Changes of Climate, Air Pollution and Growing Season in Correlation with Changes of Sun Activities

Horst Borchert

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

Abstract

Continuous Measurements of air pollution and meteorological components in Europe within the last 30 years show strong changes between 1987 and 1991. After this event, we call it "Climate Jump II", SO2-based winter smog-alert-systems were cancelled and Ozone-based summer smog-alert-systems were introduced. These changes were caused by a sudden increase of temperature combined with an increase of global radiation. Both were caused by reduction of clouds initiated by a reduction of cosmic rays (neutrons) within the 22nd sunspot period: Sun observations of NASA show a stronger increase of eruptions of protons producing stronger solar winds, which were reducing cosmic radiation by magnetic deflections during this and the following period. The Climate Jump with increasing ground near temperature of about 1.2 °C in Central Europe seems to be sun made. Moreover the North Atlantic Oscillation (NAO) shows correlation with neutron flux. This leads to the assumption, that there is a causal connection between sunspot controlled cosmic rays and cloudiness, which finally leads during increasing sun activities to increasing temperature and prolongation of growing seasons in Central Europe.

Keywords: Air pollution, Climate change, Global temperature, Global radiation, Cloudiness, Cosmic radiation, Sunspots, Neutron flux, 22nd Sunspot period, North Atlantic Oscillaton, Growing Season,

Introduction

The widely forested German country Rhineland-Palatine with its 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 (ZIMEN, 2005). By Comparing trends in air pollutants and meteorological parameters one can see remarkable coincidental changes of all components between 1987 and 1991: The concentrations of SO2 and Particle Matter (PMx) decreased by more than 30 %, while Ozone concentrations, temperature and global radiation increased significant within this short time interval of only 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 to reduce emission. The strong increase of anthropogenic O3-concentrations was seen as a result of the increase in traffic (Borchert, H., 1998).

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. It was supposed that these sudden changes of anthropogenic air pollution in this short time interval came from meteorological changes, which were combined with climate change in Europe caused by extraterrestrial influences (Borchert H., 2004).

In the following there are shown the causes of this opinion and further data to prove and stable this opinion.

Change of Temperature and Air Pollutants

The simplest method to describe climate is to study temperature.

During wintertime the monthly averages of temperature before 1987 were relatively cold (lower than 0°C, Fig. 2). The concentrations of SO2 were high. The main part of SO2 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 wintertime 1988/89 these cold eastern winds vanished and the measured concentrations of SO2 and dust in western Germany decreased very strong, while the emissions in the eastern countries remained unchanged. Only after 1991 emissions also stopped by collapse of the emitting industries in the eastern countries and by legal reductions of emissions of power plants.

