# CLIMATE CHANGE IN CENTRAL EUROPE IN CORRELATION WITH CHANGES OF SUN ACTIVITIES

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## ABSTRACT

Continuous measurements of air pollution and meteorological components in Central Europe within the last 30 years showed between 1987 and 1991 very strong changes of their values. As a consequence SO2-based winter-smog alert-systems were cancelled and Ozone-based summer-smog alert-systems were introduced. These changes of air pollution were accompanied with a strong increasing jump of the long time trend of global radiation of nearly 2 mW/cm2 (yearly averages) and of ground-near temperature of about 1,2 °C in Central Europe during this short time interval. These climatic changes were accompanied with the reduction of cloudiness which was in correlation with the reduction of cosmic rays (neutrons) especially strong within the 22$^{nd}$ sunspot period. Sun observations of NASA showed since this time stronger increase of eruptions of protons transporting solar winds, which were reducing cosmic radiation by magnetic deflections. This effect caused reductions of cloudiness partly till about 30 %. Therefore this "Climate Jump" with its increasing ground near temperature, causing the above mentioned changes, is sun made. Moreover the North Atlantic Oscillation (NAO) showed correlation with neutron flux, which stables the assumption, that there is a causal connection between sunspot controlled cosmic rays and cloudiness: The found correlations between these components give a causal chain which leads to the knowledge, that increasing sun activity causes the increase of global temperature and as a consequence also the observed prolongation of the growing season and further more increasing UVB-radiation, what means finally climate change in Central Europe,.

**Keywords:** Air pollution, Climate change, Global temperature, Global radiation, Cloudiness, Cosmic radiation, Sunspots, Neutron flux, 22$^{nd}$ Sunspot period, North Atlantic Oscillation, Growing Season, Stratospheric Ozone

## INTRODUCTION

The widely forested German country Rhineland-Palatine with its industrialised towns Mainz and Ludwigshafen seems to be an area representative for Central Europe in geographic sense. Air Pollutions and meteorological components there are measured by the telemetrical controlled system ZIMEN with 31 measuring stations in forested regions and in towns (ZIMEN, 2005). Comparing long time trends of these components one can see remarkable coincidental changes between 1987 and 1991 (Fig.1). The strong decrease of SO2 and PMx was in earlier times seen mainly as a result of successful legal management to reduce emissions. The strong increase of anthropogenic O3-concentrations was first seen mainly as a result of the increase in traffic (Borchert, H., 1998). But these strong changes of pollutants since 1987 were accompanied with very strong increase of ground-near air temperature and of intensity and duration of sunshine, caused by reductions of cloud cover. Further investigations lead to the knowledge that these sudden changes of anthropogenic air pollutions in this short time interval were also caused by strong changes of meteorological components which were relative strongly controlled by extraterrestrial influences (Borchert H., 2004). In the following paper is shown by correlations the causes of this knowledge.

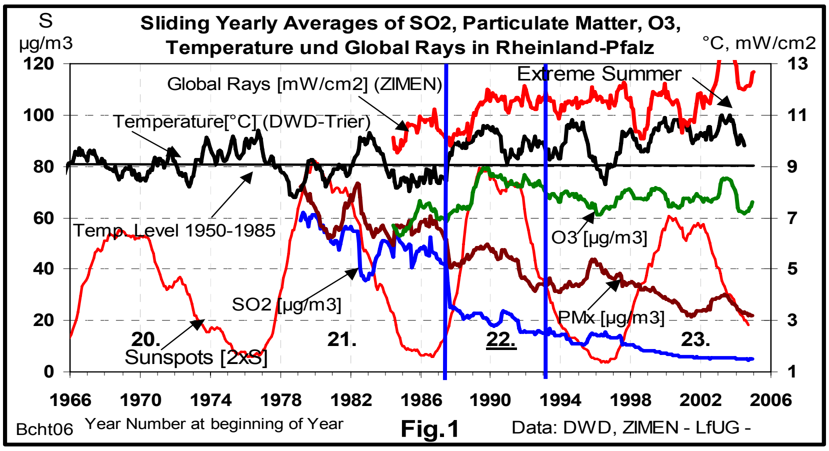


**Figure 1.** Air-pollution and meteorological components in West Germany

**Climate Change in Central Europe**

The simplest method to describe climate is to study temperature (Figure 2).

