APCC -
AIR POLLUTION IMPACT TO CLIMATE CHANGE

Third International Symposium
on
AIR QUALITY MANAGEMENT
at Urban, Regional and Global Scales
&
14 th IUAPPA Regional Conference
26-30 September 2005
Istanbul, Turkey

AIR POLLUTION IMPACTS ON CLIMATE CHANGE

Proceedings of the Third International Symposium on Air Quality Management at Urban, Regional and Global Scales. 26-30 September 2005, Istanbul – Turkey

INDONESIAN SMOKE INDUCED BY DROUGHT EVENTS (INSIDE)

Baerbel Langmann [1], Edvin Aldrian [2], Hans-F. Graf [3], Angelika Heil [1], Elina Marmer [1], Frank Nober [3] and Melissa Pfeffer [1]

[1]Max-Planck-Institute for Meteorology, Hamburg, Germany
[2]Agency for the Assessment and Application of Technology (BBPT), Jakarta, Indonesia
[3]Department of Geography, Centre for Atmospheric Science, University of Cambridge, Cambridge, UK
langmann@dkrz.de

ABSTRACT

The INSIDE project (Indonesian Smoke Induced by Drought Episodes) within the Asia Pro Eco Program of the European Commission aims to determine the amount and distribution of smoke-haze in Indonesia and the adjacent countries generated from vegetation and peat fires, and the related implications for human health (e.g. respiratory diseases) and climate (droughts, floods, aerosol-cloud interactions, CO_2 release). The main goal of the project is to provide, optimise and apply a regional model tool for Indonesia.

Key Words: Indonesia, Regional Modeling, Smoke-haze, Climate Impacts

1. INTRODUCTION

In recent years, fire and smoke-haze occurrence increased in Indonesia by intentionally set land clearing fires and higher fire susceptibility of disturbed forests. Especially during El Niño years with prolonged droughts in Indonesia, the land clearing fires become uncontrolled wildfires and produce large amounts of gaseous and particulate emissions. Fires in drained peat swamps are of particular importance for the overall emission production as peat fires release up to several orders of magnitude more emissions per unit area burned than fires in surface vegetation. In addition, they are difficult to extinguish.

Within the Asia Pro Eco Program of the European Commission a new project called INSIDE (http://www.mpimet.mpg.de/~langmann.baerbel/INSIDE/index1_web.html) has been established. It aims to determine the amount and distribution of air pollution in Indonesia focusing on smoke-haze generated from vegetation and peat fires. The related implications for human health (e.g. respiratory diseases) and climate (e.g. droughts, floods, aerosol-cloud interactions) are investigated. Due to the sparse air quality monitoring in Indonesia our initiative with the country-wide determination of ambient air quality offers guide to local decision makers in protecting human health and planning future agricultural activities. The main activity of the project is to provide and apply an optimised regional climate-chemistry/aerosol model tool for Indonesia. A state of the art regional three dimensional chemistry-climate model called REMOTE (Regional Model with Tracer Extension, http://www.mpimet.mpg.de/~langmann.baerbel/REMOTE/remote1.html) (Langmann, 2000) is chosen as core model tool of the INSIDE project. The major activities of the INSIDE project are indicated as circles in Figure 1. These include an estimate for the gaseous and particulate matter emissions from vegetation and peat fires in Indonesia, the determination of secondary smoke aerosol formation and the smoke particle chemical composition and size distribution. As wet deposition is the major removal process of the atmospheric smoke particles, a new convective cloud scheme will be applied, which also offers the possibility to determine heavy precipitation probabilities in dependence on land use changes. Local Sea Surface Temperature (SST) is an other major factor driving rainfall variability in Indonesia; therefore coupled atmosphere-ocean simulations will be carried out.

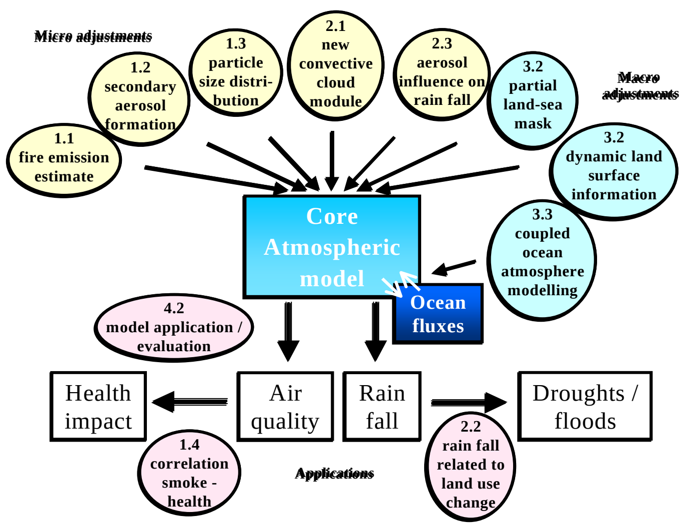


Figure 1. Major activities of the INSIDE project.

2. SELECTED PRELIMINARY RESULTS

First results of model simulations of the smoke-haze distributions in Indonesia during 1997/1998 showed that the model REMOTE is able to reproduce the spatial and temporal distribution of the smoke-haze (Langmann and Heil, 2004). An improvement of the methodology to estimate vegetation and peat fire emissions in Indonesia during 1997/1998 (Langmann and Heil, 2004) with respect to the spatial distribution of peat areas, emission factors and biomass load is given in Heil et al. (2005).

In addition to a reference model experiment (EXP_REF) carried out with REMOTE during 1997 (Figure 2), one simulation was carried out where emissions from peat fires were neglected (EXP_NOPEAT) and an other one, which investigates the influence of the meteorological conditions on smoke-haze dispersion by using 1996 meteorology (EXP_MET96). Simulation results illustrate the dominant role of peat fire emissions in creating severe trans-boundary air pollution episodes. When peat fires are excluded, ambient air quality standards are exceeded only in areas close to the main fires. Compared to normal years, El Niño conditions strongly reduce the removal of smoke particles from the atmosphere by wet deposition and favour the cross equatorial transport of fire emissions. A more detailed description is provided by Heil et al. (2005).