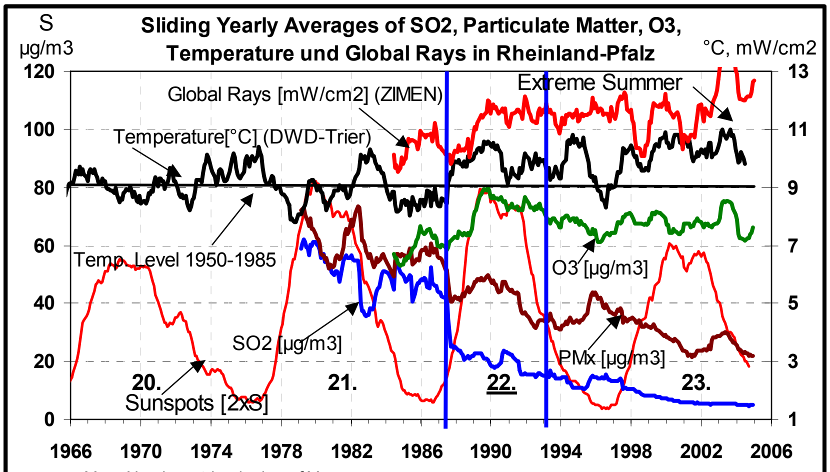

Fig.1

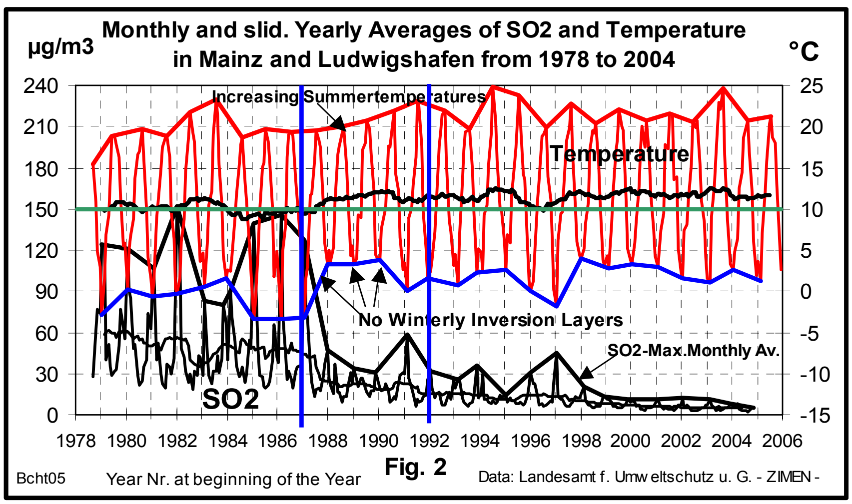

Fig. 2

Since 1989 the coldest monthly averages of temperature in wintertime are about 2 °C higher than before.

The Trend of the warmest summer temperatures increased from 1988 to 1991 by about 3 °C. After this jump of the temperature the trend of the warmest monthly temperatures was almost until now.

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

Sliding yearly averages of NO_2 in the industrialised towns Mainz and Ludwigshafen show the typical development of mainly traffic-induced immissions in western Germany (Fig3). NO_2 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 NO_2 decreased since 1984

But with increasing temperature since 1988 NO_2 goes up again and we observe a new maximum in 1990 during this warm period. After this since about 1992 NO_2 shows a continuous reduction, caused mainly by the introduction of the catalyst.

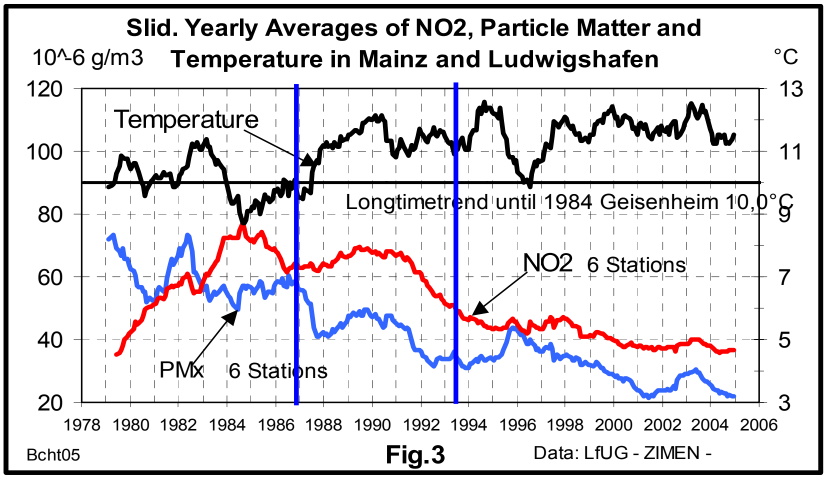

Fig.3

PMx - concentrations showed a similar behaviour to SO2 until 1988. From 1987 to 1988 PMx decreased as a result of the above-mentioned disappearance of pollution transports from eastern regions. From 1988 to 1990 PMx increased again, but now parallel with NO2. This phenomenon points to traffic as a common source of both components. Up to 1988 PMx was mainly caused by industry and power plants, after this till 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.

Jump of Temperature in Central Europe

As ZIMEN started in 1978, we had to look for longer time measurements of meteorological components to study transport phenomena of air pollution over the landscape. To find alternations in relation to earlier times, we studied the data measured by the Deutsche Wetterdienst (www.dwd.de) at about 40 measuring points all over Germany, partly since 1900. The sliding yearly averages of the published temperatures of the DWD do not show any significant increase of long time trend between about 1940 and 1986.