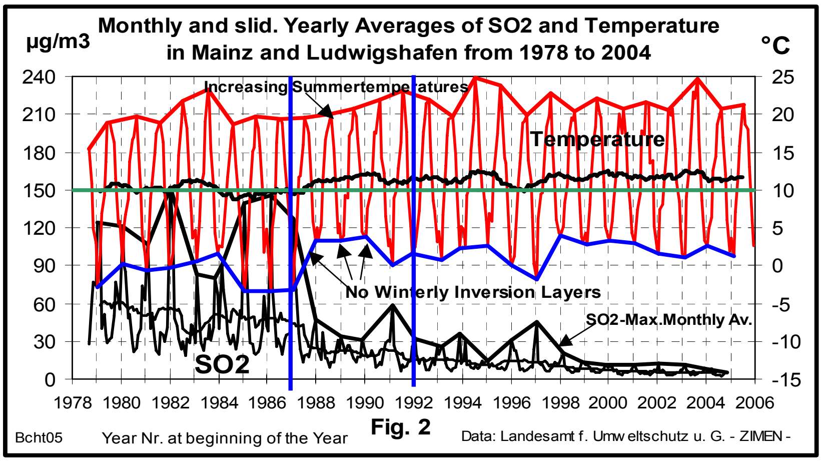


**Figure 2.** Monthly and sliding Yearly Averages of SO2 and Temperature in Mainz and Ludwigshafen from 1978 to 2004

Yearly averages of temperatures in the west of Germany show since 1988 a relative strong increase of about 1.2 °C and remain with this higher value until now (Fig. 2). Before this jump the monthly averages in wintertime were relatively low (~ 0°C). SO2 showed high values. It came partly from power plants of the eastern COMECON countries, transported by cold and dry north eastern winds beneath inversion layers of about 800 m height. After 1988 these cold eastern winds vanished. Since 1990 the monthly temperature in wintertime was higher than 2 °C before. SO2 and dust decreased very strong. After 1991 these emissions were stopped by legal reductions of emissions of power-plants and also by collapse of the emitting industries in the eastern countries. In summer time the temperatures were continuously increasing from 1987 to 1991 of about 3 °C. After this "**jump of temperature"** the long time trend of the warmest monthly temperatures was almost constant until now.

Looking for longer time measurements of meteorological components than ZIMEN we used data of the Deutsche Wetterdienst (www.dwd.de). The long time trend of temperature at all measuring stations does not show any significant increase between about 1940 and 1986. **The main increase of the temperature in Central Europe happened between 1988 and 1990.** From 1991 on until now the sliding yearly averages of the ground near temperatures (measured 2m above ground) are oscillating around a level which is between 0.8 °C and 1.5 °C higher than the level before. 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 (Figure 3).

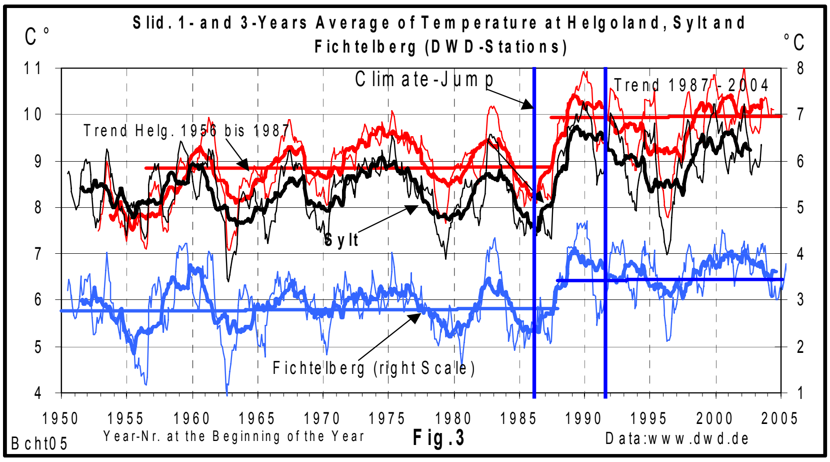


**Figure 3.** Temperature at Helgoland Sylt and Fichtelberg

This Jump of the temperatures occurs at all sites in Central Europe. At higher positioned stations the jump is smaller than in valleys. But all stations show the same trend (Figure 4).

