Is the solar irradiation nearly steady, or is it variable by some percents? A debate paper.

In the days before the satellite observations and measurements it was generally accepted among astronomers that solar irradiation is totally steady over millions of years with very slow increase over hundreds of millions of years. The current observations of 0,1% variation in the visible light did not change that much. It still is believed that the sun always did have only these small variations allied with the 11 year sunspot cycle. Although this variation is small it may have some influence on the climate. In fact such small solar variations are considered by many scientists as a stimulus for climate change, only because it works by the positive feedback, the solar signal receives from the systems on Earth as described here further. In this insight solar variation ever is very small, but may have some more impact if it lasts longer. For instance during the Maunder minimum (1645 – 1715) were counted a very few number of sunspots. On behave of the positive feedback and the duration the 0,1% or perhaps 0,2% less irradiation than now at the solar maximum could have caused the temperature dip of the small ice age in the 17th century. This are about the general accepted ideas in solar variation and its influence in climate change, but I think it is necessary to query this, because:

We don't have any evidence for the premise of the steady sun.

We don't have evidence either for the premise of the variable sun. The variable sun is anyway more probable than the (nearly) steady sun, because anything we can observe is fluctuating and changing and changes more in proportion at a longer period of observation. Moreover exist some specific indications for the variable Sun:

1st A-priori:

Some basic knowledge about the physics of the Sun learns that the solar activities are founded on an equilibrium of forces. Already this is an indication for variability, because equilibriums cannot exist without oscillation. The implosive force of the gravity ever is (about) in balance with the explosive force of the energy the solar plasma has. The source of that energy is the production of radiation (photons) in the solar core by nuclear fusion at which arise int. al. photons and more heavy atoms. These photons are preserved for hundreds of thousands years in the solar body. The photons are attached to particles and are ever moving from one particle to another. By this is on balance only a very slow movement of the energy upwards by radiation. In the external 200000 km the photons and the particles move further to the surface by convection. At both of these forms of energy transport is much interaction between the particles and the photons, which must lead to fluctuations. This only is well to be seen on the solar surface (photosphere), which shows an impressive picture of electro-magnetic interaction causing large local variations in the transport and radiation of energy. The variation in the Total Solar Irradiation (TSI) by this stays limited in the 30 year observations, but at these dynamics you should expect larger fluctuations for longer periods. Especially fluctuations in the transport of the energy are probable, while also fluctuations in the production of energy are not impossible. If by the dynamic interaction between particles and photons exists anyway fluctuation in the transport or production of energy the vast stock of solar energy also will change somewhat and by that again the form or the arrangement of the solar body will change. If the Sun loses energy and the gravity is constant the total Sun may become smaller and more compact, but the equilibrium also is restored if only a layer within the Sum becomes more dense. Furthermore is possible that variations in the gravity forces at the Sun could exist. One cause of this should be the variation the tidal forces the planets have on the Sun by their elliptic orbits. The planets, however are very small in relation to the Sun, which contains 99,8% of the total mass of the solar system. Thus the consequences of this in variations of the form of the solar body and its irradiation is much too small for the realization of obvious differences. The gravity and tidal forces from outside the solar system , however are much more important for the Sun. This galactic gravity after all is the cause of the movement of the Sun in an orbit around the center of the galaxy, with a velocity that is now about 220 km/sec. So that is much more than the velocity of the Earth on her orbit around the Sun, on average about 29,8 km/sec. The source and the character of the forces that determine the orbits of the stars in the galaxy, however are still unknown. So the gravity and tidal forces from the galaxy on the Sun may be variable in principle and may so induce the Sun to variations in activity.

Furthermore the irradiation and solar wind we receive here on Earth is for a larger part coming from the equatorial areas of the Sun than from its poles. Because of this fluctuations in the participation of the solar polar and equatorial areas in its total irradiation can cause variations in the solar irradiation on Earth, while the total quantities of energy the Sun irradiates into space are about constant. Observations do give indications for these kinds of latitude variation at the Sun.

So exists a-priori a lot of physical possibilities for variation in solar activity, probably larger at a longer term than scientific research in our days is able to observe.