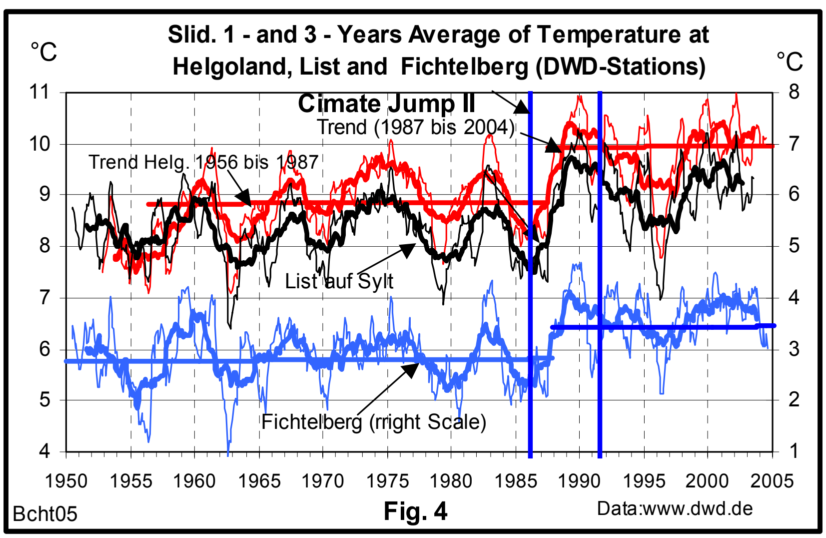

Fig. 4

The main increase in temperature in Central Europe happened between 1987 and 1990. From 1991 on until now the sliding yearly averages of the ground near temperatures oscillate around a level of approximately 0.8 °C to 1.5 °C higher than the old level. 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.

Sliding yearly averages of the temperature show an oscillation period of about three years. Therefore the sliding three years averages demonstrate the jump of temperature between 1987 and 1992 much clearly.

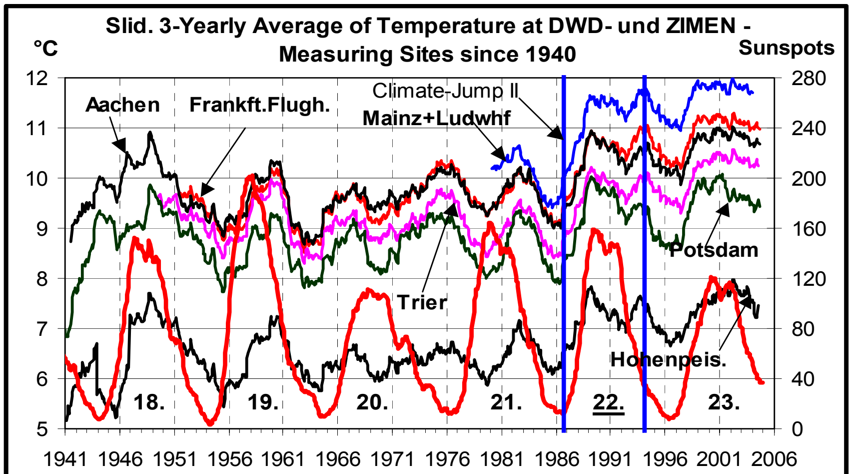

Fig. 5

Fig.5 shows the climate jump of some measuring sites in Central Europe. Absolute temperatures on mountains (Hohenpeissenberg) are lower than in valleys but all stations show the same trend. There one can find an opposite correlation between the temperature differences during the jump with the high of measuring points above NN. The curves of temperature are shown in comparison with the yearly numbers of sunspots since 1941 (Cugnon P., 2005). 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 Earth was influenced by a lot of very strong extraterrestrial events (Thompson R., 2004), (STEDATA 22, 2003).

Tropospherical O3, Global Radiation, Sunshine and Clouds

To seek for causes of the new forest decline measurements of air pollution and meteorological components had been started since 1984 at fife forested background stations in Rhineland-Palatinate. Since this time were measured global radiation and O3. 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..

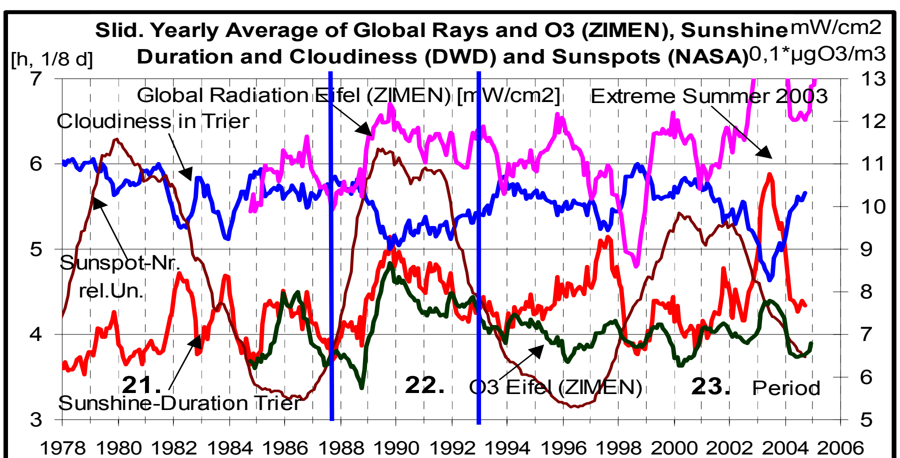

Fig.6

The strong increase of O3 in the short period between 1987 and 1990 mainly is caused by the strong increase of global radiation. 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. Sliding yearly averages of sunshine duration corresponds nearly with Global Radiation (Fig.6). Naturally inverse are the time rows of cloudiness. 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 +- 0.3 °C. The Global Radiation is strongly modulated by Cloudiness. Therefore one must look fore possible influences on Cloudiness, which steers Sunshine and in consequence anthropogenuous O3 and Temperature. These strong alternations of all components were lying in the time range of the 22^{nd} Sunspot period with its already mentioned extreme terrestrial influences. Therefore one should seek for possible links between Sunspot frequencies and terrestrial meteorological components.

