Part 2 El Nino and the Sun

The mechanism driving El Niño

It is not easy to demonstrate that the atmosphere fluctuates in its permeability to solar radiation. It could be done if one set out to acquire the necessary data. That data may already exist. One would need scans of the intensity of infrared radiation returning to space according to latitude over time.

It is easier to describe the way in which the radiation window can change than to demonstrate that it happens. Manifestly it happens. There is no doubt about that. How else could the tropics vary in temperature over time?

The behaviour of plasmas and their interaction with the neutral atmosphere is a new branch of science. It is a product of the space age and depends upon observations by spacecraft. Our knowledge of the sun and its processes should improve dramatically following the launch of Solar Dynamics Observatory (SDO) in 2008 or 2009. Unfortunately, at this stage the period of observation is short and the data available from space missions may be inadequate, unavailable or in such a form that it may not support the analysis required. When I ask the question, I get no answer.

No data set can fully explain the intermittent increase in surface temperature that has been witnessed over the entire period since 1880 unless it clearly links the sun, atmospheric phenomena and El Niño warming. The determination of the United Nations Panel on Climate Change that 'El Niño' is due to 'an internal oscillation in the climate system' and that 'Global Warming' is due to man himself is an impediment to progress. There is a parallel here with the parental response to the question: Where did new baby come from….found under the cabbage in the bottom of the garden, brought by the stork etc. Is this the considered opinion of experts or is it the determined position of ideological zealots?

There are two ways in which the sun might cause an increase in radiation intercepted at station Earth. The first is that the sun should get brighter. It would then put out more electromagnetic radiation of the sort we recognise as sunlight. The wave lengths of solar radiation vary between that of gamma rays that will penetrate concrete and radio waves larger than a football field. Studies of stars other than the sun suggest that a fluctuation in radiation level over the life of a star is to be expected. But, it happens over very long periods of time. Satellite observations have confirmed that the extent of the fluctuation seen during recent solar cycles is slight. We observe a pumping El Niño at the start of the great majority of solar cycles, often the biggest warming event of the cycle. At solar maximum the temperature can go either way. In studying the influence of the sun we have suffered from a disconnection of sensate experience from thought process and left the subject to trusted others……experts we thought.

The second agency by which the sun might influence the Earth is via the emission of plasma from its corona in a phenomenon known as the solar wind.

The aa index of geomagnetic activity does cover the period for which we have data for the Southern Oscillation Index. However, it is not easy to interpret. It is known to respond to the solar wind but the relationship is ambiguous.

The aa index is a measure of the extent of the variation in the Earths magnetic field as measured at the surface of the Earth. It is compiled from observatories in England and Australia where the horizontal deviation in a magnetic needle is measured every three hours. If we were trying to measure the flow of traffic along an expressway we might set up a flagpole on the median strip and

take pictures of the flag as it flutters in the breeze. Then we could score the rate of deviation in the flag from the vertical along the plane of the expressway and we would have a measure that is analogous to the aa index of geomagnetic activity. Would it tell us anything about the number of vehicles of various sizes that passed by? It could, but we would have to be very smart to interpret it.

The solar wind is characterised in terms of several elements. First is its Bz (southward) orientation that affects its ability to penetrate the magnetosphere, secondly its mass, thirdly its dynamic pressure and fourthly its speed. Of the four measures of its potential influence the Bz orientation probably affects the aa index more than the others because it very much affects the rate of penetration of the Earths magnetosphere. How this relates to the distribution, temperature and density of the ionosphere and the neutral atmosphere and the extent of cloud cover that affects the opacity of the atmosphere to solar radiation is only apparent when we graph the two side by side. Then we find a relationship……of sorts.

The Ionosphere is plasma energised from the Earths own atmosphere by the power of ultraviolet, X ray and gamma radiation. These forms of radiation have a shorter wave length than visible light, and have the power to split atoms and electrons from susceptible molecules. Oxygen and Nitrogen are both susceptible. Together, these gases make up 99% of the atmosphere.