2nd A-posteriori:

Also from research by observation are indications. It is possible to examine the magnetic activity of the sun by indirect parameters, proxies. The data of 400 year counting of the Sunspot Numbers (SN) and the research for the radionuclide's (^{14}C and ^{10}Be) for the era of the Holocene (11500 year) provides evidence for more variation of the sun than now is observed by the satellites. The few existing research to solar variation by the ^{14}C and ^{10}Be proxies give as described here indications for much larger variations of the sun during the ice age and at the climate transfer to the Holocene then we know from our present era, the Holocene, with its relative stable climate. Although this is in fact an important item none other good research with the radionuclide's in the Pleistocene exists and so is only minor evidence for the sharp solar variation in the Pleistocene. However over the Holocene and mainly the later centuries exists some more evidence for somewhat larger solar variability. Also then is the problem the all the data of the solar proxies (SN, ^{10}Be, ^{14}C) only give information about the generic magnetic activity of the sun, so its total particle radiation, while also disturbing factors are possible. These observations also cannot give conclusive evidence about the question of the solar climate driving, because there is no physical connection. Indeed it is not known how this non specified magnetic activity can change the climate on Earth.

Obvious is how changes in the quantity of the electromagnetic radiation can change the climate. Also is evidently a physical relation of the electromagnetic radiation and the particle radiation or the magnetic fields, of which some data are known. This relation however is not quantified, so that you cannot calculate the unknown electromagnetic variation in the past, from the data of the solar magnetic variation. Further are found in many cases a good statistic correlation between the magnetic variations of the sun, following the proxies and the climate factors as temperature and precipitation, mostly only in the Holocene[1], but some seldom older studies this correlation reaches also into the Pleistocene, as [2] So altogether exists evidence for the solar climate driving in the Holocene and is accepted also by many scientists at which the driving of the sun receives positive feedback from factors on Earth. For the period before 11500 BP, the Pleistocene solar climate forcing however generally is rejected by scientists and the climate variations in this era mostly are described as driven only by non-solar factors, like the internal fluctuations of the systems on Earth, f.i. the ocean currents and the orbit. Only a very small part is given to the sun in that scientific theory. In this it may be possible that by small oscillations of solar activity the sun triggers the very large internal climate variations of the Pleistocene, but these very large and fast Pleistocene temperature variations also may arise without any external stimulus[3]. This is very curious, because it is primary more likely that the part of internal fluctuations is larger in periods with small climate variations than with large ones. If such profound climate change should arise within the fluctuations of the systems on Earth, the climate on this planet should be very instable of its own, which makes the emissions of greenhouse gasses by people very hazardous. Such large instability is however unlikely. Further is the sun simply a good candidate, which is potentially able to cause the large and fast climate variations of the Pleistocene the more so as in the occurrence of many of these climate fluctuations, the interstadials, can be reduced a cycle of 1470 year on average[4] and that period of 1470 year also is the sum of some well-known periods in the solar cycle. So it is astonishing that the relation sun – climate is not well examined for the Pleistocene and that other factors are mentioned in the literature as the cause of climate change before examining the solar driving. The large climate variations in the past before 11500 year ago indicate large sun variations for someone who do not take on trust the sun is nearly constant without any evidence.

The measured solar variation

By the 10Be, the 14C and the SN proxies we have a lot of non specified information about the variability of the sun in the past, but what are the exact quantitative variations at the

[1] See for instance D Fleitmann in Science, 300(5626), 1737-1739, 2003: http://www.sciencemag.org/content/300/5626/1737.full and The sun GCR – Cloud connection of H. Svensmark ea: http://www.space.dtu.dk/English/Research/Research_divisions/Sun_Climate.aspx and the work of dr Bas van Geel ea, as in Journal of Archaeological Science 31 (2004) 1735e1742; http://cio.eldoc.ub.rug.nl/FILES/root/2004/JArchaeolScivGeel/2004JArchaeolScivGeel.pdf

[2] B. van Geel ea in Quaternary Science Reviews 18 (1999) 331Đ338; http://www.gg.rhul.ac.uk/elias/teaching/VanGeel.pdf

[3] See prof S. Ramstorf ea in Nature f.i: http://www.pik-potsdam.de/~stefan/Publications/Nature/rapid.pdf and http://www.pik-potsdam.de/~stefan/Publications/Nature/rapid.pdf

[4] See H. Braun, S. Ramstorf ea in Nature 2005: http://www.pik-potsdam.de/~stefan/Publications/Nature/Braun_etal_Nature_2005.pdf

different aspects of solar activity only is known over the last 30 years. Many forms of radiation by the sun are stopped in the atmosphere of earth and so cannot be examined on the surface. That is why we can only have a full picture of the different aspects of the solar radiation that reaches the outmost layers of the atmosphere by observations from satellites and space craft's and those exist only from 1978. In **TABLE 1** are these specific variations as annual averages for the last 30 years.