Sunspots and Neutronrates

According to a theory of Marsh and Svensmark (Eur. Org. for Nucl. Res. CERN, 2000) secondary particles of the extragalactic cosmic rays produce clouds in air saturated with water like in a **Wilson Fog Chamber** (1911). To study the production of these secondary particles of cosmic rays several physical institutes worldwide are measuring the neutron rates since 1958 (World Data Centre C2, 2005). Besides other Particles Neutrons are formed through nuclear collisions of extra galactic cosmic radiation interacting with the atmosphere. They represent the intensity of secondary particles and are relative easy to measure. A comparison with the sunspot frequencies shows, that there is a reduction of neutron flux during the maximum of each sun spot period. The frequency of Sun spots influences the intensity of cosmic rays. If the secondary particles of cosmic rays would produce clouds, than exists a link between sun activity and terrestrial climate change.

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.

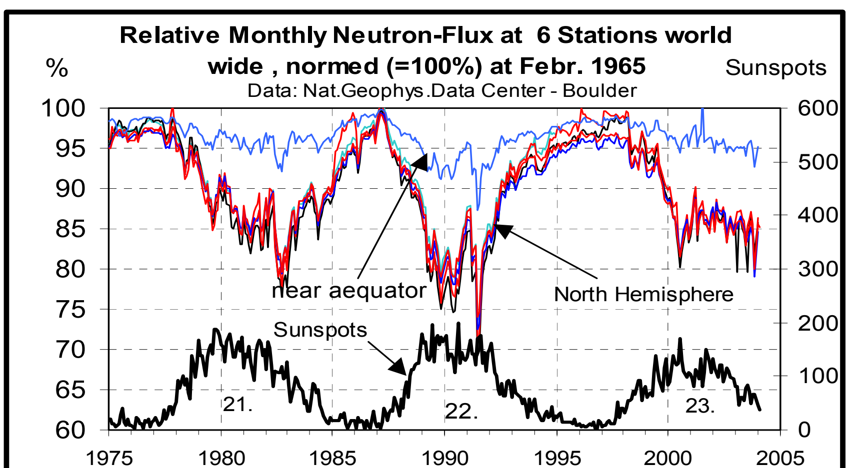

Fig.7

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 (so far as we know), and reduces the secondary particles in the lower atmosphere und on this way cloudiness. This effect depends on the number of sunspots and especially of their energetic efficiency. With this method the Sun opens its way to the earth and warms up the lower atmosphere.

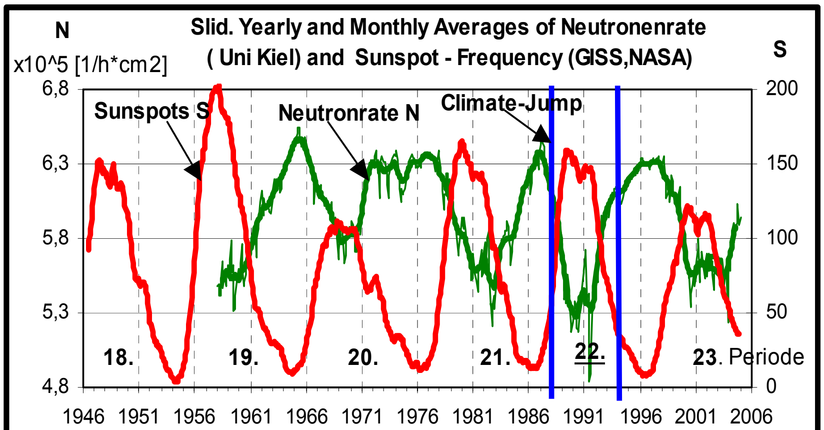

Fig. 8

This process works always und modulates the terrestrial climate. One can find harmonic correlations between the sun periods and the oscillating global temperatures (Scafetta and West, 2003). During the 22nd and actual 23rd period relative often extremely high energetic mass ejections were observed. They are to distinguish from all periods before 1986.