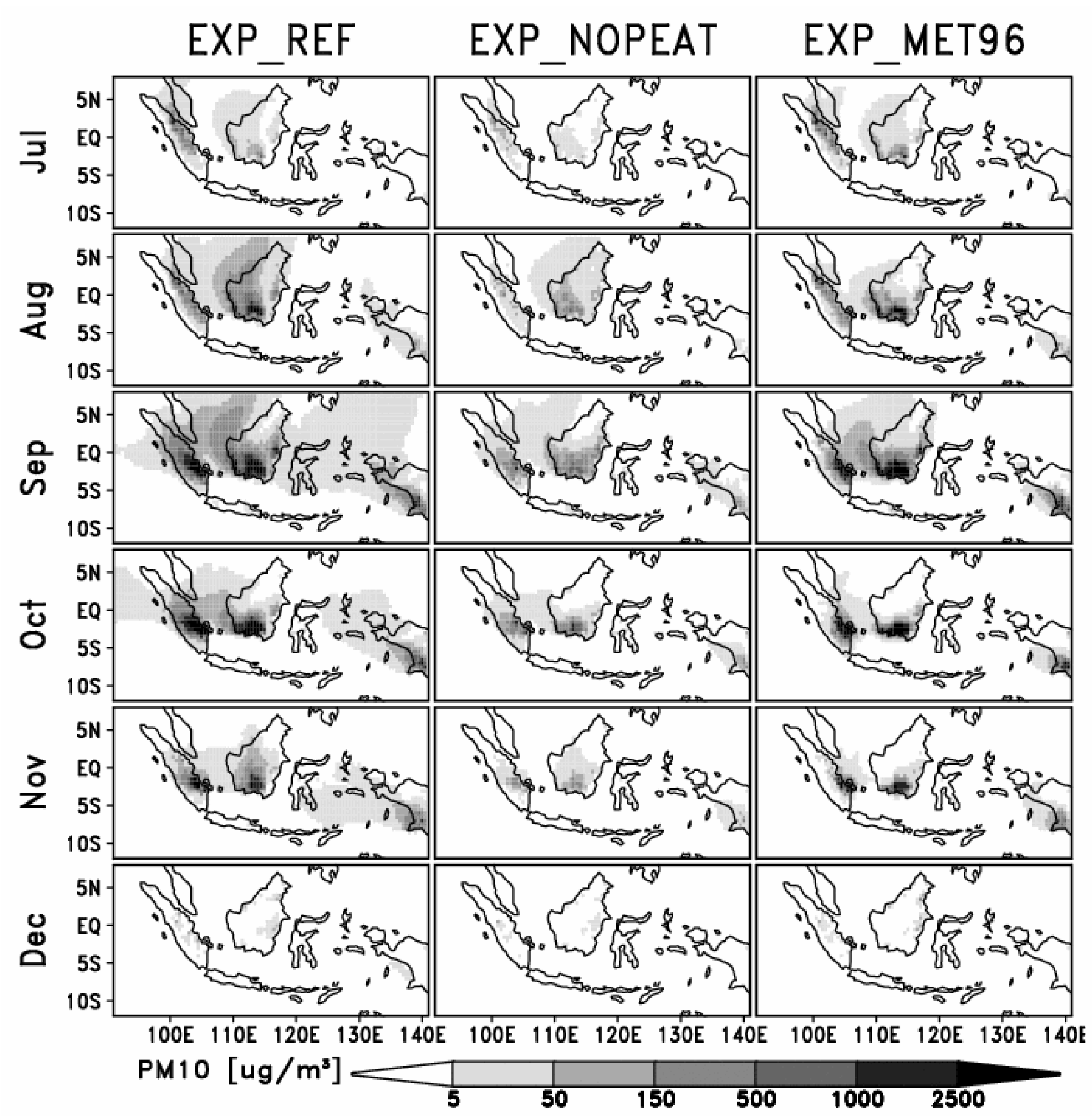


Figure 2. Monthly mean PM_{10} concentration during 1997 modelled with REMOTE for the lowest model layer for the scenario runs EXP_REF (left column), EXP_NOPEAT (middle column) and EXP_MET96 (right column).

For the period July 1997 to June 1998 the influence of smoke-haze aerosols on cloud properties and warm precipitation formation in Indonesia – the so called second indirect aerosol effect - is investigated with the REMOTE model (Langmann, 2005). The goal of this study is to analyse local to regional modifications of atmospheric properties over Indonesia, like a suppression of precipitation in smoke-haze regions (Rosenfeld, 1999) and a potential prolongation of smoke-haze episodes, or contrarily, increased precipitation lee side of the fires (Andreae et al., 2004) with potential heavy precipitation events.

The aerosol influence on warm precipitation formation is introduced into REMOTE by taking into account an additional dependency on cloud droplet number concentration in shallow and convective clouds, which in turn depends on the available aerosol concentration. The simulation results show a temporal and spatial redistribution of atmospheric moisture, precipitation and smoke-haze. Monthly mean values are difficult to interpret as they are the results of several overlapping effects. Daily total precipitation and precipitation from shallow clouds (stratiform precipitation) over Borneo during March 1998 is presented in Figure 3 - convective precipitation results from the difference of both. Figure 3 reveals that the aerosol-cloud INTERACTION simulation determines days with reduced as well as increased precipitation compared to the CONTROL simulation without aerosol-cloud interactions.

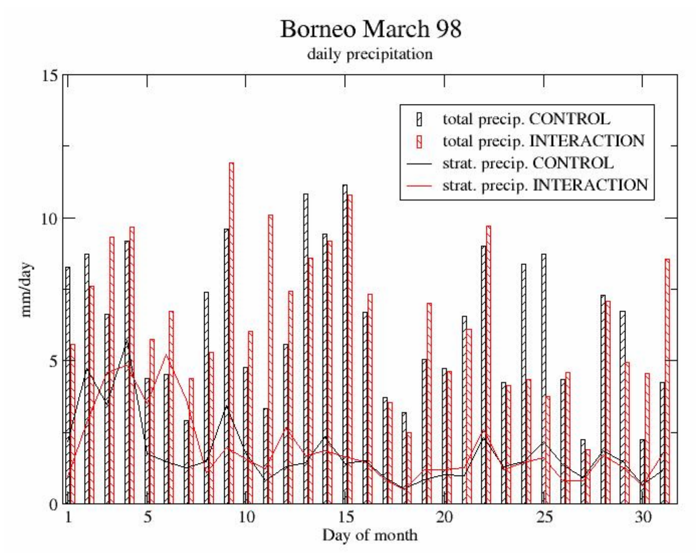


Figure 3. Daily precipitation over Borneo during March 1998 as determined by the REMOTE model simulations.

By separating precipitation decrease and increase events it becomes visible that precipitation decrease dominates over precipitation increase in the smoke-haze regions of Indonesia, and that both occur in the same areas and are compensating each other to a certain extent during one month. It becomes also visible that precipitation decrease events are accompanied by lower convective cloud top

heights, whereas precipitation increase events show higher convective cloud top heights and an increase in cloud water and ice content.
Compared with an observed event of reduced convective precipitation over Borneo on March 1, 1998 (Rosenfeld, 1999), the results of the REMOTE model experiments show a nearly complete suppression of more than 30 mm/6h in the same region affected by smoke-haze. Taking into account, that the model results are not only the results of aerosol-cloud interactions during the last few hours, but that they are also affected by preceding processes in other regions, the ability of the model to reproduce this single event can be regarded as pretty good. However, only very few observation data sets exist for the years 1997/1998 so that an overall evaluation of the presented model simulations on aerosol-cloud interactions is not possible.