TABLE 1[5]

E.M. SOLAR RADIATION	AV. ENERGY FLUX	ABOUT 11 YR SOLAR CYCLE CHANGE		MOST IMPORTANT DEPOSITION ALTITUDE	IONISATION
TSI (mostly visible and IR)	1366 W/m^2	1,2 W/m^2	rel 0,1%	Surface	Low
UV-A (315-400 nm)				Surface	Low
UV-B (280-315 nm)				15-50 km (95%)	Low
MUV (200-300 nm)	15,4 W/m^2	0,17 W/m^2	rel 1%	15 -50 km	Low
FUV (126-200 nm)	50 mW/m^2	15 mW/m^2	rel 30%	30-120 km	Moderate
EUV, Xray (→0-125 nm)		10 mW/m^2	rel 100%	80-250 km	High

PARTICLE RADIATION	AV. ENERGY FLUX	ABOUT 11 YR SOLAR CYCLE CHANGE		MOST IMPORTANT DEPOSITION ALTITUDE	IONISATION
Galactic cosmic rays	0,7 $\mu W/m^2$	0,7 $\mu W/m^2$	rel 50%	0-30 km	High +nuclear act.
Fast solar protons		2 mW/m^2	rel 100%	30-90 km	High +nuclear act.
Aurora protons and electrons	1 mW/m^2	20 mW/m^2		100-120 km	Moderate
Joule Heating	20 mW/m^2	2 W/m^2		100-150 km	Moderate

[5] http://sdo.gsfc.nasa.gov/mission/science/solarirradiance.php

The TSI, the Total Solar Irradiation, thus the sum varies about 0,1% in the annual averages between the maxima and the minima in the about 11 year solar cycle during this observation time of 30 years. In this the variation in the shorter wave lengths of the spectrum (UV and further) is larger than 0,1% and in the longer wavelengths (IR) it is smaller than 0,1%. Further is to be deduced from this that the energy flux, which reaches the surface or the troposphere is some 1350W/m^2, with a variation of some 1W/m^2 so relative some 0,075%. This variation will influence directly the temperature on the surface and the resting variation, 0,025% of the TSI, has a more indirect influence on this. Before the time of the satellites this solar variation of 0,1% of the TSI and somewhat less in the visible light, may have been somewhat more in the 1960's, but was never identified by observation on the surface. These measurements indeed were difficult, but not impossible, I think. A reason why scientists did not identify the solar irradiative variation beforehand was probably that they did have the idea the sun is anyway constant and so it is useless to make difficult measurements for research to variations. The Galactic Cosmic Radiation (GCR) consists mainly of particles as very fast protons, typically with an energy of hundreds of geV. This radiation is called galactic because it comes from outside of our solar system. The sun stops this radiation partially by its magnetic activity that is present within the total solar system. That is why the GCR on and near Earth is minimal during the solar maxima. The cyclic change of the sun in the high energetic EM radiation and in the particle radiation mainly is founded on explosive events on the sun during the maxima: A solar flare irradiates EUV and Xrays that reach the outmost atmosphere of the Earth in 8 minutes causing there ionization and heating. At these events also are discharged fast protons that reach the earth after half an hour to some hours. Those fast solar protons have an energy from 30 meV to several geV's, causing ionization and even nuclear reactions in the atmosphere. **Remark thus that not only the GCR but also the fastest solar protons are nuclear active and can change the atoms of the gasses in the atmosphere. In this activity is produced int. al. the radionuclide 10Be. So not only by the GCR that is stopped by the sun but also by the sun itself 10Be is produced during very short periods at the explosive events. The very high production by the fast solar proton events (SPE) comes true from the 10Be deposition in the polar ice during about one year, see FIG 13 – 16.** At these explosive events also are sometimes ejected some larger masses of plasma (mainly protons) from the solar corona. These CME's reach the Earth after 1,5 to 3 days. The impact of the CME's here is mainly by their fast moving magnetic fields, that accompany them at their journey along the Earth. The CME's transfer energy to the outmost atmosphere by induction: the moving magnetic fields generate electric currents there and this is an important part of the Joule heating. Further penetrate also waves of protons into the outer layers of the atmosphere and they cause the aurora's (polar light). In the larger magnetic shock waves by these moving charged particles arise magnetic storms on Earth. By the stronger storms electric currents also are induced in the lower atmosphere and on the surface.