As a consequence of these high activities of the sun there are relative strong reductions of cosmic rays till about 30% of the monthly averages worldwide (Fig 7). Stations in the north of the 40th Latitude have nearly the same loss of cosmic rays and more than twice of equatorial places (Huancayo): Therefor it seems to be plausible that the averaged increase of global temperature is smaller in the equatorial region (0.5 to 1 Degree C/100 Years) than in the northern hemisphere (2 to 4 Degrees/100 Years) (Gray, V.R., 2003).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 (Roehrs, 2005) (Fig.8).

Neutron Rates and Cloudiness

During the 22nd Period we had 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 ground near temperature of about 1.2 +- 0.3 °C in Europe.

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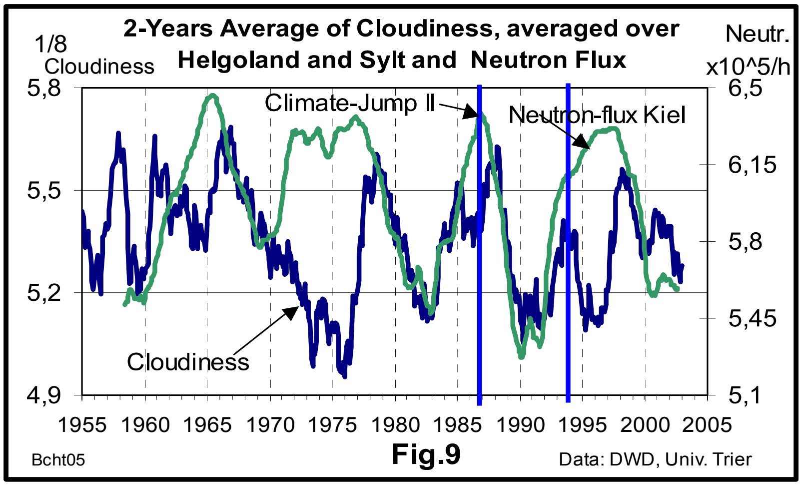

Fig.9

This correlation between cloudiness and cosmic rays is the link of the controlling connection between sun activity and terrestrial climate change.

One finds this correlation at all measuring sites of the DWD, for instance at stations direct at the cost in the Northern See (Fig.9) and in the south of Germany near the Alps.

Some deviation of this rule happens between 1970 and 1978, but it seems to be a greater part of systematic delaying effect: After each main reduction of cloudiness which is correlated with reduction of cosmic rays, exists nearly systematic a delayed short time reduction of cloudiness. These "delayed reduction" seems to be caused by another meteorological influence, which is modulated by sun activity, for instance the North-Atlantic Oscillation. (NAO). Between Changes of Neutron flux, representing secondary particles of Cosmic radiation, and Changes of cloudiness seems to be a delaying time. Using a delay-time of 1 year, one gets an correlation factor of 0.8 between Neutron rates and cloudiness in Potsdam.

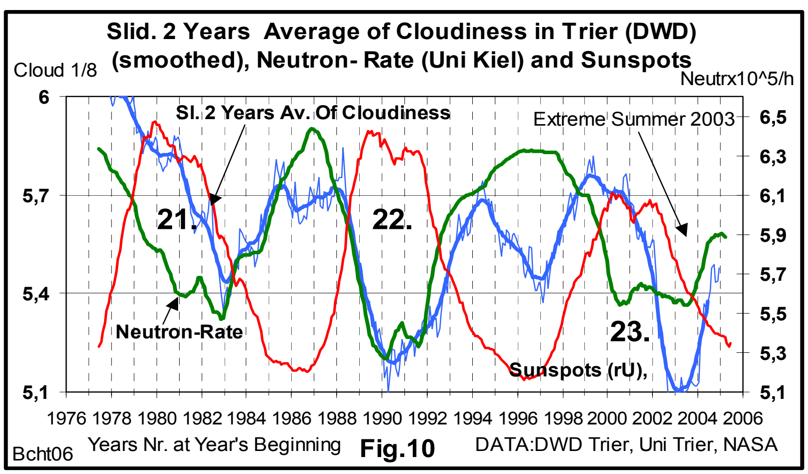

Fig.10

Therefore one could suppose, that cloudiness will be really influenced by drops producing cosmic rays (micro aerosols), delayed by the inertia of the oceans..

