AIRCLIM-NEWS

AIRCLIM-NET

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FROM THE CO-ORDINATOR

Dear Colleagues,

On the 1st of December 2008 in Poznań a world debate on one of the major issues of our civilization, i.e. climate changes will start. Polish Government will host representatives of 193 countries, including prime ministers, deputy prime ministers, politicians, representatives of international institutions, business, non-governmental organizations as well as scientists and media.

In the face of the Climate Summit there are many questions to be answered, most of them being verified by the latest financial crisis. The first question is: will the actions aimed at the reduction of climate changes be continued or hampered by the financial crisis and to what extent? Will the financial crash have an impact on production, technology and economic growth? Can the obligations connected with the counteracting climate changes become an essential part of a new plan of the economic growth? Some people, for example Mr. Erik Solheim, Minister of the Environment, Norway have no doubts and claim that the climate protection issue can not be put off till tomorrow due to the financial crisis. According to Mr. Solheim *„the climate change is not only the task for our children and grandchildren but it is the problem which occurs now and must be solved immediately. This is an absolute priority, a problem which is deeper, longer-lasting and more serious than the financial crisis"*.

Will the COP14 Conference be a milestone on the way of reaching an international agreement?

Dr Janina Fudała
Network Co-ordinator

IN THIS ISSUE

SINZAP MODELLING SYSTEM AND SERVICE

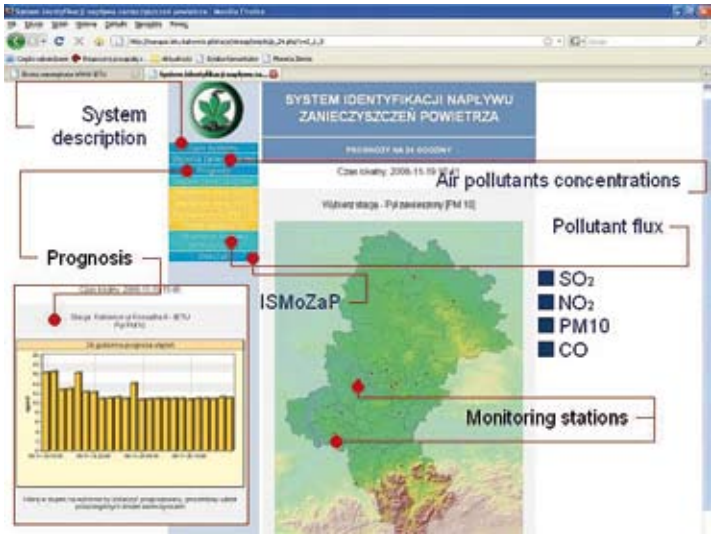
Identification System of Air Pollution Inflow (Polish acronym – SINZaP) is a real time operating system resembling a neural network. It is designed for modelling of pollutant emissions and air pollutants concentrations, addressed to specialists or decision makers responsible for air quality management. SINZaP consists of four main modules: data module including data scanner for reading public data accessible in the Internet, module for preparation of meteorological data, BackTrack module for simulations of pollutants emissions and simulations of air pollutants concentrations, and Trainer module, the task of which is correction of input parameters for adjusting modelling and observed data.

In the years 2005–2006 SINZaP was considerably modified. The modifications included:

- a new extension for reading the air quality data from the world wide web pages,
- the capability of using meteorological service containing data on 3-D wind field and temperature, mixture high, precipitation as well as downwelling radiation,
- the air pollution simulation system based on VLSTrack model Lunching.

Thanks to these modifications and owing to introduction of the meteorological forecast from HIRLAM (FMI), SINZaP gained the capacity to serve as the main tool for forecasting of air the quality at selected monitoring stations of Silesian Voivodeship. For example, it was used in the information service created in MARQUIS project of the EU eContent Programme.