3. CONCLUSION AND OUTLOOK

The particular meteorological conditions prevailing during El Niño years in Indonesia strongly aggravate smoke-haze dispersion to wider areas, including the densely populated areas of Northern Sumatra, Malaysian Peninsula and Singapore. Compared to normal years with similar fire emissions, El Niño conditions strongly reduce the removal of particles by wet deposition and favour cross equatorial transport of fire emissions. The study also illustrates the dominant role of peat fire emissions in creating severe transboundary air pollution episodes.

The model study on aerosol-cloud interactions adds an important contribution to the understanding of the non-linear aerosol-cloud effects in the atmosphere. In the smoke-haze regions in Indonesia the presented model results show events with decreased and increased precipitation considering the aerosol influence on warm precipitation formation. In total, the effects of precipitation suppression dominate pointing to a prolongation of smoke-haze periods due to the aerosol influence on clouds. Altogether, the model experiments suggest decreased convective activity due to aerosol cloud interactions accompanied by a small number of events with higher convective activity leading to modifications of the water, energy and trace species cycles in the atmosphere.

According to Hamid et al. (2001) who analysed the frequency of lightning events in Indonesia during 1998 and 1999, the number of convective storms decreases during El Niño years whereas the number of lightning events increases. These results indicate few but more intense convective storms with higher vertical extension and stronger glaciation during El Niño events and therefore point into the same direction as the REMOTE model results presented here. Andreae et al. (2004) described the coupled occurrences of precipitation suppression and increase during a field campaign in smoke-haze regions in Amazonian. Suppression of precipitation and the remaining atmospheric moisture leads to higher convective clouds which produce additional energy for higher vertical development due to the release of latent heat during the glaciation processes. Precipitation events with hail were only observed in smoke-haze regions by Andreae et al. (2004), under smoke free conditions hail showers did not occur. A model study of Khain et al. (2004) with a detailed two-dimensional atmospheric microphysical model reveals that suppression of precipitation due to aerosols induces an event with even stronger convection in the later course of the simulation which does not occur during an reference experiment under unpolluted atmospheric conditions. Again, these findings point into the same direction as the REMOTE model results. According to Andreae et al. (2004) the overall effect of the modification of total precipitation remains unknown until now.

Another important part of the INSIDE project is a reliable description of cumulus convection and associated tracer transport and precipitation formation within the REMOTE model as Indonesia represents the main center of deep tropical convection on the Earth. The standard convective cloud module of REMOTE is based on the scheme of Tiedtke (1989). It is one of the current cumulus convection parameterisations which are formulated as mass flux schemes (determination of the overall mass flux of all cumulus clouds in one grid column). This will be replaced by a new cloud field model (Nober and Graf, 2004) which determines for each grid column an explicit spectrum of different clouds. The information about the actual cumulus convection state in a grid column includes therefore the number of different cloud types. The degree to which part each cloud type participates in the whole cloud field is determined by the cloud field model.

First results from coupled ocean-atmosphere simulations with the MPI Ocean Model (Marsland et al., 2003) and REMOTE show a significant improvement for total precipitation, especially over the ocean (Aldrian, 2003) because intense ocean atmosphere interactions take place in Indonesia with the local SST being among the major factors that drive rainfall variability. Ongoing studies investigate how important these improvements are for the modelled distribution of smoke-haze, as wet deposition is the major loss process of particles from the atmosphere.

4. ACKNOWLEDEMENTS

This work has been funded by the German Ministry for Education, Science, Research and Technology (BMBF) in the Focus Program AFO2000 within the joint project EFEU and the INSIDE project within the Asia Pro Eco Program of the European Union.

REFERENCES

Aldrian, E., Simulations of Indonesian rainfall with a hierarchy of climate models, Ph.D. thesis, Examination Report No.92, Max-Planck-Institute for Meteorology, Hamburg, Germany, 2003.

Andreae, M. O., D. Rosenfeld, P. Artaxo, A. A. Costa, G. P. Frank, K. M. Longo and M. A. F. Silva-Dias, Smoking rain clouds over the Amazon, Science 303, 1337-1342, 2004.

Hamid, E. Y., Z.-I. Kawasaki and R. Mardiana, Impact of the 1997-98 El Niño event on lightning activity over Indonesia, Geophys. Res. Lettr. 28, 147-150, 2001.

Heil, A., B. Langmann und E. Aldrian, Indonesian peat and vegetation fire emissions: Factors influencing large-scale smoke-haze dispersion, Mitigation and Adaptation Strategies for Global Change, in press, 2005.

Khain, A., D. Rosenfeld and A. Pokrovsky, Aerosol impact on the dynamics and microphysics of convective clouds, Q. J. R. Meteorol. Soc., submitted, 2004.
Langmann, B., Numerical modelling of regional scale transport and photochemistry directly together with meteorological processes, Atmos. Environ., 34, 3585–3598, 2000.
Langmann, B. and A. Heil, Release and dispersion of vegetation and peat fire emissions in the atmosphere over Indonesia 1997/1998, Atmos. Chem. Phys. 4, 2145-2160, 2004.
Langmann, B., A numerical model study of smoke-haze influence on clouds and warm precipitation formation in Indonesia 1997/1998, to be submitted, 2005.
Marsland, S. J., H. Haak, J. H. Jungclaus, M. Latif and F. Roeske, The Max-Planck Institute global ocean/sea ice model with orthogonal curvilinear coordinates, Ocean Modelling 5, 91-127, 2003.
Nober, F. J. and H.-F. Graf, A new convective cloud field model based on principles of self organisation, Atmos. Chem. Phys. Discuss. 4, 3669-3698, 2004.
Rosenfeld, D., TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall, Geophys. Res. Lett. 26(20), 3105-3108, 1999.
Tiedtke, M., A comprehensive mass flux scheme for cumulus parameterisation in large-scale models, Mon. Wea. Rev. 117, 1778-1800, 1989.

Proceedings of the Third International Symposium on Air Quality Management at Urban, Regional and Global Scales. 26-30 September 2005, Istanbul – Turkey

ROLE OF LOCAL URBAN PLANNING IN EAST ASIAN CITIES IN REDUCTION OF GHG EMISSION AND ENERGY USE

Noriko Kono
Institute for Global Environmental Strategies

ABSTRACT

East Asian countries have increased their GHG emissions and energy use rapidly in these few decades. Urban Environmental Management Project of Institute for Global Environmental Strategies has pursued a research on growing GHG emissions and urban energy use trends in East Asian mega-cities, Tokyo, Seoul, Beijing and Shanghai and showed their respective attitudes towards these global environmental issues. The research indicates that only the local government of Tokyo has been active in making CO_2 related policies and other governments are yet to apply any explicit policies. Considering the rapid urbanization and motorization of this area, it is obvious that urgent local policies towards the GHG mitigation are needed.