This supposition seems to be stabled by similar behaviour of the long time trends of neutron flux and cloudiness (Fig.11)

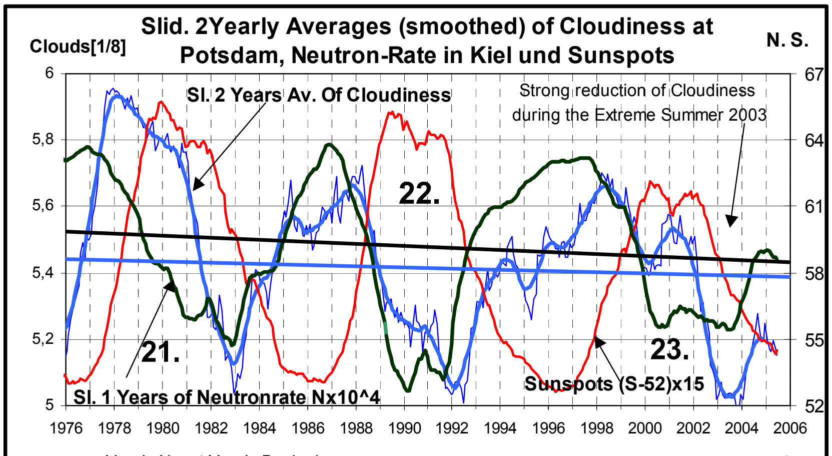

Fig. 11

North Atlantic Oscillation (NAO) and Sun Activity

Locking for other data to support this theory one can find an relatively strong anti correlation between the time rows of the North Atlantic Oscillation (NAO) and Neutron rates especially since about 1980, when global Temperature starts to increase the second time in the last century (Climate Jump II). The NAO shows the time rows of the Difference of Air Pressure measured at Azore - Islands and at Iceland

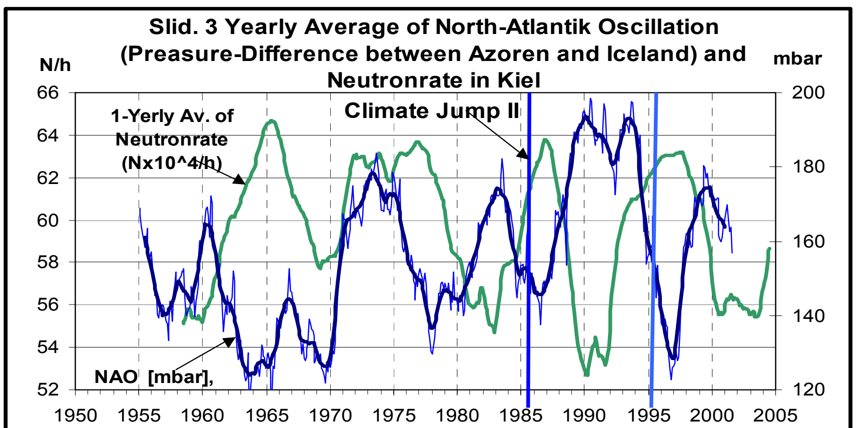

Fig.12

The opposite correlation between the NAO and Neutron rate in Fig. 12 gives rise to the opinion, that cosmic radiation influences via Swensmark- effect the NAO and by this the climate in Central Europe.

There exists a relatively strong correlation between the North - Atlantic- Oscillation and the behaviour of the weather in Central Europe, for instance the cloudiness (Fig. 13).

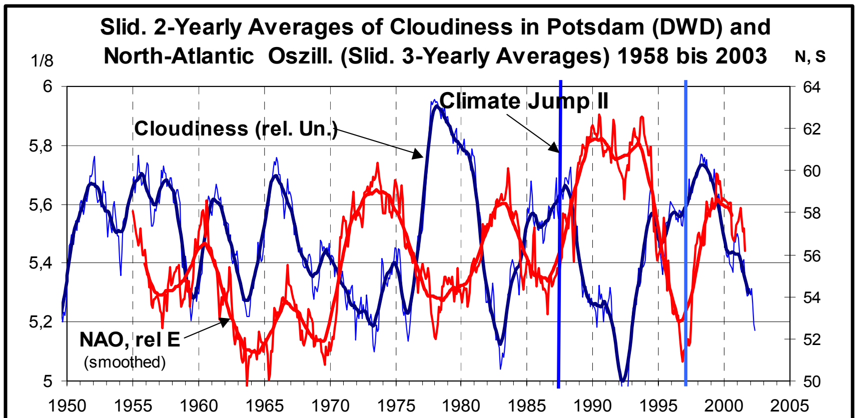

Fig. 13

Further more we can find a relative good correlation between sunspots and NAO (Fig. 14). Between the periodic changing sun activity and its influence on the earth's meteorology one can observe a certain delay-time of about one year, possibly caused by the inertia of the ocean.