For more information please visit http://www.marquis.ietu.katowice.pl



Examplary prognosis of air pollutant concentrations

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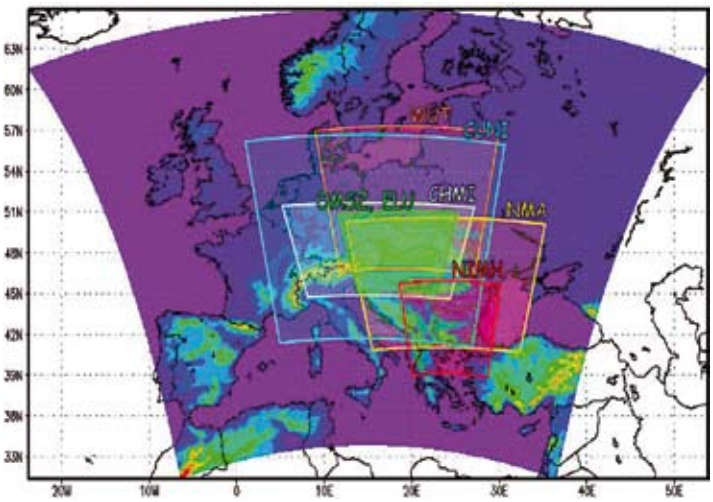
CLIMATE CHANGE AND AIR QUALITY MODELLING IN CENTRAL-EASTERN EUROPE

Warsaw University of Technology (WUT) participates in the research project which started as a part of the 6. Framework Programme of the European Union (Priority: Global Change and Ecosystems). Project CECILIA – **C**entral and Eastern Europe **C**limate **C**hange **I**mpact and Vulnerabil**LI**ty **A**ssessment (http://www.cecilia-eu.org) is under realization (2006-2009) by sixteen institutions from twelve European countries. The project is co-ordinated by Prof. T. Halenka from Charles University in Prague (CUNI); Poland is represented by WUT with Prof. K. Juda-Rezler as a team leader.

CECILIA's primary goal is to improve the understanding of local climate change in Central and Eastern Europe (CEE) and its impacts on extreme events, forestry, agriculture, hydrology and air quality. During the last decade regional climate models (RCMs) have been increasingly used to examine climate variations at scales that are not resolved by global climate models (GCMs). The skill of RCMs in simulating climate variability of 50 km resolution, has been evaluated so far. However, for CEE region very high resolution simulations are necessary, due to the presence of complex topography and land use.

Thus, the main objective of the project is to adapt some of the RCMs, i.e.: RegCM (ICTP, Trieste) and ALADIN-Climate (Meteo-France) for very high (10 km) resolution simulations over selected sub-domains of the region. For air quality modelling, the photochemical, third-generation models coupled to RCMs are used. These are: CAMx (ENVIRON Int. Corp., USA) and CMAQ (US EPA). Poland participates in three, among seven, Workpackages (WP) settled down in the Project, leading WP7 research activity (*Climate change impacts on air quality and health*).

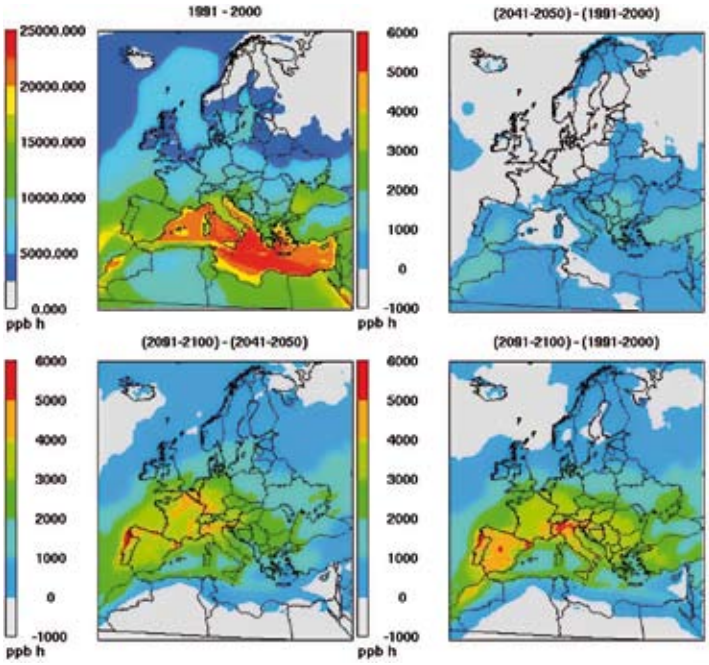
As yet, 50km (climate and air quality) as well as 25km (climate) simulations were completed for CECILIA modelling domain (figure below). The results are now used as boundary conditions for high resolution simulations performed in selected sub-domains (figure below). Exemplary results of BOKU's (Universität für Bodenkultur, Vienna) simulations are shown in the next figure.



CECILIA domain used for climate change simulations (violet). High resolution RCMs domains: WUT – Warsaw University of Technology, CUNI – Charles University (Czech Republic), CHMI – Czech Hydrometeorological Institute, NIMH – National Institute of Meteorology and Hydrology (Bulgaria), NMA – National Meteorological Administration (Romania), OMSZ – Hungarian Meteorological Service, ELU – Eotvos Lorand University (Hungary).

