimer
Free University of Berlin (FU), Germany

A vital point is the chemical transport modelling for different horizontal scales. Within the EU CAFÉ initiative like CITY DELTA and national activities the use of models is examined. For about 10 years there is evidence, that chemical transport models are usable for explanation and simulation of air pollution levels.

- The models used are LOTOS and REM/Calgrid with 30 to 4 km horizontal resolution, which have been used for air pollution and emission scenario modelling in relation to the EU directives for years.
- The models will be used nesting down to the urban scale.
- The relevant species simulations, especially NO_2, PM10 and PM2.5, SO_2 and O_3 will be performed on an hourly basis for a whole year for the first step.
- In a later phase calculations will be performed for up to 5 years to cover the meteorological variability and to be able to calculate the long term EU thresholds.

The model system M-SYS, which consists of mesoscale (METRAS and MECTM) and microscale (MITRAS and MICTM) meteorology and chemistry models, will be employed to investigate meteorological parameters (e.g. wind, temperature) and concentration fields (e.g. NO, NO_2, SO_2, O_3) in the mesoscale by resolving the atmospheric boundary layer and in the local scale within the urban canopy layer by resolving e.g. building effects. The model investigations will focus on selected periods, e.g. pollution periods with high surface concentrations.
This complex model system can be used to characterize the detailed flux of polluted air in streets and in the urban areas together with the important vertical exchange of pollutants.
M-SYS results will be aggregated to be employed for validation of the medium complex models REM/Calgrid and CPB (Canyon Plume Model). Input data for M-SYS will be emission data from the scale and street canyon scale, orography and land-use data and large scale model data as boundary condition.
Model CPB (Canyon-Plume-Box-Model) will be used for long term assessment of air pollution levels in the streets of Tehran. CPB can model the trafficborne pollution concentrations in streets. The hourly traffic emissions are modelled by $IMMIS^{em/h}$ ($IMMIS^{luft}$, 2004).

High resolution Regional Model (HRM), definition and verification

S. Sodoudi
Free University of Berlin (FU), Germany

The **H**igh resolution **R**egional **M**odel (HRM) is a flexible tool for **N**umerical **W**eather **P**rediction (NWP). The Deutscher Wetterdienst (DWD) provides this comprehensive package to meteorological services, universities, and research institutes world-wide. Many countries, specially the neighbour countries of Iran such Jordan, Oman, Pakistan, India, United Arab emirates and china use this model for meteorological forecast. This model has a horizontal resolution of 28 to 6 km and a hybrid vertical coordinate with 20 to 40 layers. This model has been run over Iran. It has been verified over two stations in Iran (Isfahan and Bandar Abbas). The predicted values are in good agreement with observations. Without regional meteorological model and forecast of wind fields, air pollution modeling is impossible.

Communication and Education

Möller
Technical University of Cottbus , Germany

Braun
Free University of Berlin (FU), Germany

The whole project combines a widespread number of models, analysis and strategies which afford an intensive exchange of knowledge to the Iranian partners.
Therefore the educational point of view is of eminent interest. The exchange of scientists (students and PhD) between the institutions will be arranged especially with respect to the procedures and tools used in this project. It should be stressed that next to well established procedures and tools, like air quality models, that can directly be applied in the project also advanced and state-of-the–art methods and models will be exchanged enabling Iranian universities to increase scientific research in this area.
In alliance with European and North American Universities the Free University of Berlin has established a new masters programme in „Metropolitan Studies“. The new curriculum is structured as international in terms of comparative studies and studying abroad, structured as interdisciplinary in terms of the multilinked interfaces between economics, sociology, architecture, ecology, and planning as well as structured by its strong research orientation. The curriculum itself contains the four keystones intra- and interurban systems, governance/ urban planning and spatial comparison. These four keystones are integrated in project studies at all levels of the curriculum dealing with current urban processes at various spatial levels.

Control and Management of Air Pollution In Industrialized Cities

Hossein Ganjidoust[1,2] And Bita Ayati[2]

1- I. R. of Iran Meteorological Organization (IRIMO),Atmospheric Chemistry, Ozon Depletion and Air Pollution Committee, Tehran, I. R. of Iran

2- Tarbiat Modaress Unibersity, Tehran, I. R. of Iran

I.R. Iran is located in the center of the Middle East. Because of its location, it is one of the important countries in the region. The population of I.R. Iran is over 60 millions in a surface land area of 1’548’195 kilometer squares. Seven cities of Tehran (The Capital City), Tabriz, Isfahan, Meshed, Kerman, Ahvaz and Shiraz with populations over two millions are the major industrialized ones. In recent years, these cities have faced to air pollution problems. Population growth and industrial development are the main reasons for the air pollution problem. Due to the geographical condition in the area, inversion happens especially in fall and winter seasons.