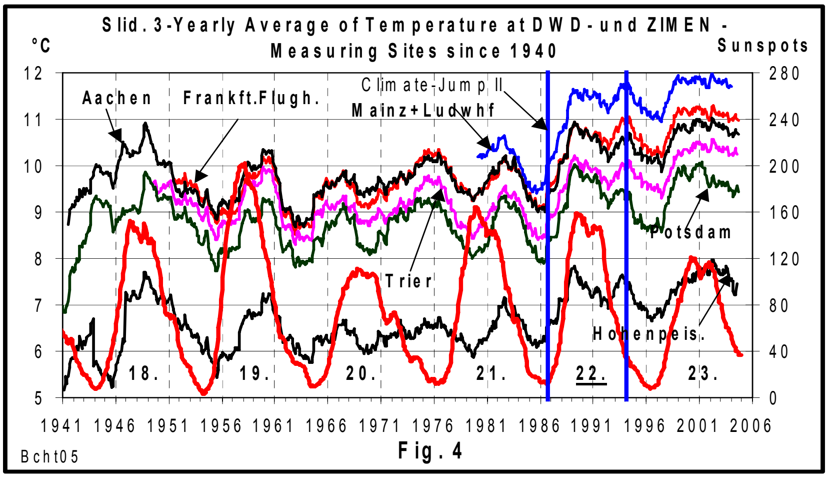


**Figure 4.** Temperature since 1940 in comparison with Sunspot-Frequencies

The jump of the temperature at all stations, we call it "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). Therefore we ask for any possible causal connections between changes of sun activity and observed climate changes. Researches in this direction have already been done in earlier times until now (Karin Labitzke, 1987, 2005).Sun intensity (Global radiation) was continuously measured to study anthropogenic O3-formation. Between1987 and 1990 Global Rays were relatively strong increasing of about more than 1,5 mW/cm2 (Yearly Average) (Fig.5). It was found agreement between global rays and sunshine duration (Fig.6). Further more there was a plausible agreement between O3 - development and global radiation. 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 anthropogenic precursors. O3 shows a strong increase between 1987 and 1990 too.

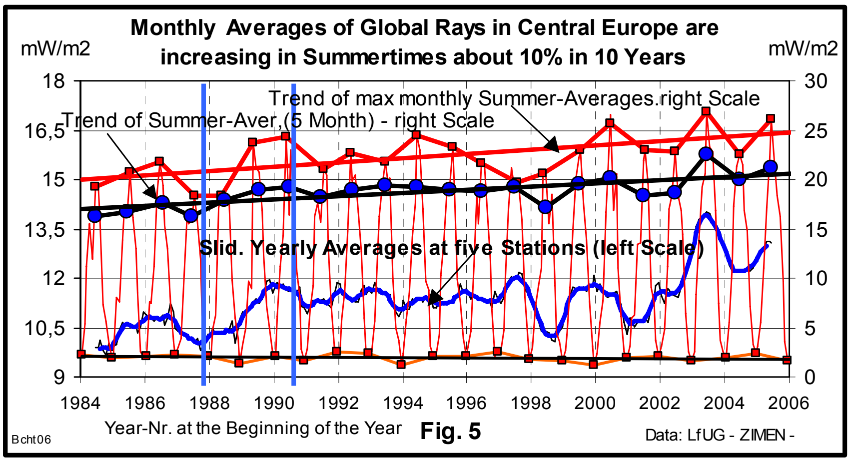


**Figure 5.** Increasing Global Radiation, measured at 5 sides in Central Europe

The yearly averages of Global Radiation were also increasing during this short time about 1.8 mW/cm3 and caused an increase of the yearly averages of temperature of 1.2 +- 0.3 °C.

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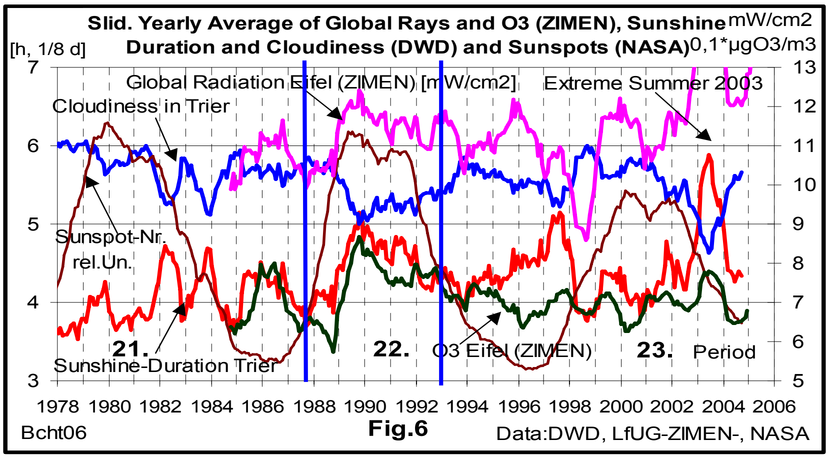


**Figure 6**. Sliding Yearly Averages of Global Rays and O3 (ZIMEN), Sunshine-Duration and Cloudiness (DWD) and Sunspot-Frequencies (NASA)

It is obvious that global radiation is strongly modulated by Cloudiness (see extreme summer 2003). The measurements of Global Radiation at 10 sites showed a strong increase of Sunshine intensity between 1987 and 1992, sorted by the geographical altitude. This phenomena pointed to strong influence of cloudiness which modulates temperature. **Therefore one must look for possible influences on Cloudiness, which controls Sunshine and in consequence anthropogenic O3 and ground near Temperature.**

These strong changes 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 Cosmic Rays**

According to a theory of Marsh and Svensmark (1998), (Eur. Org. for Nucl. Res. CERN, 2000) secondary particles of the extragalactic cosmic rays produce clouds in air which is 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 (mostly protons) interacting with the atmosphere. Structure and percentage of the reduction of neutrons depend only from their geographic altitude (Figure 7)