At WUT, the sub-domain was settled down with climate (RegCM) as well as air quality (CAMx) models implemented to it. The RegCM model, driven by ERA40 reanalysis fields, was positively tested for the domain and the high resolution RegCM simulations for 1991-2000, driven by the ECHAM5 global climate model, were completed. Then, the high resolution photochemical simulations (RegCM-CAMx) have been started. Validation of the test run results indicated a satisfactory model performance. Thus, high resolution photochemical simulations for control run and future projection by ECHAM5–RegCM–CAMx have been started.

It is worth to point out, that WUT is currently one of the two institutions in Poland, working with regional climate simulation. Moreover, the system of models ERA40/ECHAM5–RegCM–CAMx is a first modelling tool of such class, which works operationally for long-term simulations in Poland.



Exemplary results of the ECHAM5–RegCM-CAMx 50km simulations for CECILIA domain.
The average AOT40 (accumulated exposure over a threshold of 40 ppb) values [ppb h] for present climate (1991-2000) – left upper panel and forecast of AOT40 changes in near future climate (2041-2050) and far future climate (2091-2100) in reference to earlier periods (other panels).
Source: CECILIA Project, 2008: B.C.Krüger, BOKU-Met (Universität für Bodenkultur, Vienna)

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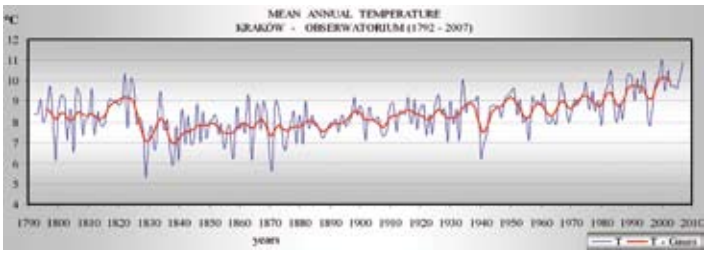
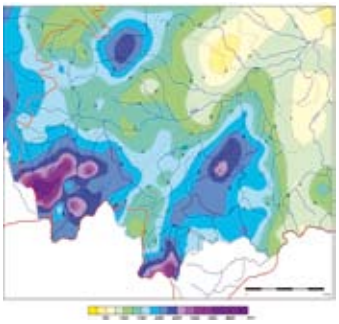
RESEARCH ACTIVITY OF THE FACULTY OF CLIMATOLOGY OF THE INSTITUTE OF GEOGRAPHY AND SPATIAL MANAGEMENT, JAGIELLONIAN UNIVERSITY, KRAKOW

The Faculty of Climatology of the Institute of Geography and Spatial Management at the Jagiellonian University, Krakow has been carrying out research activity focused on long-term climate changes, extreme meteorological phenomena, atmospheric circulation, bioclimate, town's climate, impact of the relief and land use pattern on the local climate. The research was based on data (e.g. on air temperature) obtained from a meteorological station located in the Botanic Garden of the Jagiellonian University, which has been operating since 1792 (figure below). A great part of the research activity has been carried out in co-operation with the Institute of Meteorology and Water Management. The examples of this co-operation are spatial studies of extreme precipitation in July 1997, which caused the great flood in the Southern Poland and contributed to the highest maximum temperature (10 August 1992) and the lowest minimum temperature (9 February 1956) recorded in Poland in the period of 1951–2006.



Mean annual temperature in Krakow in the period 1792-2007



Total twenty-four hour precipitation 4-9.07.1997

Maximum temperature 10.08.1992

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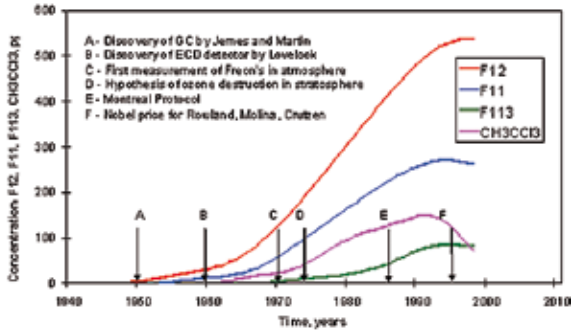
ASSESSMENT EFFICACY OF INTERNATIONAL REGULATIONS ON CFC'S CONCENTRATION IN THE ATMOSPHERE OF POLAND

The concentrations of chlorofluorocarbons (CFCs) and sulphur hexafluoride (SF6) in the atmosphere are on the ppt level. As radiatively active gases they influence the depletion of the Earth's ozone layer and increase of the greenhouse effect.
The decisions of the Vienna Convention (1985) and of the Montreal Protocol (1987) limited the world production level of CFCs in the year 1989 at least 35% after 2004, 90% after 2015 and total reduction after year 2030. The investigations of the global trends of the concentration CFCs in the atmosphere by Advanced Global Atmospheric Gas Experiment (AGAGE) program indicate that limitation of the world production of CFCs take effect in fall tendency of the concentration of several investigated compound in the atmosphere [1].