This research will focus on defining possible local urban planning policies in East Asia for mitigating GHG emissions, in view of the fact that the per capita energy consumption in dense urban area is lower than that in non-urban areas in Tokyo, the most developed city in East Asia. Their policies includes development controls, intensive land use, mixed land use, pedestrian friendly developments, introduction of public transit systems, traffic calming measures, car sharing, and so on. The paper will also look at other urban planning policies to reduce GHG's in the US and Europe, which have already tried many different attempts at the local level. In the end, with the help of multi criteria analysis, some synergistic urban planning policies for the area will be proposed.

Key words: East Asia, GHG emissions, Urban planning

Proceedings of the Third International Symposium on Air Quality Management at Urban, Regional and Global Scales. 26-30 September 2005, Istanbul – Turkey

CHANGES OF CLIMATE AND AIR POLLUTION IN CENTRAL EUROPE IN CORRELATION WITH CHANGES OF SUN ACTIVITIES

Horst Borchert

Johannes-Gutenberg University Mainz, Westring 159, D-55120 Mainz, Germany, BCHT01@aol.com

ABSTRACT

Continuos Measurements within the last 30 years show strong changes of air pollution and meteorological components in Europe between 1987 and 1991. As a consequence winter smog-alert-systems were cancelled and summer smog-alert-systems were introduced. These changes were caused by an increase of temperature combined with an increase of global radiation, caused by reduction of clouds initiated by a reduction of cosmic rays (neutrons) within the 22nd sunspot period. This climate jump of about 1.2 °C between 1987 and 1991 was sun made, not anthropogenious.

Key Words: Air Pollution, Climate Change, Sun Activity, 22nd sunspot period, Cosmic Radiation

1. INTRODUCTION

The widely forested country Rhineland-Palatine with its large industrialised towns Mainz and Ludwigshafen seems to be an area representative for Central Europe. The components SO2, Particular Matter (PMx), O3 and NO2 and meteorological components there are measured by the telemetrical controlled system ZIMEN with 31 measuring stations in forested regions and towns [1]. Comparing trends in air pollutants and meteorological parameters one can see remarkable coincidental changes of all components between about 1987 and 1991: The concentrations of SO2 and Particle Matter (PMx) decreased by more than 30 %, while Ozone concentrations, temperature and global radiation increased remarkable strong within this short time interval of only about 4 years (Fig.1).

As a consequence winter-smog-alert systems (introduced in 1985 and concerning SO2, PMx, NO2 and CO) were cancelled and summertime smog-alert systems concerning O3 were introduced. The strong decrease of SO2 and PMx was seen mainly as a result of successful legal management, e.g. regulations to reduce the emission of power plants [2]. The strong increase of anthropogenic O3-concentrations was seen as a result of the increase in traffic. But these strong changes of pollutants since 1987 were accompanied by very strong increase of air temperature and of intensity and duration of sunshine, caused by reduction of cloud cover.

Now one gets the opinion, that in this short time interval between 1987 and 1991 the sudden strong change of anthropogenic air pollution was mainly destined by strong meteorological alternations, which were combined with climate change in Europe.

These observations were giving rise to look for causes of these strong changes of climate

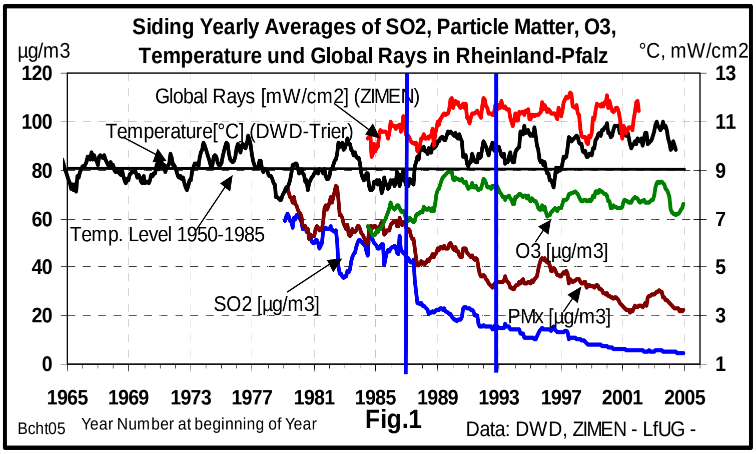


Fig.1

2. CHANGE Of TEMPERATURE AND AIR POLLUTANTS

The simplest method to describe climate is to study temperature.

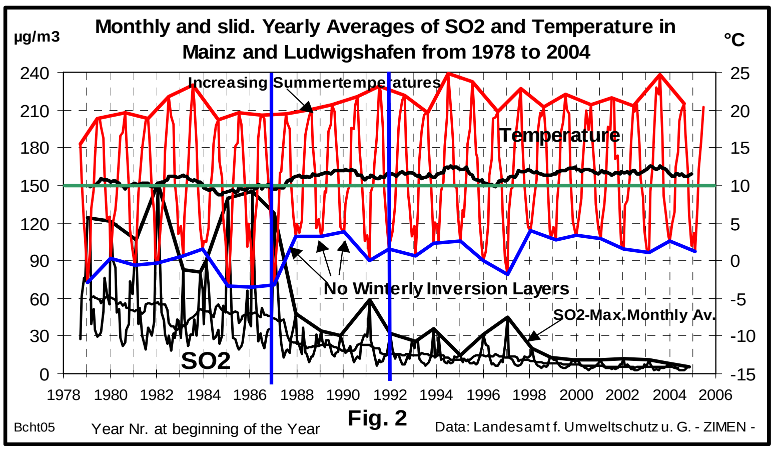


Fig. 2

During wintertime the monthly averages of temperature before 1987 were relatively cold beneath 0°C (Fig. 2). The SO2 concentrations were relatively high. The main part of these pollution came during this time from power plants of the eastern COMECON countries, transported by cold and dry north eastern winds beneath inversion layers of about 800 m height. In the winter 1988/89 these cold eastern winds vanished and the concentrations of SO2 and dust decreased very strong. After 1991 the concentrations of SO2 and dust became small mainly by the collapse of the emitting industries in the eastern countries and also by the introduction of laws to reduce emissions in Germany. Since about 1989 the coldest monthly averages of temperature in wintertime remain until now at a higher level of about 1 degree Celsius then before.