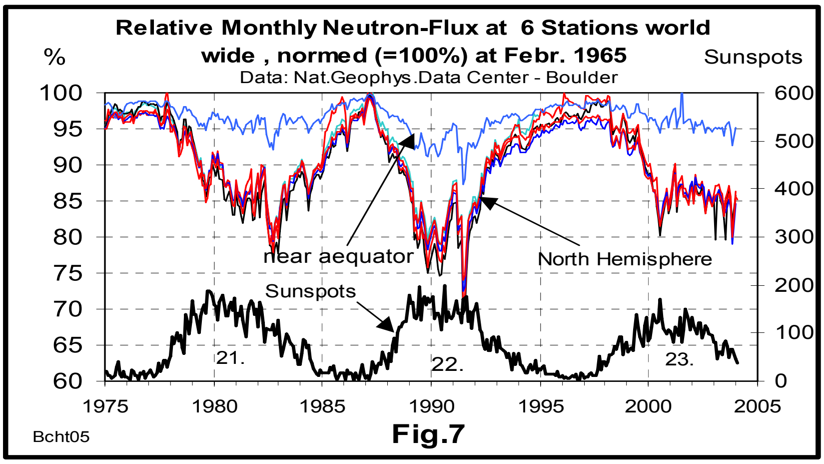


**Figure 7.** Relative Monthly Neutron-Flux at 6 Stations world wide, normalized (=100%) to February 1965

Sunspots are accompanied by soft Röntgen - Rays of 0,01 to 1 nm (Flares), which are produced by magnetic deflection of sunspot emitted protons and electrons. They are reaching the Earth after 8 minutes and mark the starting point of the current of protons and electrons (sun wind), which have velocities of more than 300 km/sec and reach the Earth several hours later (www.spaceweather.com). The “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. There is a good correlation between reduction of neutron flux and sun spot frequency that means Sun spots are controlling the intensity of secondary particles of the cosmic rays in the atmosphere (Figure 8)

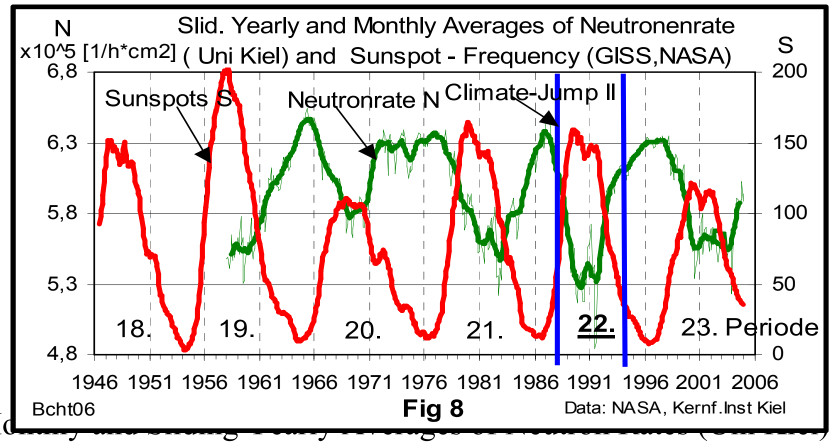


**Figure 8.** M… and Sunspot-Frequencies (NASA)

**If the secondary particles of cosmic rays would produce clouds, then there exists a link between sun activity and terrestrial climate change.** Data collected from satellites have shown that the amount of low clouds over the earth closely follows the amount of secondary particles of extra galactic cosmic radiation. This effect (max 30 %) depends not only on the number of sunspots but especially of their energetic efficiency. **With this method the Sun opens its way to the earth and produces more direct global radiation.** This process works always und modulates the terrestrial climate. One can find harmonic correlations between the sun periods and the oscillating global temperatures (Labitzke, K. et al., 1988), (Scafetta and West, 2003). During the 22$^{nd}$ and actual 23$^{rd}$ period relative often extremely high energetic mass ejections from the sun were observed, especially in Spring and Autumn of 1989.

The time rows of the Neutron rates, measured by the Institute of Physics of the University in Kiel, are in a very good correspondence with all measurements of cosmic rays world wide.

They are very good negative correlated with the time rows of the sunspot frequency (Roehrs, 2005) (Fig.8). Stations in the north of the 40$^{th}$ Latitude have nearly the same loss of cosmic rays and more than twice of equatorial places (Huancayo): Therefore 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).

## Neutron Rates and Cloudiness

To prove the thesis of Svensmark, there are in the following Figures time rows of cloudiness compared with Neutron-flux. in Central Europe. .