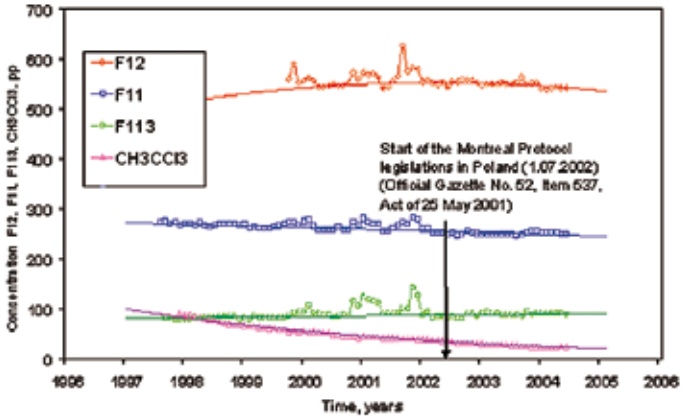
In the figure below the concentration of CFCs obtained by AGAGE program on the main historical facts concerning of Earth ozone layer protection are presented.



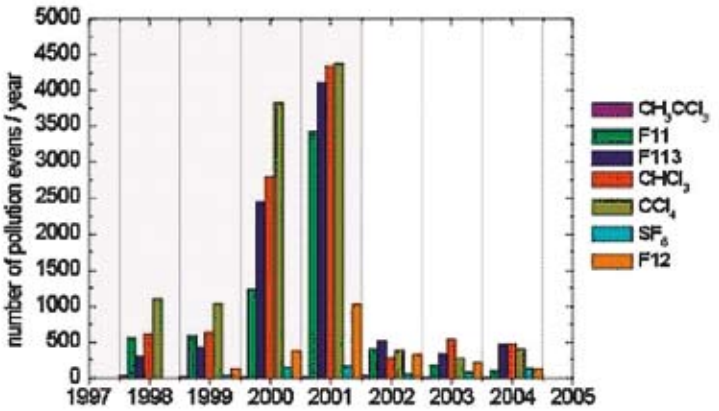
The concentration of CFCs in years 1950-2000 on the historical facts concerning protection of Earth ozone layer

However, measurements of SF6 concentration air indicate that its concentration in is still growing [2]. The measurements of CFCs and SF6 in air are usually conducted at the so-called clean stations, i.e., at places situated far from the urban areas. Such clean station in Europe is Mace Head station (Ireland) participated in AGAGE program since 1987 [3]. In central Europe such measurements are conducted in Krakow since 1997 [4].

In this work the long term measurements of the concentration of halogenated compounds, i.e., freons F-11 (CFCl3), F-12 (CF2Cl2), F-113 (CCl2FCClF2), 1,1,1-trichloroetane (CH3CCl3), carbon tetrachloride (CCl4) and SF6 performed in the densely populated urban area of Krakow in years 1997-2005 are presented. In the figure below results of mean month concentration measurements of chosen CFCs in air of Krakow, Poland are given.



The mean month CFCs concentration in air of Krakow, Poland



Number of pollution events per year in the air of Krakow for the years 1997-2005

The last figure presents an interesting diminishing frequency of the seasonal variability of CFC's concentration pollution events after the date of 1.07.2002 when the Montreal Protocol legislations have been started in Poland (The Journal of Laws No. 52). This suggests that the most observed sources of CFC's has been localised to the territory of Poland (the rouse of wind and air mass movements are still the same in Krakow region as before of the Montreal Protocol legislation implementation). This suggests that CFC's emission limitations posed by the Montreal Protocol are being respected in Poland [5]

References:
[1] R. G. Prinn et al., J. Geoph. Res., 105, 17751-17792, 2000.
[2] M. H. Maiss & C. A. M. Brenninkmeijer, Environ. Sci. Technol., 32, 3077-3086, 1998.
[3] P. G. Simmonds et al., Atmos. Environ., 30, 4041-4063, 1996.
[4] Lasa J. & Sliwka I., Applied Energy, 75: 155 -163, 2003.
[5] Official Gazette No. 52, Item 537, Act of 25 May 2001.