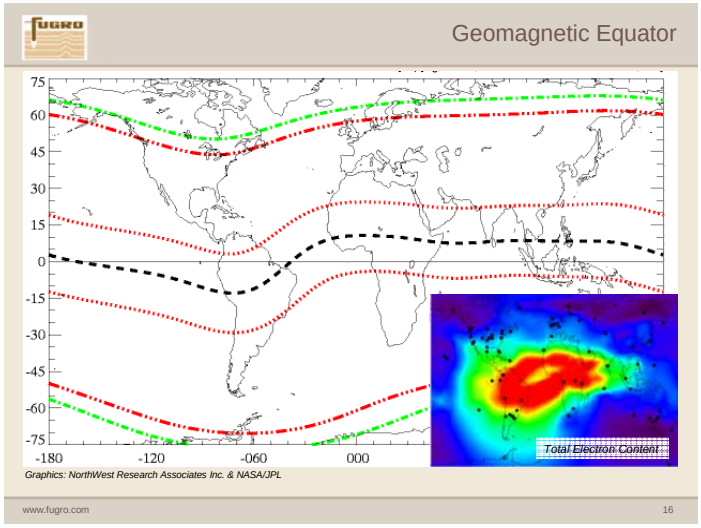
The ionosphere is co-extensive with the neutral atmosphere between the tropopause and 100 kilometres of elevation. Ultraviolet radiation deconstructs atmospheric gases enabling atoms and electrons to be energised sufficiently to escape the bonding that is usual in the lower levels of the atmosphere. Ozone is a fleeting product of this process and free electrons are observable during daylight hours in the D region at about 50 km in elevation with much greater concentrations at higher elevations where the atmosphere thins and the opportunity for energy dissipation and recombination is less. In the tropics UV radiation penetrates to the surface of the Earth. The population of ions at any interval depends upon the scope for energy acquisition, dissipation and particle recombination and all these depend upon atmospheric density. In daylight the population of ions increases and overnight it falls. The free ions of the ionosphere and the solar wind have a lot in common. They are both plasmas, the fourth state of matter in the continuity solid, liquid gas and plasma.

Plasma behaves very differently to the other states of matter because it has unbalanced electrical charges and is therefore subject to electro-magnetic influences. It exists in the atmosphere at densities less than can be achieved by application of vacuum pumps at the surface of the Earth and there is very little friction to impede movement. Plasma from the sun interacts with plasma in the atmosphere and it also interacts with the neutral atmosphere.

Whereas two plasmas interact non-collisionally via their inherent magnetic-field-aligned currents, plasmas interact with the neutral gases of planetary upper atmospheres collisionally, resulting in a mutual exchange of energy and momentum. The aurora is a phenomenon that owes much to the energising activity of plasma on atmospheric oxygen and nitrogen. The scope for shifting matter, ions or atmospheric gas, in one direction or the other at great speed, in the ionosphere is much greater than we observe in the more pedestrian world of solid, liquid and gas. This is achieved via the application of electrical or magnetic energy in a low density environment. Acceleration is fast.

The Earth also influences the state of plasma in the ionosphere via the return of infrared radiation from the surface of the Earth. This tends to energise the ionosphere as can be seen in the graphic below. The distribution of land and sea plays a part because the daytime emission of infrared from

land and cloud free seas can be higher than over the remainder. One should not underestimate the emission of infrared from the sea under cloud free conditions.



It is hypothesised that the energising of the ionosphere and the neutral atmosphere by the solar wind affects the rate of transmission of solar radiation through the Earths atmosphere. This affect may well be coupled to factors affecting cloud distribution in the tropics and the local density of the atmosphere itself. Whatever the dynamics, and one is guessing at best, the net effect is to change the proportion of the available solar energy that is received at the surface. The net effect is that, depending upon the level of energising activity of the solar wind, the energy absorbed by the oceans in subtropical zones varies over time giving rise to the La Niña and El Niño phenomena so long observed in the Eastern Pacific. The manifestations of the phenomena will vary between the major oceans because of the manner in which land and sea is distributed across the globe, the location of the relatively cloud free zones that are due to rain shadow effects and the varying supply of very cold waters from high latitudes.