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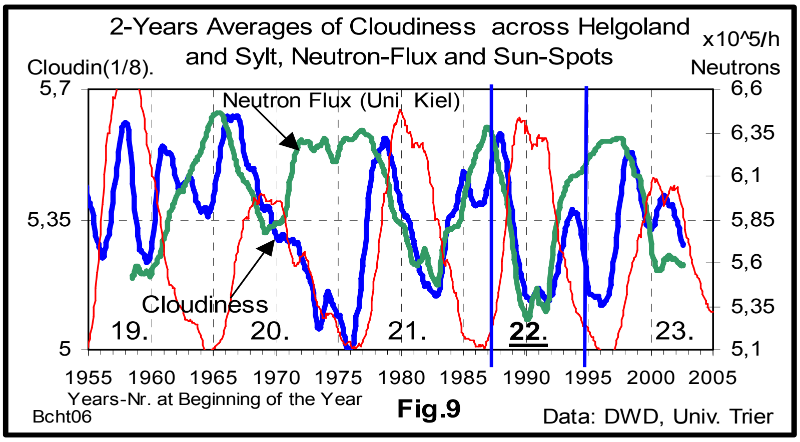


**Figure 9.** Cloudiness, averaged over **Helgoland and Sylt** (DWD), and Neutron Flux (Uni Kiel)

The sliding 2-Years Averages of the Islands Helgoland and Sylt in the eastern part of the North-Sea show a lot of resonance with the alternations of Neutron-flux. Especially during the 22nd Period there is a good correlation between the 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 %. This effect causes an increase of the averaged yearly ground near temperature of about 1.2 +- 0.3 °C in Central Europe.

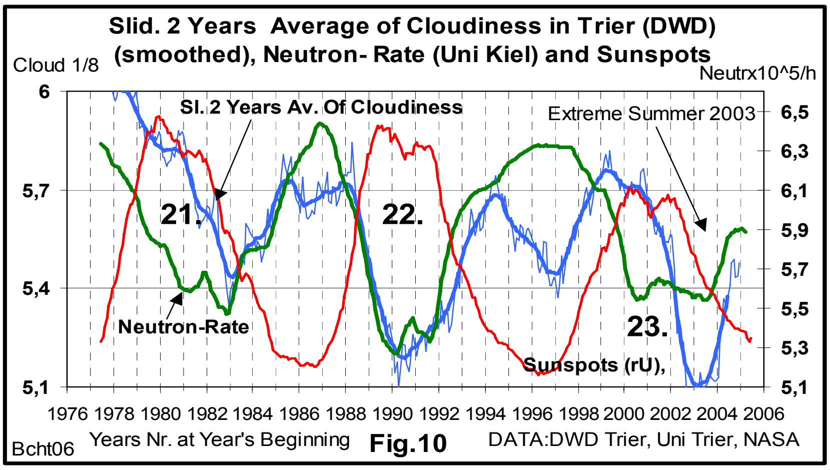


**Figure 10.** Sliding 2-Yearly Averages of Cloudiness at **Trier** (DWD), Neutron Rate (Uni Kiel) and Sunspot-Frequencies (NASA)

One finds this correlation at all measuring sites of the DWD from the North-Sea (Figure 9) and to the south of Germany near the Alps and it seems to sustain the postulation of Svensmark.

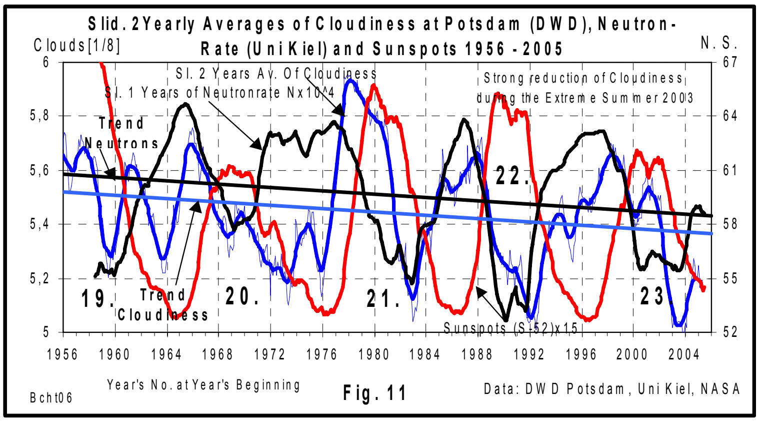


**Figure 11.** Cloudiness at Potsdam (DWD) and Neutron-Rates (UNI-Kiel)

Therefore one can suppose, that clouds periodically in the range till nearly 30 % are really produced by drops which are produced by cosmic rays as micro aerosols. This supposition seems to be stabilised by similar behaviour of the long time trends of neutron flux and cloudiness (Fig.11)

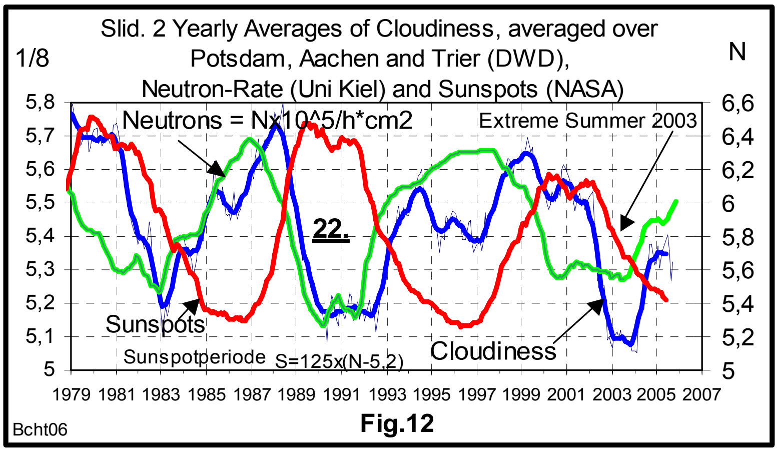


**Figure 12.** Comparison of Neutron-Rate with delayed Cloudiness

**If there is a causal connection between cloudiness and cosmic rays, than there exists a link of the controlling connection between sun activity and terrestrial climate change.**