Industries, traffic and houses and buildings’ heating systems are the main sources of pollution. Annually, more than 15 and 6 milliard liters petrol and gasoline are consummated by different kinds of transport means in the country, respectively. As statistics shows, the age of automobiles in Tehran are from 10 to 22 years (average age is 15.9 years) that have an important role on air pollution. In addition, due to heavy traffic, the average velocity is 30 Km-hr. In the other hand, 30 percent of I.R.Iran industries are located in Tehran that is about 6500 units. Most of them are in west although wind direction is from west to east. So, in new management plan, establishment of industries is forbidden within the area of 120 kilometers around the city of Tehran unless in defined industry sites. Some polluting units should be move to another suitable site, too. Sometimes, numbers of polluting industries are prevented from activities but it doesn’t seem to be an effective way. It is preferred to change and improve the industrial emission to reach the acceptable air quality standards.

In recent years, original activities with short and long aims are done in different cities, separately. For example, researching and cooperating with different institutes, centers and countries like Japan, Sweden and Germany implementing more than 300 studying and researching plans in meteorology and dependent courses, establishing of the meteorological research centers and atmosphere sciences, three applicator meteorological research centers and more than 40 new stations in the country, installation of newest computer systems in metrological information, using of wall map and continuous radio-traffic to announce traffic news, completing of subway construction in Tehran, forbidding of industrial activities in a definite distance away from Tehran and transferring them to suitable places, building of highways and freeways, improving of public transportation and gasifying them, developing of fuels quality and removing lead from them, gasifying of the heating systems in houses and buildings, are the main activities that are done in recent years.

It is the purpose of this study to investigate the control mechanisms for air pollution problems in the major industrial cities. The necessary action plans that were taken in recent years in some of the cities and are suggested to be taken in the other ones are the other purpose of this research

Air Pollution Model For Tehran

Ahmad Zand Niapour

Advisor of I.R. of Iran Meteorological Organization, Tehran, Iran

Tehran is one of the most polluted urban area, with a population of 12 millions and more than 2 millions mostly and vehicles Tehran is Surrounded by high Mountain which traps the pollutant in the city. Further the city is located at a latitude of 35.7 degree and an altitude of 1000 to 1800 meters above see level. Therefore photochemical Activity is here very high.
In Corporation with MAX-PLANCK institute for chemistry and meteorological institute of the university of mains is CBMZ-KLIMM model developed for Tehran. This paper describes This model brifly.

Tehran Air Pollution Resolutions and Hindrances

Yousef Rashidi
Air Quality Control Co.

What you are reading in this article is all about air quality in the city of Tehran. The topography of Tehran indicates that the city is surrounded by the sierra from the north and the east. Most of the time during a year, the wind speed is in a low level. These two factors prevents a natural ventilation in Tehran, so that the air quality was standing above the standard level for 82 days during 1384, according to the data received from the air quality monitoring stations. The research and studies implemented by the World Bank, indicates that the damage on public health amounts to 8 billions USD for the year of 2004, followed by the international research and regulations upon air pollution in Tehran, as well as relevant standards for the country of Iran. A part of this study deals with the concentration of the two parameters of CO and PM10 together with the fuel consumption within different years. The concentration change process for O3 and CO is being shown in two different traffic spots during a day, followed by meteorological and topographical situation of Tehran. Also, the share of mobile and stationary emission source for all pollutants is being presented, according to the emission inventory together with emission factors for all domestic and old vehicles. According to the latest survey, the %88 of air pollution in the city of Tehran is being caused by the urban transportation considering the type of vehicles (Cars, motorcycles, Vans, trucks and buses) for each pollutants (CO, NOx, SOx, THC and PM10). At the end the action plans regarding to several subjects such as emission standards for new vehicles, fuel quality, public transportation, inspection and maintenance program and scapage of old vehicles will be explained.

Air Pollution Meteorology in Urban Areas

A.A. Bidokhti
Institute of Geophysics, University of Tehran, I. R. of Iran

Air pollution has become a major source of hazard for the health of people living in large cities. Specially uncontrolled emission in some cites with poor ventilation due to meteorological conditions is a serious problem.
In this paper some meteorological parameters affecting air pollution in large cites with topographic influence will be mentioned. Then some of the recent works done at the Institute of Geophysics concerning meteorological aspects of air pollution of Tehran will be covered. These include some observational study of wind characteristics, wind regimes, air pollution concentrations, results of an integral model of air pollution and results of a mesoscale numerical model for wind field and air pollution concentration with hypothetical sources. At the end a scheme for control of air pollution in large cities will be proposed.