The thinning of the ionosphere and the neutral atmosphere at low latitudes by the agency of the solar wind could be amplified by:

1. Expansion and contraction of the Hadley cell involving an increase or decrease in the area of the high pressure cells of the subtropics. This area is relatively cloud free and allows the transmission of solar energy in an unobstructed fashion to the surface of the Earth.
2. The aforementioned return of infrared radiation from the warmed area, especially the land masses, tending to energise the ionosphere and the neutral atmosphere in part determined by the orientation of the geomagnetic equator and the orientation and power of the ring current.
3. As the Hadley cell contracts during a La Niña the cloudy areas of the frontal zones of the mid latitudes course from west to east in a path that is closer to the equator reflecting solar radiation and keeping the surface cool.
4. Heating of the atmosphere reduces its density and probably accelerates the reduction of aerosol content due to increased humidity both in the troposphere and the stratosphere. This factor is very probably responsible for the decline in the temperature of the stratosphere that is part of the recent temperature record. Decline in temperature in the stratosphere indicates reduction in short wave energy intercepted in that part of the atmosphere and is likely associated with an increase of radiation pressure at the surface of the Earth….the reverse of the volcano effect.
5. The trend to La Niña cooling tends to rob the intertropical convergence of the energy derived from the latent heat of condensation and disperse this energy in creating thunderstorm and monsoonal activity in the adjacent landmasses further weakening the sub tropical high pressure cells and reducing their surface area.

6. Fluctuation in the height of the tropopause in the tropics can affect the rate of drying of the air and thereby upper atmosphere humidity and cloud cover within the tropical zone.

Because the aa index can be relatively stable, and therefore *manifest low values at any strength of the solar wind* it needs to be interpreted with caution. The solar wind drives the Southern Oscillation Index but the evidence does not manifest as a simple correlation between these two indices. Dismissal of the relationship because of a lack of correlation represents a mistake based upon a sad misunderstanding of the dynamics involved. Here, we are dealing with the behaviour of plasma that is influencing the Earths electromagnetic fields and an 'indicator' of the strength of that plasma that is no more sophisticated than the freeway flag fluttering in the breeze as an indicator of traffic flows.

Logically, if the aa index jumps it is because the level of disturbance of the magnetosphere and the ionosphere by the solar wind has increased. If the index suddenly falls, a reduction in the effect of the solar wind on the atmosphere might be inferred. The extent of the movement in magnetic needles simply indicates continuing change of increasing amplitude *in one direction or the other,* rather than providing a true measure of the underlying force that is driving the change in the Earths atmosphere. If the solar wind stabilizes at a high level the aa index will fall. This is analogous to the traffic on a freeway locking bumper to bumper while travelling at an increased speed. The flag will flutter less.

If the solar wind is unvarying at a low level the scope for change in the aa index via a reduction in the strength of the solar wind is small. The scope for change in the aa index is much greater at high solar wind intensity. It can be inferred therefore that a jump in the index is likely to indicate an increase in the strength or penetration of the magnetosphere by the solar wind. However, should the wind stabilize at a high intensity, as it appears to do at solar minimum, the aa index will fall. Remember, the aa index measures change. It does not measure the underlying intensity of the solar wind or tell us about important characteristics of the wind including its speed, mass, dynamic pressure or Bz (southward) orientation.

The consistent relationship between the aa index of geomagnetic activity and the Southern Oscillation Index.