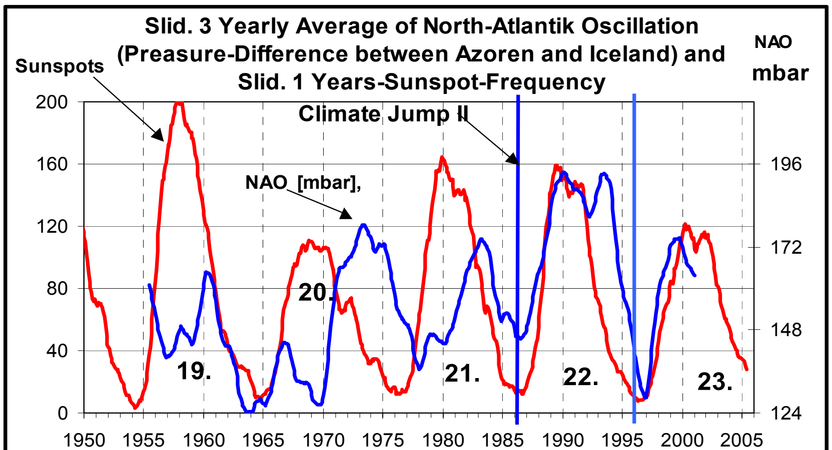

Fig.14

Cosmic Rays, Temperature and Growing Season

Time rows of temperature averaged over 4 DWD-stations in Central Germany are in wide time ranges similar to periodic alterations of Sun spot frequencies. Further they are in opposite correlation to Cosmic Radiation (Fig.15), which is good correlated with cloudiness (Fig.10). On this way there seems to be a causal chain between sun activity and development of terrestrial temperature: The strong alterations of air pollution and climate components between 1986 and 1991 seems to be a consequence of a not normal increase of sun activities with strong reducing cloudiness and increasing sun shine. During this climate jump ground level temperature increases relatively strong (about 1,2 °C +- 0,3 °C) and remains at higher long time level up to now.

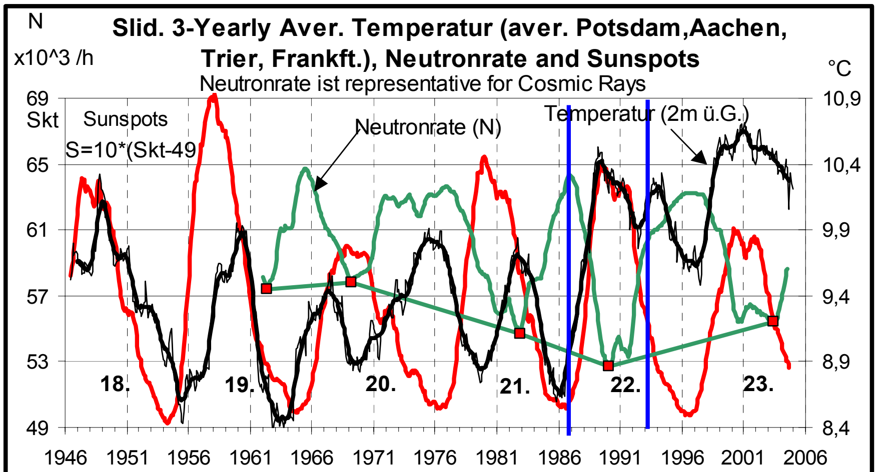

Fig .15

As a consequence of this Climate Change at the end of the eighties one can observe a strong influence into biological systems: Fig.16 shows a correlation between the Reduction of Starting time of growing season in Central Europe and decreasing Neutron rates.

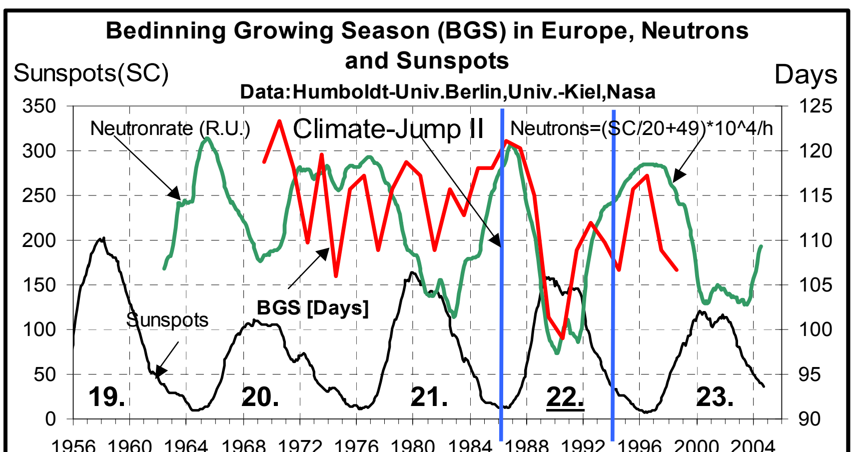

Fig.16

The prolongation of the greening time of Plants (Chmielewski, F.-M. and Rötzer, T.)

starts just with the strong reduction of Neutron Rays with beginning of the 22. Sunspot period. The Growing Season seems to be controlled by Sun activities.