The measured variation of 0,1% on annual average over 30 year in the TSI on Earth is a strong indication for the larger variation of the sun. This observation of course is only a snap-shot in the billions of years of solar history and the millions we are interested in for the relative recent climate history. The extrapolation of these data over only 100.000 years shows it is possible or even probable the solar variation is rising to some percents in this longer time scale. This simple extrapolation of the data from the satellite observations already indicates the sun as a potential important driver of the fast and large climate variations on Earth in the cycles of glacials with interglacials and interstadials, by which the era of the Quaternary is characterized, unimpeded the driving by other factors as the Earth's orbit. Further is important that at least in the present situation in which is an about 75% part in the variation of the energy flux from the sun to the Earth in the longer wave length range (>400nm) that ever reaches the surface. The 25% part is in the high energy EM radiation and the particles and that relative high variation is in the present totally absorbed by the atmosphere. However an important question here is if the variation in the high energy radiation and the particles was in the past also always totally stopped in the atmosphere. It is not impossible that some radiation in the MUV and FUV reached the surface in periods with much more sharp increase in solar activity than we can observe now. Of particular importance further is that this variation in the higher energy radiation must have various effects in the atmosphere and even on the surface, different from climate chance. These non-climate results must have caused traces, if the variations were large enough. Well-known examples of these non-climate traces for solar variation are the 14C and 10Be quantities, but many other traces must be present, if the solar variation was as high as it seems probable here.

A possible instance of the non-climate effects by the larger solar variation in the high energetic radiation and so a hint to the larger Sun variability is another impressive event in the late Quaternary: the massive extinguish of large animals and plants at the end of the ice age. In all the continents and islands except Africa many species died out. In North America this was some 70% of the larger animal species, from the measure of a goat, and many plants. Many of these species as the mammoths died out in relative short periods, while they were successful species beforehand, occurring in very large numbers. This extinguish was less in the tropics and also less among the smaller animals in the areas with moderate or cool climate. The cause of these events is a riddle. All efforts that are made to explain this are not conclusive. They have resulted int. al. to the absurd theory that prehistoric people should have eliminated species as the mammoth, while these animals occurred frequently over the whole continents and remains of people are not or rarely to be found in many areas. Solar change in some percents within a relative short period combined with genetic factors may be a good explanation here. The intensity of all the electromagnetic rays of the Sun may increase form a level that is some percents lower than now to the present level, within some decennia. The increase than in the UV part than is much larger than in the visible light. At this the ozone layer cannot stop all the UV radiation in a period of some decennia, because the ozone high in the atmosphere can only increase slowly and so is lagging at a sharp and fast incline of the ionizing UV radiation. The ionizing radiation that penetrates so to the surface has a mutagenic effect in living creatures. Some mutations in the DNA can cause cancer, but the genetic mutations are more important. These mutations are transferred to the next generations and so they can form part of the genetic composition of the populations. New genetic mutations often are induced by radiation on the gonads of masculine animals. Although some of these mutations may be useful by bringing more opportunity for survival, all the mutations by UV radiation are based on DNA damage and hence loss of function. The animals can generally well survive at some minor loss of functions in the paths of metabolism, but this will be a problem if the mutation causing small disturbances are accumulating. It is well-known that smaller animals do have less risks than large ones for the accumulation of mutations by radiation. Also animals in the tropics have less risks, because they are more adapted to higher doses of UV radiation. These mutations are not regularly removed from the population by the Darwinian selection, following the survival of the fittest. On the contrary just by selection the mutations often accumulate in the population.