Figure 1

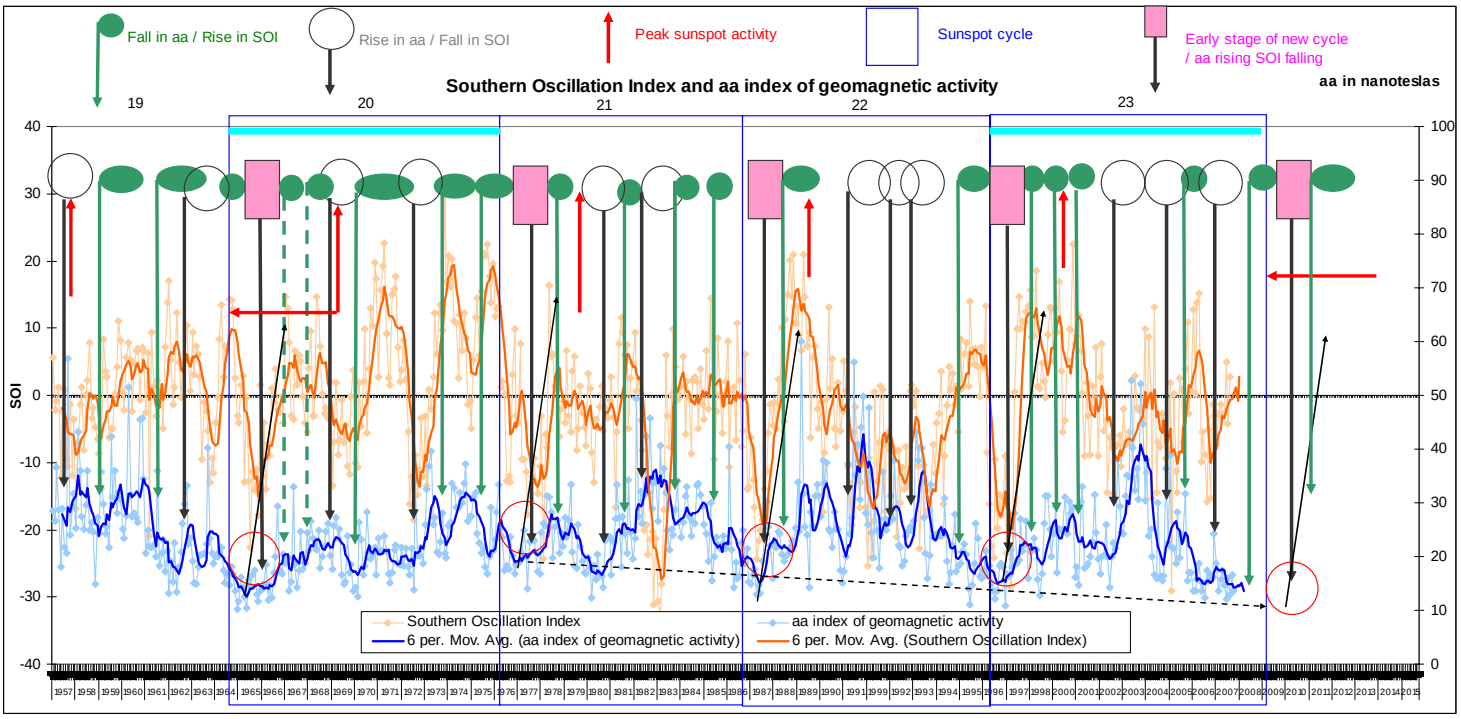


Figure 1 shows a consistent relationship between the aa index of geomagnetic activity and the Southern Oscillation Index. When the aa index jumps the SOI falls and vice versa. The dotted green lines represent the only instances over this entire period where the relationship is not clearly manifest. This occurred in the early stages of solar cycle 20 when the aa index behaved most atypically. Otherwise, change in the aa index precedes change in the Southern Oscillation index in all instances and the relationship is inverse. If one relates temperature at the surface to the aa index the relationship is congruent. Disturbance of the ionosphere relates to rising temperatures at low latitudes. The dependence of the El Niño phenomenon upon the sun is clearly apparent.

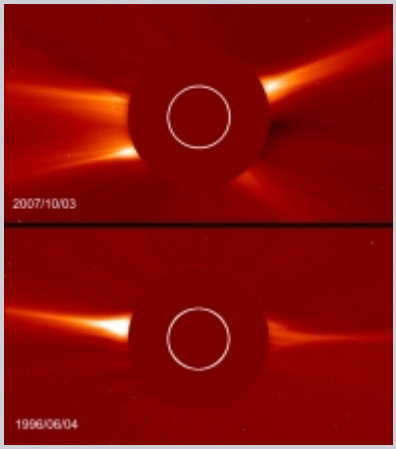
What is the weather prognosis for the remainder of solar cycle 23?