Sun Emissions of Protons

To look for further observations to stable the sun made climate change during the eighties we studied by NASA published satellite measurement values. Fig 17 shows the monthly satellite-measured sums of Protons with energies higher than 10 MeV and per cm2 and sterad. These strong "Sun Winds" started during the 22nd Period 1989 with an extremely large sunspot in March and continued in October with great solar mass ejections. These proton currents produced 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 occurred repeatedly during the 22nd and in the 23rd period until now. The NASA comments this behaviour "The Sun Goes Haywire". One of the last great sun wind events influencing earth occurred at the 15 January 2005 from a sunspot Nr. NOAA 720.

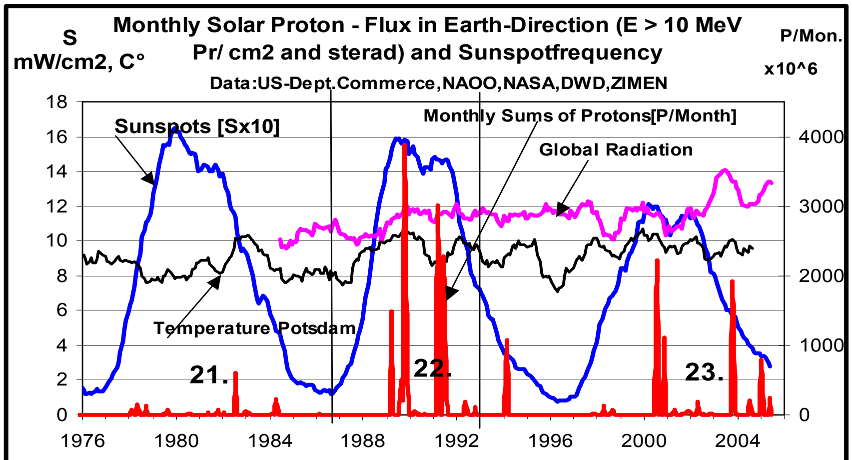

Fig. 17

This behaviour of the sun makes the fact plausible that temperature remains in tendency at a higher level than before 1988.

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 like described in this paper.

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.

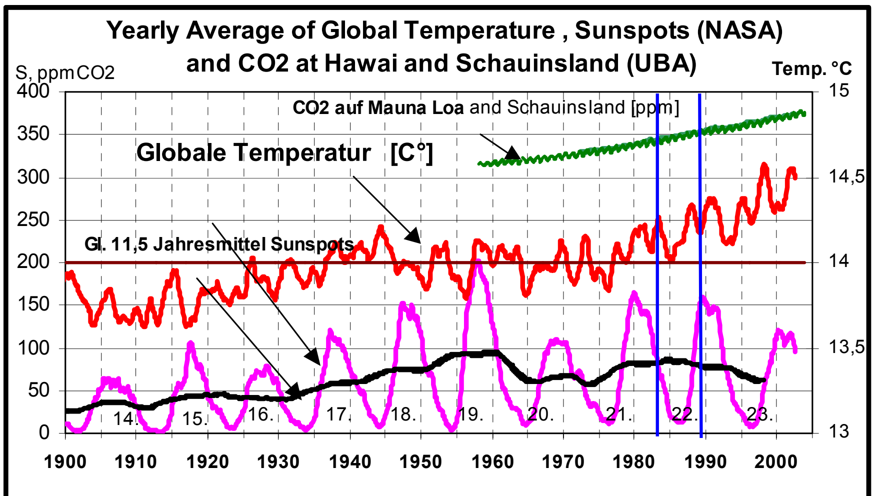

Abb. 18

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 nearby constellation of the torques of the Sun and Sun System (Landscheidt Th., 2004). 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.

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 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 mainly with starting of the 22^{nd} Sun spot period climate changed in Central Europe, which strongly influenced transportation (SO2, Dust, NO2, O3), air chemical production (O3) and concentrations of air pollution. Correlations between changes of the North Atlantic Oscillation and Cosmic Radiation point to a strong controlling influence of sun activity (Sunspot frequency and intensity of Sun Winds) to terrestrial climate change.

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