Damage of genetic DNA by UV radiation means in principle always total or partial loss of function of the gene and of the proteins the gene codes for. This functional decline however may be opportune for survival and then is evolutionary selective. An instance: By DNA damage in various genes animals and people can lose in different ways their capacity to produce pigments and by this their skin and fur becomes white. This white color, however may increase the chances of survival, because it protects against predators in a cold climate with snowfall and it may enlarge the sexual attractiveness and the social status, which is obvious the case among people. To this advantages in the short term aspects of the evolutionary selection in this way, often are disadvantages for the health and fertility, which mostly work more on the longer term. In this case the lack of pigments makes the individuals more sensible for diseases as skin cancer. The low pigment production in the example here is caused by damage at one or some of the numerous different genes that all code for proteins important for the metabolism of the pigments. Loss of the function of the gen and protein mostly also give some more problems at various paths of the metabolism chains in the organisms other than the loss of pigments. So these genes and their products do have also other functions that also will deteriorate than by the evolutionary selection on the light color. Also this brings some disturbances, which may still be small, but they will ever accumulate if more mutations arise. Sometimes, however are immediate important problems on the other paths of metabolism. An extreme and seldom example of this in people is PKU. In the metabolic path the low production of pigments at this disease PKU is accompanied by accumulation of toxic products, causing brain damage. So it is clear that Darwin's thesis of the survival of the fittest often is somewhat tricky, because in the DNA of the organisms accumulate mutations that are favorable for their short term survival, but that gradually undermine their health and fertility and may be fatal for the species at the end. In medical genetics are many examples of the tricks at the evolutionary selection: For instance in a malaria-infected region it is favorable for people to have sick red blood cells, because the parasites cannot survive in them. So the trait for sick blood cells is selected for, etc. Besides the Darwinian selection also for stochastic reasons the mutations accumulate in a process called genetic drift. Also by the stochastic genetic drift increases gradually the genetic load, the amount of mutations in a population or species. If the species cannot get rid of those mutations the health and fertility of the individuals is undermined, what can lead to sudden extinguish in some circumstances. At the genetic drift genes accumulate stochastically in a nonselective way by some processes that all are practically based on inbreeding [6] . A well-known example of this is the founder effect: If some small number of people, animals , etc comes under more easy circumstances for survival, as happens often after migration, they will extend to large populations. So arise large crowds of animals from a few ancestors. This leads to accumulation of noxious genes and increase of their expression by homozygosis. Also by this process the population loses important genes, that are necessary for the development of the immunologic system. So, after their successful multiplication, the animals, or other creatures, may suddenly exhibit genetic diseases and may be less resistant for infectious diseases. This

[6] How the selective and the stochastic evolution works is more elaborated described here on http://www.genevo.nl/images/bestanden/Micro-%20evo%20Engels.pdf

founder effect is exactly what occurred many times at the procreation and multiplication of all the different living creatures by the many sharp climate changes during the ice ages at the much warmer intervals, the interstadials, and at the end of the ice ages in the climate transfers to the interglacials. During the cold basic glacial climate areas as the present Western Europe were ice deserts, inhabitable for most animal species. At the warming up phases in the begin of the interstadials and intergracials the temperature increase may be more than 10^{o} C in this area, resulting in a climate almost as warm as the present one. Attracted by these favorite conditions some animals come from Southern Europe and Africa to the North and multiply to large crowds, but at the end of the interstadial the climate becomes colder and the animals have to retire to the South. Then the compulsory southward migration concerns more animals than the northward migration did. These events repeated many times in the era of the quaternary. So the DNA mutations by solar activity accumulate strong in these selective and stochastic genetic changes by the population dynamics.

So it is evident that survival of many species came under great pressure during the Quaternary, due to the necessity of adaptation, which often comes at the cost of the vitality and fertility, and to the genetic drift during the many sharp climate changes. Because of this it is no wonder from the population genetic point of view that species died out in this era, but it still is very remarkable indeed that this extinguish of so many species occurred simultaneously in a relative short period of time. If the Sun scattered mutagenic radiation in some or many periods of intensive climate warming, many mutations were absorbed by the sharp increasing populations at these periods. It is probable that an extra large number of new mutations by the fast increasing UV radiation of the sun during the intense climate changes at the transit from the ice age to the Holocene may have destabilized the genetic systems of the populations within which the creatures reproduce. These species already had some critical genetic load upon which these new mutations suddenly may have been too much for their survival. This could be a real explanation for this sudden extinguish. Of course from the available data exists no good evidence for this theory. However, a possible liaison between the variable Sun and the dying out and evolution of living creatures already is so important that much more data should be collected for the deny or confirmation of this theory. If this theory is truthful these data of course are to be found: If the variability of the Sun had impacts on Earth like this mass extinguish it must have left behind much more witnesses that can be traced by research.

3rd The conclusions:

A (more) variable Sun is a-priori more likely than a (nearly) constant Sun.

Some specific observations indicate indeed a more variable Sun, although without definite evidence.

This lack of evidence possibly is the result of the fact that nearly no research is undertaken for the larger solar variation in the Pleistocene, so more than 11500 year ago, than now is observed in a short period in our time.