My projection for the end of the current solar cycle is different to that of the official panel. It is based upon:

1. The expectation that the polar field of the sun will continue to collapse. The rate of collapse evident since solar cycle 20 is assumed to continue.
2. Solar cycle 23, being weak, is assumed to be of similar length or longer than cycle 20.
3. According to IPS Australia the arrival (or non-arrival) of new cycle sunspots gives a good indication as to when the solar cycle will end. For the past few solar cycles, the first sunspots were seen at high latitudes 13-19 months prior to the official sunspot number solar minimum. So, when finally we see the first sunspots of Cycle 24 clearly identified b y their location at high latitudes, then we will know that solar minimum is around 13-19 months away. Following this rule the end of cycle 23 is at least 18 months away (due April 2009 at earliest).
4. Observations from SOHO in relation to the appearance of the sun at solar minimum that appears immediately below. We are clearly short of solar minimum at present time October- November 2007 and it may be 17 months away.

http://sohowww.nascom.nasa.gov/pickoftheweek/old/05oct2007/

ARE WE THERE YET? (OCTOBER 5, 2007)



Hi-res TIF image (359K)

Many people ask if we are at solar minimum yet and how do we know when we are. Solar minimum is the period when the Sun has reached its lowest point of solar activity in its 11-year cycle. One way to see if we are there yet is to observe the solar corona, easily seen in SOHO's C2 coronograph images. The structure we see in the coronagraph images is a marker for the global magnetic field extending into the corona and heliosphere. When the Sun is at its minimum and the corona is "relaxed", the elongated structures in the corona will extend out horizontally with both sides fairly balanced.

See the bottom coronagraph from 1996. At solar minimum, it's a simple "dipole" field, like a bar magnet's, and aligned with the solar equator. Compare that with the corona in an image from October 3, 2007 -- the structures are angled and unbalanced and they have looked like this for some time. In the absence of almost any sunspots over the past month or more, we still have this strong indicator that we are NOT there yet. Many predictors suggest that we will reach solar minimum sometime between January and March, 2008.

Points 1-4 and graphical analysis in **figure 1** indicate a high probability that the currently developing La Niña will intensify over 2008.
Figure 1 makes a projection based upon simple graphical analysis as to the likely starting point of solar cycle 24 and therefore the likely trend in the SOI up to that point and beyond. The La Niña currently developing is likely to strengthen until solar minimum. This will shape up as a period of quite dramatic cooling in Northern Hemisphere winter 2008 and 2009. As Solar cycle 24 gets underway in mid 2009 a strong El Niño will develop as the aa index of geomagnetic activity accelerates from its current very low level. After the El Niño, that usually persists for 18 months, a cooling La Niña should establish.