One gets best correlations (K~0,75, values between 1980 and 2005, 2Yearly averages) between Cloudiness and Neutrons by using a delaying time of cloudiness of about 10 month in relation to time rows of Neutron rates.. This effect seems to be caused by the delaying inertia of the ocean. Furthermore there is another systematic destruction of the general correlation: After every new increase of by reduction of cosmic rays reduced cloudiness there exists systematic a certain "intermediate reduction" of cloudiness, which is modulated by sunspot frequency too. This systematic effect is not yet understood.

## North Atlantic Oscillation (NAO) and Sun Activity

There exists a good known correlation between the North - Atlantic- Oscillation and the behaviour of the weather in Central Europe, for instance the cloudiness (Fig. 13). The NAO-Index shows the time rows of the Difference of Air Pressure measured at Azore - Islands and at Iceland.

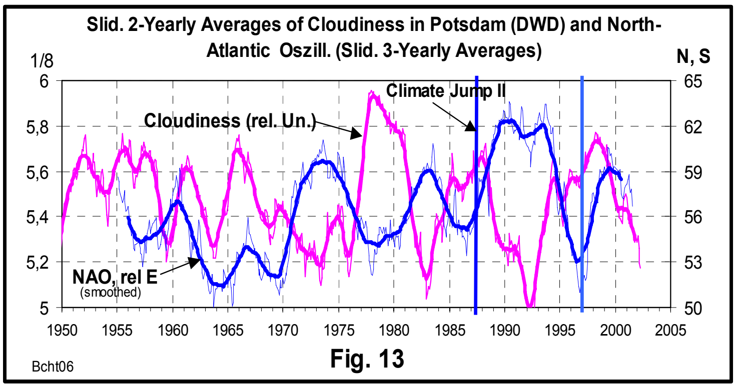


**Figure 13.** Cloudiness in Potsdam (DWD) and North- Atlantic Oscillation Index

As a consequence there exists an anti correlation between changes of the NAO-index. and Neutron rates (Fig.14)

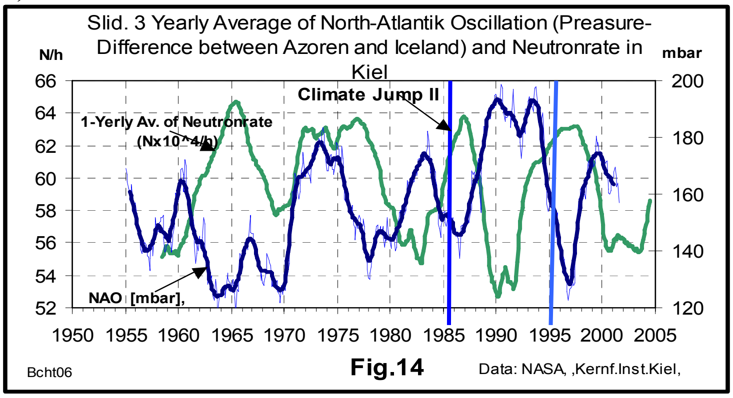


**Figure 14.** North-Atlantic Oscillation Index and Neutron Rate (Uni Kiel)

The opposite correlation between the NAO-index and Neutron rate in Fig. 14 gives rise to the opinion, that cosmic radiation controls via "Swensmark-Effect" the NAO-Index and the climate in Central Europe. Between the periodic changing sun activity and its influence on the earth's meteorology one can observe a certain delay-time of a half to one year, possibly caused by the inertia of the ocean.

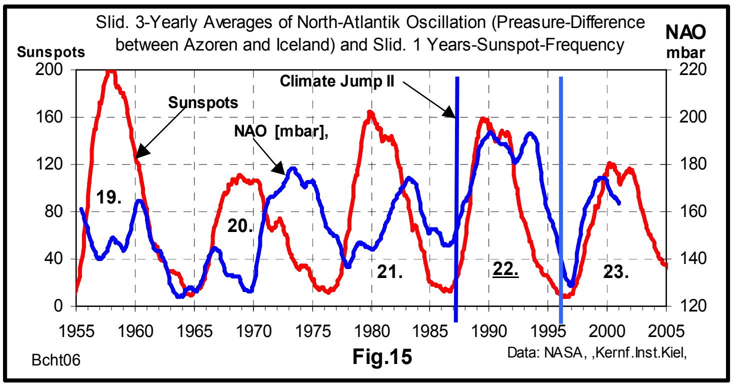


**Figure 15.** North-Atlantic Oscillation Index and Sunspot-Frequencies

## Cosmic Rays, Temperature and Growing Season

On this way there is a causal chain between sun activity and development of terrestrial temperature: Strong changes of climate components between 1987 and 1991 seem 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.