The Trend of the warmest summer temperatures was increasing during 1988 to 1991 continuously about 2 degrees Celsius. After this jump of the temperature the trend of the warmest monthly temperatures were stable including the extreme summer 2003 until now.

The trend of the sliding yearly averages of the temperature was increasing between 1988 and 1991 about 1.2 degrees Celsius and remains in this higher value until now.

Sliding yearly averages of NO2 in the industrialised towns Mainz and Ludwigshafen show the typical development of mainly traffic-induced immissions in western Germany (Fig3). NO2 increased in the early eighties very strongly and reached in 1984 nearly the legal limit value of 80 µg/m3 (annual mean) in these towns. With the introduction of more efficient motors and legal emission control of vehicles and of industry the immissions of NO2 decreased since 1984. But with increasing temperature since 1988 NO2 goes up again and we observe a new maximum in 1990 during this warm period. After this since about 1992 NO2 shows a continuous reduction, caused mainly by the introduction of the catalyst.

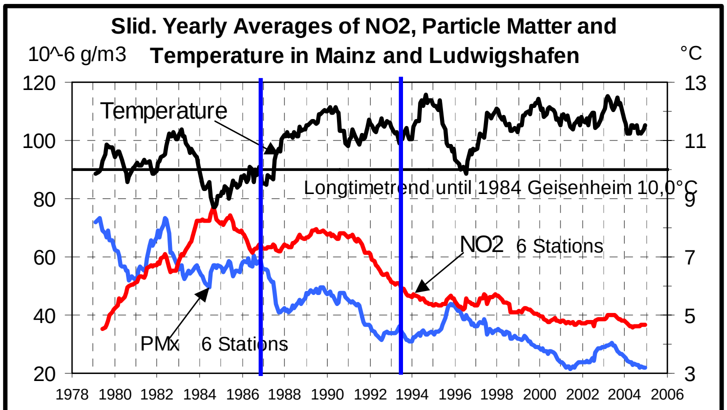


Fig.3

PMx - concentrations were showing until 1988 a similar behaviour to SO2. Since 1987 PMx decreased in consequence of the above-mentioned disappearance of pollution transports from eastern regions. With further increasing temperature in 1988 PMx increased again, but now parallel with NO2. This phenomenon points to traffic as a common source of both components. PMx was until 1988 mainly caused by industry and power plants, after this until now it seems to be more caused by traffic.

The actual PMx-level is less than a third of the level of 1987.

Now it is regarded as more dangerous for human health than former knowledge believed – especially its finer parts. The new legal PM10-limits of the European Union are sometimes exceeded in towns /1/.

3. SUDDEN JUMP OF TEMPERATURE IN CENTRAL EUROPE

To look for longer time measurements of temperature then by ZIMEN (it was started 1978) we studied the time rows of the sliding yearly averages of temperature measured by the Deutsche Wetterdienst (www.dwd.de) at about 40 measuring points all over Germany, partly since 1900 [3]. The sliding yearly averages of the published temperatures of the DWD do not show any significant increase of the long time trend between about 1940 and 1986. The main increase in temperature in Central Europe happened between 1987 and 1990. After 1991 the sliding yearly averages of the ground near temperatures were oscillating around a level of about 0.8 °C to 1.5 °C higher than the old level until 1986 and remains there until now. As an example Fig.4 shows the time rows of yearly averages of temperature at the islands Helgoland and Sylt in the North Sea in comparison with the Temperature at the high positioned DWD-Station of the Fichtelberg in Central Europe.

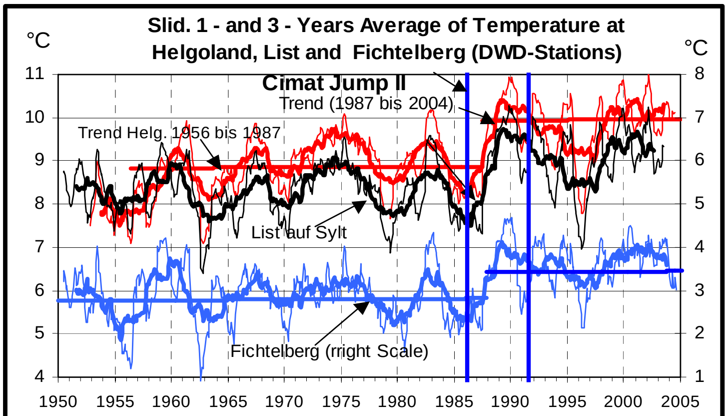


Fig. 4

The sliding yearly averages of the temperature show an oscillation of about three years. Therefore the sliding three years averages are showing the jump of temperature between 1987 and 1992 much clearly. Fig.5 shows the climate jump of the time rows at some measuring points in Central Europe in comparison with the curves of the numbers of sunspots since 1941.

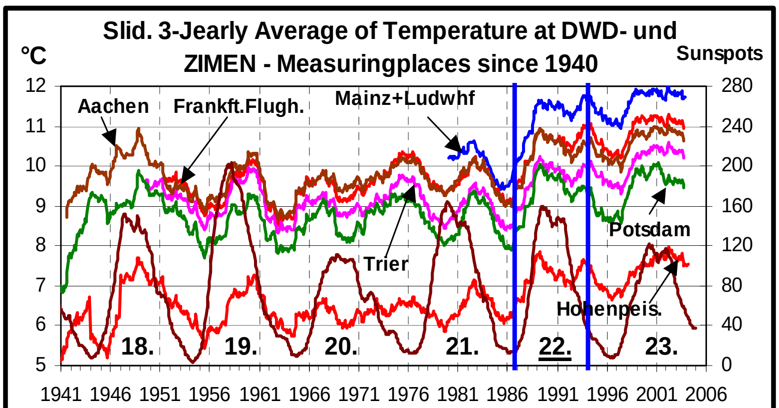


Fig. 5

There one can find a negative correlation between the temperature differences during the jump with the high of measuring points above NN.

The jump of the temperature at all stations, called “Climate Jump II”, happens with in the 22nd. Sun spot period, which appeared between 1986 and 1996. During this time a lot of very strong extraterrestrial events were influencing the earth [4], [5].

4. TROPOSPHERICAL O3, GLOBAL RADIATION, SUNSHINE AND CLOUDS

Measurements of air pollution and meteorological components had been started with fife forested background stations in 1984 to seek for causes of the new forest decline. O3 is mainly produced by photolysis of the anthropogenic precursor NO2 in presence of Hydrocarbons in traffic regions and towns. It is transported into the forested regions far away from these anthropogenious precursors. The strong increase of O3 in the short period between 1987 and 1990 is mainly caused by the strong increase of global radiation, not only by increasing precursors. After 1990 O3 was decreasing continuously as a consequence of the reduction of anthropogenic precursors by controlling the emissions of cars (ASU-controlling) and legal introduction of the controlled catalyst. Today the yearly averages of O3 are nearly constant in towns and forests at a relative low level. Yearly averages in towns are about the half of that in the forested background stations.