The mid term future

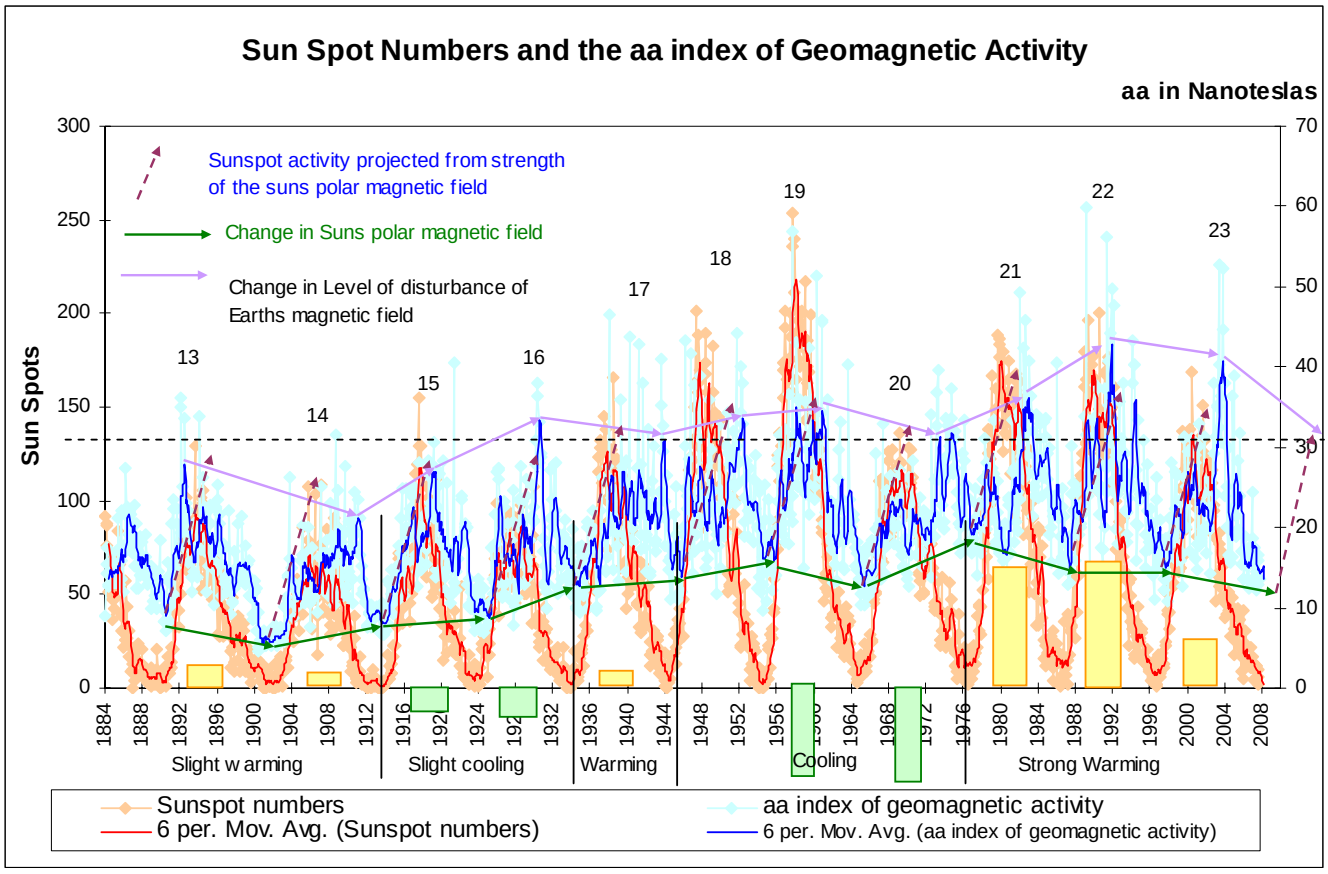
The extent to which the warming of the Earth since 1880 can be explained by solar influences depends upon the extent to which the base strength of the solar wind has increased over time. Accurate measurement of the solar wind within the ionosphere or outside the magnetosphere depends upon the availability of satellites and space probes and unfortunately this type of activity

has a history of only a couple of solar cycles. In the absence of better documentation we must fall back on the interpretation of indices of geomagnetic activity. As already explained this is like looking through a glass, darkly.

Does the aa index of geomagnetic activity provide any indication of trends in the base level of solar wind strength?

Over extended periods of many solar cycles the disturbance to the Earths atmosphere that arises from the effects of the solar wind changes with the base load at solar minimum. The aa index has increased in its minimum and its maximum value since 1880. These effects are traced in **figure 2.** The figure also shows the swings in the SOI index in the form of coloured bars.