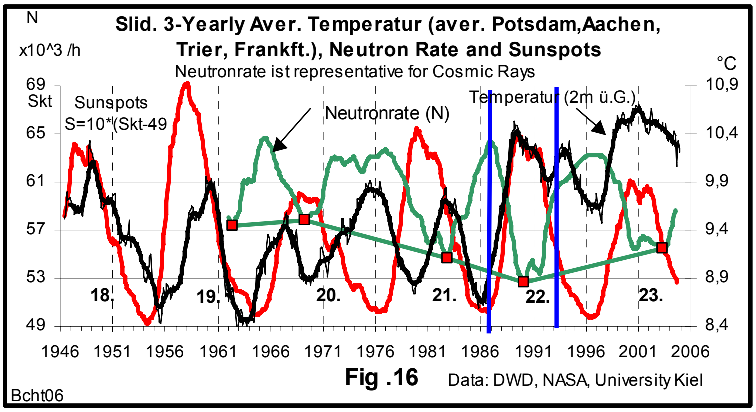


**Figure 16.** Temperature, Neutron-Rates and Sunspot Frequencies

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. The prolongation of the greening time of plants (Chmielewski, F.-M. and Rötzer, T.) starts just with the strong reduction of Neutron Rates with beginning of the 22. Sunspot period**. Finally the length of growing season seems to be controlled by sun activities too.**

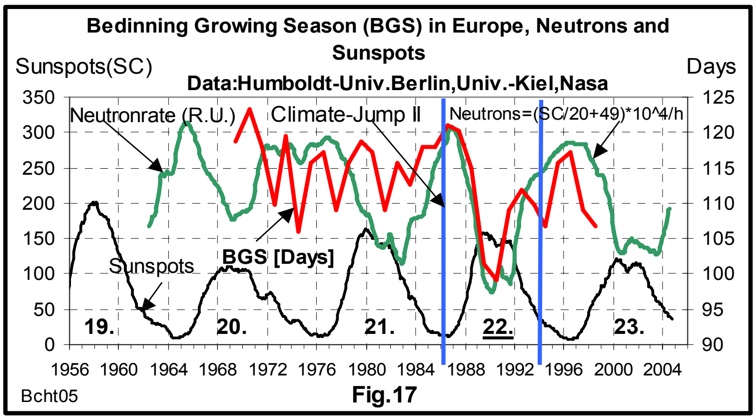


**Figure 17.** Beginning Growing Season (BGS) in Europe, Neutron Rates and Sunspot Frequencies

### Sun Activity, Cosmic Rays, O3-tot-Thikness and terrestrial UVB

Looking for further possible connections between changes of Sun activities and terrestrial climatic effects one can see correlation between changes of sun controlled cosmic radiation and ground near UVB-Radiation. There exists a very good known anti correlative change of the thickness of the stratospheric Ozone layer and ground near UVB-Radiation (DWD Hohenpeisenberg). The reduction of O3 tot - thickness mostly is seen to be caused by volcano emissions of dust, SO2 and NOx and by anthropogenic Cl, disturbing the Chapman-Cycle.

But there is an anti cyclic behaviour between O3-tot-thikness and Cosmic Rays..Further more there starts the reduction of O3-tot-thickness with the end of 21. sun spot period in correlation with the reduction of Cosmic rays too (Fig. 18). That leads to the question for an influence of

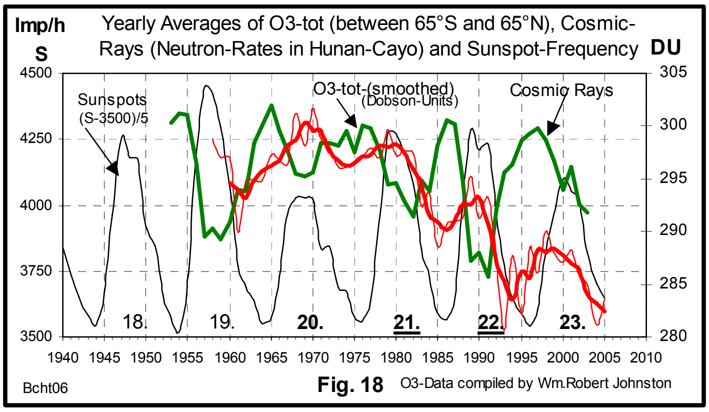


**Figure 18** . Time rows of Ozone- Layer in comparison with sun spot frequency

the changing sun activity in to the increase of UVB-radiation. The reduction of Neutron-flux is the real degree of force of sun activity in direction to the earth (sun wind). The time rows of stratospheric O3 - layer in the earth's range between 65°South and 65°North show to be in correlation with cosmic radiation (Neutron-Flux). It leads to the supposition, that the reduction of the stratospheric O3tot-layer may be caused by influencing the Chapman Cycle by increasing solar radiation (protons of the solar wind) as a consequence of increasing sun activity, not only by increasing anthropogenic Cl-Production. It follows, that the increasing UVB-Radiation in the last twenty years seems to be naturally caused too.