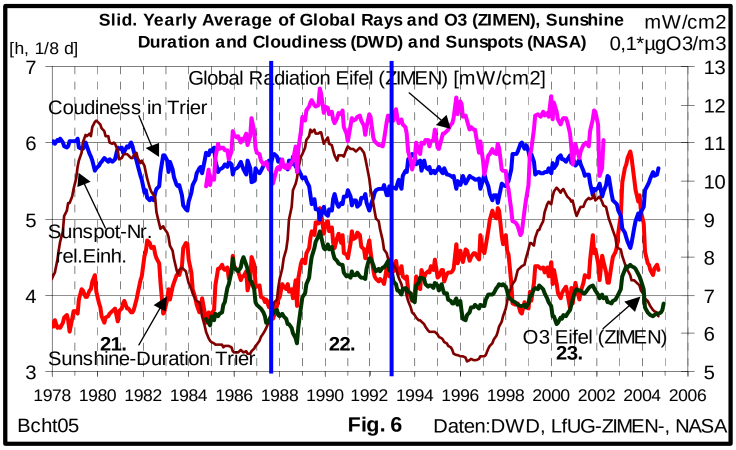


Fig. 6

Sliding yearly averages of sunshine duration corresponds nearly with Global Radiation (Fig.6). Naturally inverse are the time rows of cloudiness. The strong alternations of all components happen between about 1988 and 1991.

The yearly averages of Global Radiation were increasing during this short time about 1.5 mW/cm3 and caused an increase of the yearly averages of temperature of about 1.2 °C. The Global Radiation is strongly modulated by Cloudiness. Therefore one must look fore possible influences on Cloudiness, which steers Sunshine and in consequence anthropogenious O3 and Temperature.

These strong alternations of all components were lying in the time range of the 22nd Sunspot period with its already mentioned extreme terrestrial influences [5]. Therefore one should seek for possible links between Sunspot frequencies and terrestrial meteorological components [6], [7].

5. SUN SPOTS, NEUTRON RATES AND CLOUDINESS

There exists a theory that the secondary particles of the extragalactic cosmic rays are producing clouds mainly in the lower atmosphere like in the Fog Chamber of Wilson (1911) (Svensmark-effect) [8]. To study the stability of the production of secondary particles of cosmic rays several physical institutes worldwide are measuring the neutron rates since 1958 (Fig. 7) [9]. Neutrons are formed through nuclear collisions of extra galactic cosmic radiation interacting with the atmosphere. They are relative easy to measure and are representing the intensity of secondary particles. A comparison with the sunspot frequencies shows, that there is a certain reduction of the cosmic rays during the maximum of each sun spot period:

The Frequency of Sun pots is steering the cosmic rays. If the secondary particles of cosmic rays would produce clouds, than exists a link between sun activity and terrestrial climate change.

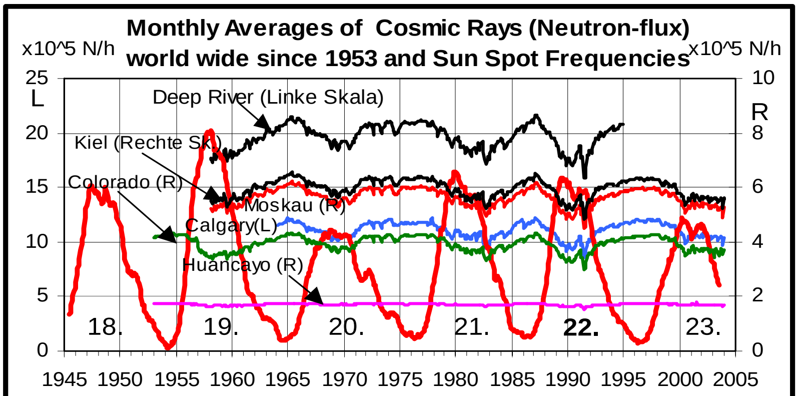


Fig.7

The time rows of the Neutron rates, measured by the Institute of Physics of the University in Kiel are very good negative correlated with the time rows of the sunspot frequency [10].

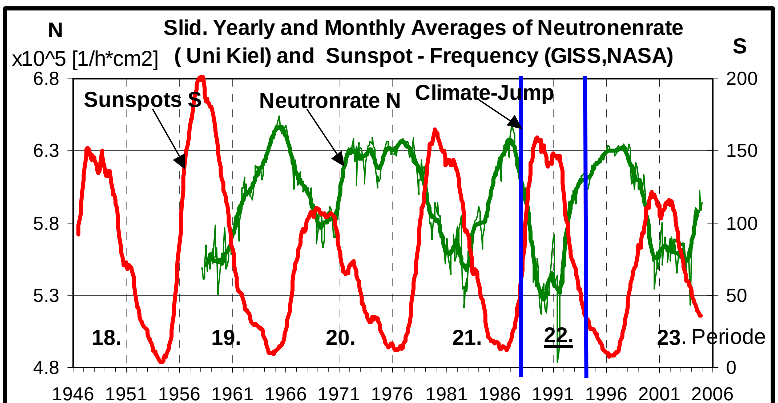


Fig. 8

Neutron rates represent the intensity of secondary particles, which are condensation nuclei for clouds. Data collected from satellites also show that the amount of low clouds over the earth closely follows the amount of secondary particles of extra galactic cosmic radiation. Stronger solar wind during the maximum of sunspots shields the earth from extra galactic cosmic rays, therefore neutron rates are opposite correlated to the sunspot curve: Sunspots are accompanied by solar f1ares, which are the most energetic explosions in the solar system and have a direct effect on the earth's upper atmosphere, which becomes ionised and expands. They are Roentgen Rays between 0.01 and 1 nm, reaching the Earth after 8 minutes and mark the starting point of the current of protons, which have velocities of more than 300 km/sec. The magnetic field of this "Sun wind" deflects the cosmic rays, which are high energetic protons, coming from extragalactic sources, and reduces the secondary particles in the lower atmosphere und on this way cloudiness. The effect depends on the number of sunspots and of their energetic efficiency. **With this method the Sun opens its way to the earth and warms up the lower atmosphere.** This process works always und modulates the terrestrial climate within the 9 to 11 years solar Period. One can find harmonic correlations between the sun periods and the oscillating global temperatures [11].

During the 22nd and actual 23rd period relative often extremely high energetic mass ejections were observed. Therefore these both periods are to distinguish from periods before 1986.