Full text of the publication on AIRCLIM-NET website www.ietu.katowice.pl/airclim-net.

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POLYCHLORINATED AROMATIC HYDROCARBONS (PAHS) AMONG AEROSOL FRACTIONS IN A HEAVILY INDUSTRIALIZED TOWN IN POLAND

In the world, ambient dust in urbanized areas has been investigated for its fractional composition for many years. In Poland the situation is different, especially as far as fine particles (less than 10 µm) are concerned. The ambient air quality monitoring system functioning in Poland for the last 15 years provides only basic data on daily concentrations of particulate matter PM10 (occasionally – PM2.5) without any information on PM10 fractions and their chemical composition.

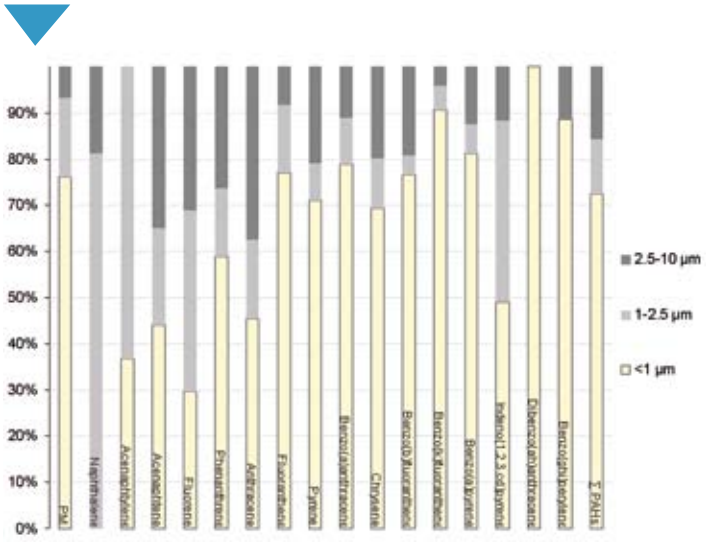
The aim of the presented work was to determine mass shares of PM10, PM2.5 and PM1 in total suspended particulates (TSP) in Zabrze, Poland in the period of 2006-2007 and the first half of 2008 and to measure the content of 16 polycyclic aromatic hydrocarbons (PAHs) in each of these fractions. Particularly important was to determine the contribution of 16 PAHs in PM fractions because of its cancerogenic effects on human health. The share of yearly average mass of PM1 was about 70% in TSP, 65% in PM10 and 60% in PM2.5, independently of yearly PM1, PM2.5, PM10 and TSP mass concentrations (table).

2006	TSP	PM10	PM2.5	PM1
Number of values	123			
Range (Min-Max)	10.0-254.6	8.0-252.0	6.7-239.4	3.7-204.3
Mean± Stand dev.	65.6±46.5	61.2±46.8	55.2±44.5	41.1±34.4
Median	52.5	46.8	40.5	31.5
First quartile	33.3	28.7	24.0	18.2
Third quartile	78.3	76.9	70.9	53.8
2007	TSP	PM10	PM2.5	PM1
Number of values	106			
Range (Min-Max)	12.7-188.2	9.4-184.6	8.3-168.8	5.4-114.3
Mean± Stand dev.	47.7±31.8	43.5±31.5	38.5±29.3	28.8±20.5
Median	39.1	34.6	29.8	22.9
First quartile	27.5	23.5	19.1	14.5
Third quartile	59.0	54.6	50.3	38.6
2008	TSP	PM10	PM2.5	PM1
Number of values	51			
Range (Min-Max)	16.2-149.2	14.2-145.3	11.8-134.9	9.3-93.0
Mean± Stand dev.	50.8±31.2	47.7±31.2	42.7-29.9	31.4±20.3
Median	40.5	35.6	30.3	24.1
First quartile	27.7	23.2	19.3	15.5
Third quartile	63.4	60.8	56.5	40.5

Characteristics of yearly series of TSP, PM10, PM2.5 and PM1 concentrations in 2006-2008

Considerable amounts of total and particular PAHs were found in PM1. There were no PAHs observed in the fraction of a diameter > 10 µm (figure below).

The presented results are the first such a long series of simultaneous observations of PM1, PM2.5, PM10 and TSP concentrations in Poland.



Mass distribution of dust and PAHs among dust fractions.

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