## Sun Emissions of Protons

To look for further observations to stabilise the sun made climate change during the eighties we studied by NASA published satellite measurement values. Fig 19 shows the monthly satellite-measured sums of Protons with energies higher than 10 MeV These strong “Sun Winds” started with the 22nd Period 1989 with an extremely large sunspot in March and continued in October with great solar mass ejections.

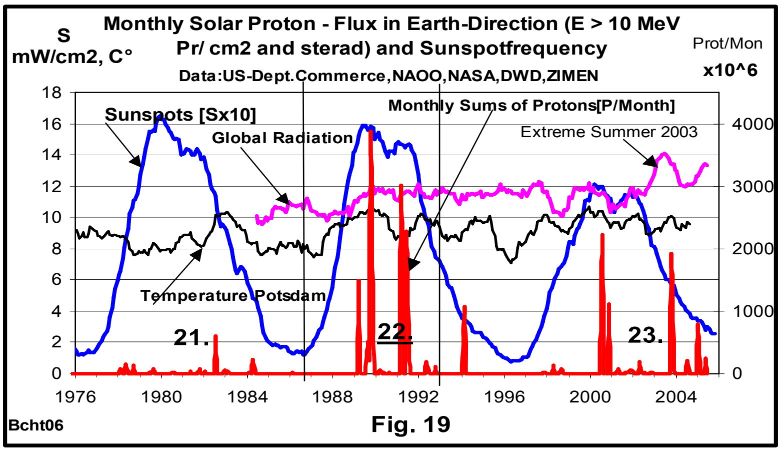


**Figure 19.** Monthly Solar Proton-Flux in Earth Direction, Sunspot Frequencies, Terrestrial Global Rays and ground near Temperature since 1976

These proton currents produced blackouts at electric power plants in the northern hemisphere and 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 15 January 2005 from a sunspot Nr. NOAA 720. This behaviour of the sun makes the fact plausible that terrestrial temperatures remains in tendency at a higher level than before 1988.

## Global Temperature and Sunspots

This work deals with the question of the global warming: The time rows of global temperature show two jumps since 1900, no continuous increasing as often postulated: The first “Climate-Jump I” happens between approximately 1920 and 1935, the second “Climate Jump II” starts about 1987 (Fig. 20). The second jump seems to be mainly caused by special solar activities like described in this paper.

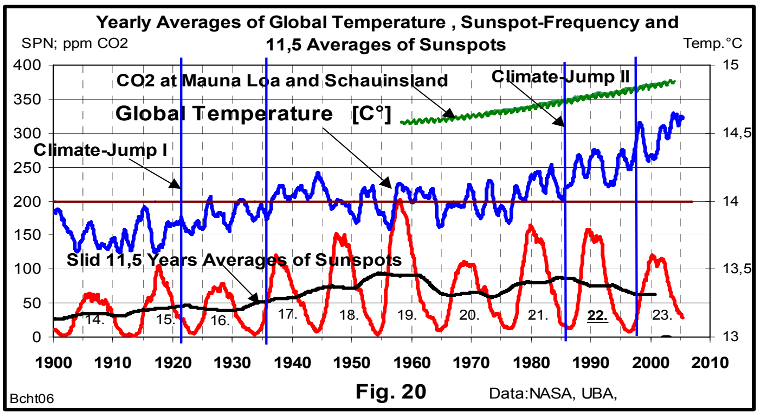


**Figure 20.** Global Temperature, Sunspot Frequencies and CO2.

Also other observations point to extraterrestrial influences causing climate change: The trend of global temperature increases with decreasing length of the basis of sunspot periods (K~0,8). Continuous reduction of Be10 and C14 since about 1880 points to decreasing cosmic radiation, caused by increasing Sun activity. That leads via Svensmark-effect to reduction of cloudiness and increasing global temperature. The increase of CO2 is continuous and shows no jump. There is a modulation of the increasing averages of the CO2-concentration of Hawaii by the 22$^{nd}$ Sun spot period. The Increase of CO2 concentrations seem to be mainly powered by increasing temperature and finally by increasing Sun activity. 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, possibly caused by a close nearby constellation of the torques of the Sun and Sun System (Landscheidt Th., 2004). Further studying of 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 of some greenhouse gases without Methan.

## CONCLUSION

In the last thirty years the main increase of temperature in Central Europe happened within the short period of 4 years between 1987 and 1991. This event was coincidental 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. It leads to the opinion that Climate Change in the past century in Central Europe seems to be mainly Sun made.

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