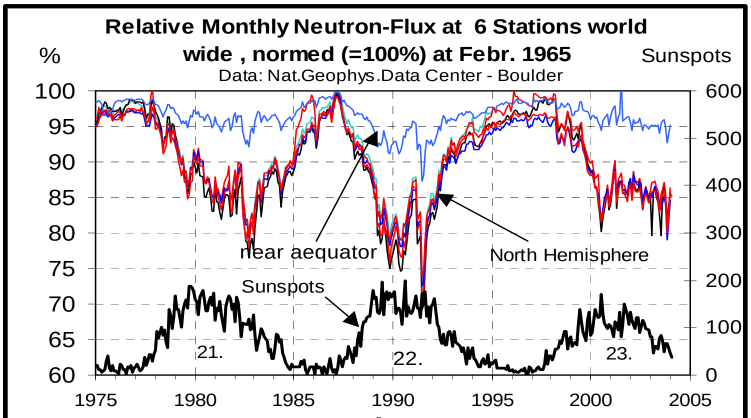


Fig.9

As a consequence of the high activities of the sun there are relative strong reductions of cosmic rays till about 30% of the monthly averages worldwide (Fig 9). Stations in the north of the 40th Latitude have nearly the same loss of cosmic rays and more than twice of equatorial places (Huancayo): The increase of global temperature by this effect is therefore smaller in the equatorial region (0.5 to 1 Degree C/100 Years) than in the northern hemisphere (2 to 4 Degrees/100 Years) [12].

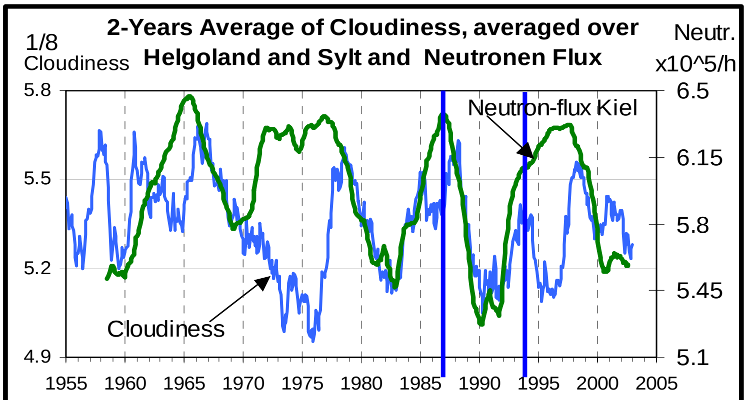
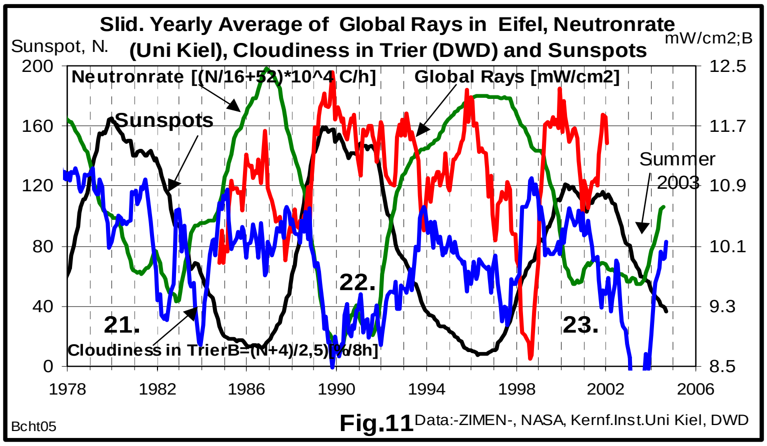


Fig.10

Comparison of the time rows of the Neutron rate and over two years averaged cloudiness, averaged over the two islands Helgoland and Sylt (North See), shows in wide ranges correlation between both components, especially between 1980 and 1994 during the end of the 21st and during the 22nd Sunspot period (Fig.10). In some time regions the correlation doesn't exist. There are another meteorological influences reducing clouds. Important is here the time row during the 22nd Period. In this time interval exists a very strong reduction of cosmic rays and clouds.

A rough estimation gives, that the reduction of the Cosmic Rays of about 17 % may lead to a reduction of Cloudiness of about 13 %. During the Climate Jump this gives an increase of the averaged yearly temperature of about 1.2 +- 0.3 °C in Central Europe.



This correlation between cloudiness and cosmic rays is the link of the steering connection between sun activity and terrestrial climate change (Svensmark effect) (Fig.11). One finds this correlation at all measuring points of the DWD because all time rows of the 2 years averaged cloudiness are very similar in Germany.

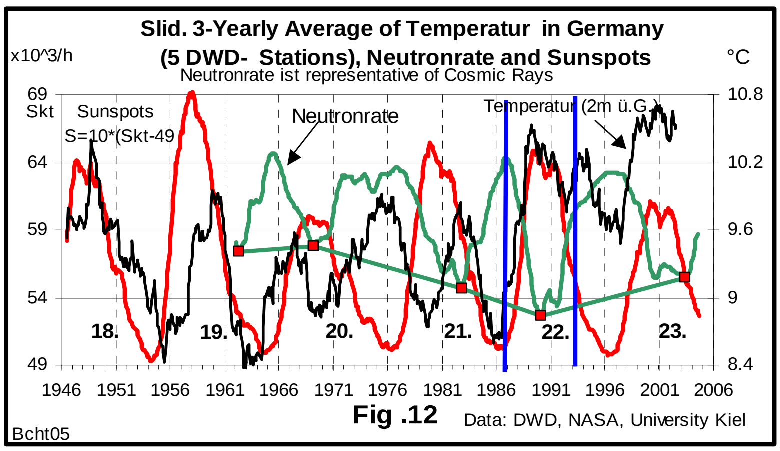


Fig 12 shows the time rows of temperature averaged over 5 DWD-stations in Germany in comparison with neutron rates and frequencies of sunspots. During the climate jump temperature increases and remains at higher lever up to now. It follows, that the strong alterations of air pollution and climate components between 1986 and 1991 seems to be a consequence of increasing sun activities with reducing cloudiness and increasing sun shine.

Locking for other data to stable this theory one can find lists of proton currents, measured by satellites of the NASA [13]. Fig. 13 shows the monthly by satellite-measured sums of Protons with energies higher than 10 MeV and per cm2 and sterad. These strong "Sun Winds" were starting during the 22nd Period 1989 with an extremely large sunspot in March and continued in October with great solar mass ejections. These proton currents were producing blackouts at electric power plants in the northern hemisphere, like USA, Canada and Sweden, they disturbed wireless contacts between earth and aeroplanes and satellites, they produced auroras seen at the Equator. Such strong solar mass ejections were repeating during the 22nd and in the 23rd period until now. The NASA says about this behaviour "The Sun Goes Haywire". The last great sun wind in direction to the earth occurred at the 15 January 2005 from a sunspot Nr. NOAA 720.