So here should arise the question: Why is not more research undertaken to the possible important phenomenon of the changeable sun, that makes the climate change and to get more information that may confirm or deny the larger solar variation? This research than must of course not be restricted to the period of the Holocene with its relative stable climate, because small climate changes are more likely than large changes caused by internal fluctuations within the systems on Earth and independent from external factor as the sun. The answer to the question why the solar variation not is examined as a potential cause, besides the Earth's orbit, of the intense climate changes in the Quaternary probably is cultural influence on scientific research: You are informed by what you measure, but you will only measure what you believe. People, also scientists, participate in a culture and in the view on nature this culture has. The tradition of a constant Sun is well established and we feel also more comfortable at a reliable Sun that may not disturb our lives with its variations. Unfortunately science is not regardless towards traditions and not indifferent for feelings of dependence and fear.

Other possibilities for research

Anyway exist many possibilities for research to solar variation at the longer term of the later Quaternary. More research with the radio nuclides can give some more evidence. The probabilities will increase indeed if you can compare the ^{10}Be quantities of very different locations with each other and with other proxies lie ^{14}C. However this cannot produce convincing evidence. The information by the radio nuclides about solar variation ever is uncertain and not specified and too much factors exist that may disturb the information the 10Be quantity should give about the sun. However if the theory is true that solar variation was as large as several percents in the Quaternary this must have left some more specific direct witnesses. More reliable information about solar variation probably can be obtained by examining the **hydrogen quantities within the small air bubbles in the polar ice.** More dense 'clouds' in the solar wind, mostly arisen by mass ejections of the Suns' corona (CME's) cause magnetic storms on Earth and many of these geomagnetic disturbances probably have been much larger in a large time scale than now has been measured from the year 1844. It is well-known and described here that these moving magnetic fields induce electric currents in the Earth's atmosphere and on the surface. A point that is not concerned still by research is, I think, that those currents will cause electrolysis especially of water in the atmosphere and in the oceans. Also a modest extent of that electrolysis can cause a significant increase in the small quantity of the hydrogen in the atmosphere and is conserved than in the air bubbles within the ice for a very long time as is also methane. The existence of electrolysis by the more intense solar wind is very likely: It is a good theory that the planet Venus lost nearly all her water by that process and the fact that the planets' gravity cannot retain hydrogen molecules or protons. Also a period of increasing electromagnetic radiation of the Sun must have left traces. If that radiation increases fast from a somewhat lower level to the now present level the incline in the UV range then is more intense than in the visible light. The ozone layer then may temporarily be incapable to withdraw all the UV radiation, so that ionizing rays reach the surface. Besides the influence on living organisms, the electro-chemical activity of that solar rays on the surface also may cause reactions in sediments and rocks that are to be recognized by soil investigation**. Some sensible layers may act as a photographic plate for this radiation.** If you do not search for this you will never find it.

Important non-climate consequences of solar variation.

Research on the variability of the Sun is not only important for improving understanding of climate change. It is known that magnetic storms from the sun can cause damage to electrical equipment, but this damage was limited during the last 100 years. If this trend continues this does not give us cause for concern, but it is doubtful whether this will persist so. In the 19th century were some larger magnetic storms, so shows the record from 1844. The largest magnetic storm of 1859 has been well described and it is generally assumed that geomagnetic disturbances of this size today would cause considerable damage. It is hoped that this was a rare phenomenon, but nobody knows anything about the frequency and intensity of the geomagnetic disturbances over some centuries. As described on .. shows the 10Be concentration in ice cores presumably information about these storms, but that has still not been examined by experts as far as I could ascertain. This research adheres naturally to the general uncertainty of the 10Be proxy. It also involves a very high time resolution is required. I've made charts of the approximately annual 10Be concentrations over the last 600 years in Greenland and Antarctica of the last 300 years. At these are then a few sharp fluctuations per century. After 1844 is there is connection of the fluctuations in the curves with the historical recorded magnetic disturbances. Although both studies of Greenland and Antarctica did not always give the same clear sharp fluctuations, at which presumably an insufficient time resolution and dating problems are involved, there is some general consistency between the two registrations. Again here is more research on the variations of the sun very much needed because the risks are probably greater than it seems. We do want to know if such electricity networks indeed should be protected from the sun! Research with other tracers such as hydrogen in the ice cores can probably also here provide more clarity.