Determination of the Number and Location of New Air Pollutant Monitoring Stations Over Great Tehran

V. Esfahanian[1], Kh. Ashrafi[2] and S. Ghader[3]

[1]Associate Professor, University of Tehran
[2]Research Scientist, Vehicle, Fuel and Environment Research Institute
[3]Assistant Professor, University of Tehran

In the first part of this research work, the statistical analysis of air quality data of great Tehran air pollutant sites and the correlation between them is studied. To perform this stage of study, recorded data of Department of Environment (DOE) stations namely, Azadi, Bahman, Tajrish, Pardisan, Sorkhe Hesar and Vila during the period 1999 to 2004 are used. Several pollutants are monitored over the DOE network, such as carbon monoxide (CO), nitrogen oxides (NO and NO_2), sulphur dioxide (SO_2), ozone (O_3) and particulate matter (PM_{10}). These pollutants are used to perform the statistical analysis. Time-series analysis of air pollutants and their evolution with time is also considered.

The daily spatial distribution of air pollutant concentrations, which is the subject of the second part of this study , is presented. To obtain the spatial distribution of the air pollutant concentration it is necessary to use some interpolation schemes. In the present work the kriging, inverse distance and thin-plate spline methods are carried out to perform the spatial interpolations over Tehran. The validity of the spatial distribution of the concentration of air pollutants obtained form different interpolation schemes is also investigated. In addition, a general computer code has been developed to calculate and report the spatial distribution of air pollutants. These daily spatial distribution of air pollutant concentrations are also calculated based on the pollutant standard index (PSI).

One of the main goals of this study is the determination of the number and location of new air pollutant monitoring stations over great Tehran. To this end, a methodology based on the correlation between DOE monitoring sites is used .

Furthermore, a general software for the urban air quality data storage and management, as a part of this study, has been developed for the DOE.

Photochemical Modeling of Air Pollution in Tehran

Mohammad Soltanieh
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Sharif University of Technology, Tehran, Iran

The high concentration of air pollutants in Tehran along with unfavorable geographical and meteorological conditions including high altitude and mountainous terrain, low rain fall and intense solar radiation all favor the formation of photochemical smog and secondary pollutants including ozone. The situation is more severe in summer time and when temperature inversion occurs. In this research a rigorous mathematical model is presented for studying the photochemical smog formation in Tehran and the simulation results are compared with the observed data. In addition, a semi-empirical approach is developed to study the effect of hydrocarbons and oxides of nitrogen as precursors of ozone. Based on the available data, several semi-empirical correlations are developed to predict the ozone concentration. The results of these studies can be helpful for air pollution control management in Tehran.

Introduction of Tehran Atmospheric Science and Meteorological Research Center (ASMERC) and Cooperation with German Universities

A. SedaghatKerdar
ASMERC, IRIMO, Tehran, I. R of Iran

Atmospheric Science and Meteorological Research Center (ASMERC) was established in 1989 as an extension center of Islamic Republic of Iran Meteorological Organization (IRIMO) to increase the effectiveness of atmospheric research.
ASMERC is located in the west of Greater Tehran area , the capital city of Islamic Republic of Iran. The total area of the center is about 50,000 square meters,6500 of this area is devoted to administration office, 20 percent of the area for residential building, and the rest is for sport complex and other facilities.
The main objectives of the center are study and research in theoretical and applied fields of meteorology. In addition , the center directs some activities for new applications in the area of meteorology.
According to its terms of reference, the center should report scientific activities and proposals to a board of trustees for approval at least twice a year.
In addition to a research council that directs scientific activities of ASMERC, there are nine research groups as follows:

1 - Dynamic & Synoptic Meteorology
2 - Climatology
3 - Physical Meteorology & Weather Modification
4 - Agro meteorology
5 - Hydrometeorology
6 - Atmospheric Chemistry, Ozone, and Air Pollution
7 - Marine Meteorology & Physical Oceanography
8 - Atmospheric prospecting
9 - Aeronautical Meteorology

Besides, faculty members of ASMERC are involved in some international activities such as:
- Preparation of a report to submit to United Nations Framework Convention on Climate Change (UNFCCC) of Global Climate Observing System in I.R. of Iran.
- Member of Joint Scientific Committee (JSC) of United Nations.
- Chairman of agricultural meteorology working group of Regional Association II (RA II) of World Meteorological Organization (WMO).
- Member of expert team on the rescue preservation and digitization of climate records of Commission for Climatology (CCL).
- Reporters of RA II working groups
- Member of Intergovernmental Panel on Climate Change (IPCC).
- Member of Commission of Sustainable Development of United Nations (CSD).
- Member of Coordinating Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea (CASPCOM)