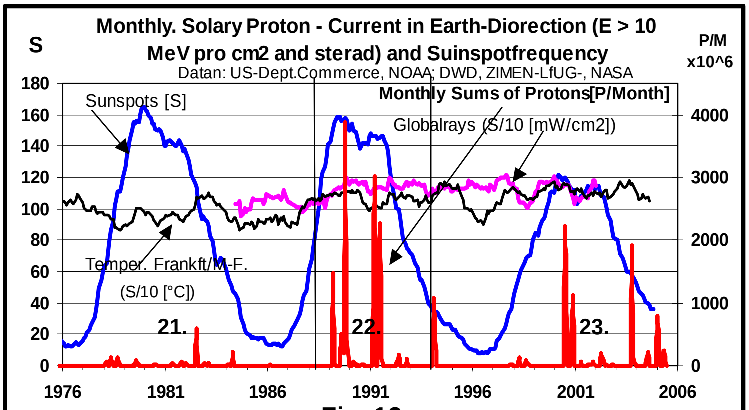


Fig. 13

This behaviour of the sun is making plausible the fact that the trend of the ground near temperature remains in tendency at a higher level in Central Europe than before 1989.

6. GLOBAL TEMPERATURE AND SUNSPOTS

This work deals with the question of the global warming: There is no continuous increase of global temperature since 1900 whereas the time rows of global temperature show two jumps since 1900: The first "Climate-Jump I" happens between approximately 1920 and 1935, the second "Climate Jump II" from 1989 to about 1994 (Fig. 14). The second is caused by special solar activities.

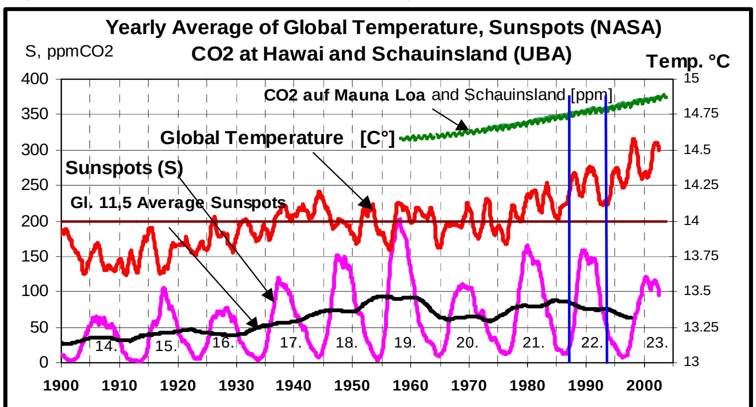


Fig. 14

Some other observations point to extraterrestrial influences of climate change: The 11 Years averaged Sunspot periods are increasing until 1960, than they are nearly stable until now.

The trend of global temperature increases with decreasing length of the basis of sunspot periods. The Index of the North Atlantic Oscillation (NAO) shows during Climate Jump II (1989 - 1992) a strong anomaly. The increase of CO2 is continuous and shows no jump. One can find a modulation of the increasing averages of the CO2-concentration of Hawaii by the 22nd Sun spot period. It seems to be possible, that the increasing CO2 concentration is powered by increasing sun activity too. The main cause of the sudden climate change during the eighties was the sudden increasing number of extreme height energetic mass ejections of the sun, surely caused by a special near by constellation of the torques of the Sun and Sun System (Landscheidt)[14]. Further studying these phenomena with further measured data may lead also to answer the question, why the global warming seems to tend today to lag behind the increase in greenhouse gases.

7. CONCLUSION

In the last thirty years the main change of measured air pollution in Central Europe happened within the short period of 4 years between 1987 and 1991. The climate change happened during the same time interval. These events coincided with increasing sun activities, increasing intensities of flares and sun winds and with decreasing cosmic radiation (neutron rates) with the consequences of reducing cloudiness, increasing global radiation and increasing ground near temperature. The conclusion is, that since about 1940 only with starting of the 22nd Sun spot period climate changed in Central Europe and by this also transportation, production and concentration of air pollution, quite more than anthropogenic activities.

8. REFERENCES

[1] Zentrales Immissionsmeßnetz (ZIMEN): Data from 1978-2000: Monthly bulletins ISSN 0720-3934; Since 2001: www.UMAD.de

[2] Borchert, H. “The Trend of Air Pollution in Western Germany in the past Twenty Years as a Result of Clean Air Management”, 11th World Clean Air Congr. IUAPPA, Durban, S.Africa, PO 2036, Parklands, 2121, Vol.3, pp 8A-9, ISBN 0-620-23064-9 (1998)

[3] Deutscher Wetterdienst: Data of temp., cloudiness, sunshine: www.dwd.de

[4] Thompson, R.: “Solar Cycle Number 22 (1986 – 1996) in Review”, Australian Government, IPS Radio and Space Services: www.ips.gov.au/Educational/2/3/2

[5] STEDATA 22, "Database for 22nd Solar Activity", Dep. of Earth Science, Baraki University: shnet1.stelab.nagoya-u.ac.jp/omosaic/step/stedata.htm

[6] Borchert, H.: “Changes of Air Pollution in Central Europe in Correlation with Changes of Climate and Sun Activities“, 13th World Clean Air and Environmental Protection Congress, London, UK, Aug. 2004, Nr. 39, on CD, www.UMAD.de (2004)

[7] Cugnon, P. et al.:” Online catalogue of the sunspot index”: http//sidc.oma.be

[8] Marsh, N. and Svensmark: “Cosmic Rays, Clouds, and Climate“, Space and Science Reviews 2000: pp 1-16, Kluver Academic Publishers. www.dsri.dk (2000)

[9] World Data Centre C2 for Cosmic Rays, www.env.sci.ibaraki.ao.jp/data

[10] Roehrs: “Ergebn. der Kieler Neutronen-Monitor-Mssg.”: ifkki.kernphysik.uni-kiel.de

[11] Scafetta, N.; West, B. J.:“Solar Flare Intermittency and the Earth’s Temperature Anomalies“, Duke Univ. Durham, North Car. 27708, Phys. Rev. Lett. 90,248701 (2003)

[12] Gray, Vincent R., 2003. Regional Temperature Change. Updated April 2, 2003, online www.john-daly.com/guests/regional.htm

[13] NASA: “Record-setting Solar Flares”; www.spaceweather.com/solarflares(‘04)

[14] Landscheidt, Th.: „Klimavorhersage mit astronomischen Mitteln?“, Schroeter Institut, Research in Cycles of Solar Activity, Nova Scotia, Canada, www.solidarität.com (2004).