Figure 2



Dynamo theory suggests that the strength of the suns poloidal (polar) magnetic field at solar minimum is influential in determining the level of sunspot and geomagnetic activity in the following solar cycle. There is a loose relationship between the strength of the poloidal field at sunspot minimum, the height of the succeeding sunspot cycle and the amount of geomagnetic activity that will occur. This is so because the suns poloidal field as expressed at solar minimum is twisted to destruction by the differential rotation of the suns convection zone, faster at the equator than at higher latitudes and this is the way sunspots are produced. Before many sunspots appear a strong El Niño event has manifested in nine of 12 solar cycles testifying to the strength of the solar wind at a time when sunspots and other coronal eruptions are few and the aa index is low and at the start of it's acceleration phase. The first sunspots appear at high latitudes showing where the twisting of the magnetic field creates the greatest initial tension. The continued twisting of the poloidal field ultimately creates a toroidal (equatorial aligned) field at sunspot maximum with great numbers of sunspots appearing close to the suns equator. Each sunspot expresses its own locally generated magnetic polarity. It's a maverick. It's a pimple on the complexion of our

adolescent sun. At this time the aa index tends to collapse slightly and a La Niña can manifest. The time between solar minimum and solar maximum is roughly half of the interval between solar maximum and the next solar minimum. It is easy to destroy order than create it anew. The greatest disruptions in aa index values occur after sunspot maximum. The gyrations in the aa index during the long period of cycle decline vary in amplitude from cycle to cycle. It is during cycle decline that the toroidal field gradually decays and the sun re-defines its next poloidal magnetic field. That poloidal field can be stronger or weaker. Intuitively the causative agent is external to the sun itself and may well be related to the suns position in relation to the centre of gravity of the solar system. (Fairbridge and Shirley 1987, Landscheidt and others). It is hypothesised that the suns massive gravitational field is affected by other bodies and that this affects the thermonuclear reactions in its core. Perhaps it shifts the fuel rods minutely closer or further away from the reactor in the core?

The timing of the geomagnetic disruptions that are reflected in the aa index was more in tune with sunspot activity during earlier cycles. As described by IPS Australia at http://www.ips.gov.au/Educational/3/1/4

Cycles show very different variations in geomagnetic activity. All exhibit multiple peaks of activity - mostly with three peaks although some with only two. Some cycles have the peak activity concentrated early in the solar cycle (e.g. Cycles 11, 13, and 19). Other cycles have activity concentrated late in the Cycle (e.g. Cycles 10, 14, and 17), whilst others are more evenly distributed.

Activity during Cycle 21 was particularly strange because of the deep trough in the middle of the cycle where the average aa index in fact dropped below its value at the previous minimum. Cycles 9, 12 and 18 also have deep troughs but not as pronounced as that for Cycle 21.

Figure 3 shows that the aggregate of both sunspot and aa activity over the entire cycle has increased over recent times. Sunspot activity has been in general decline over the last four cycles but aa activity remains high.

Figure 3

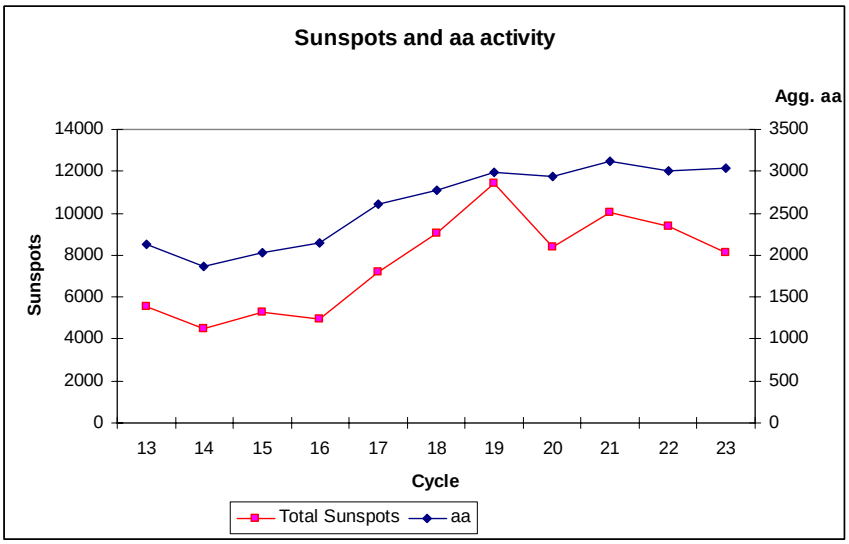
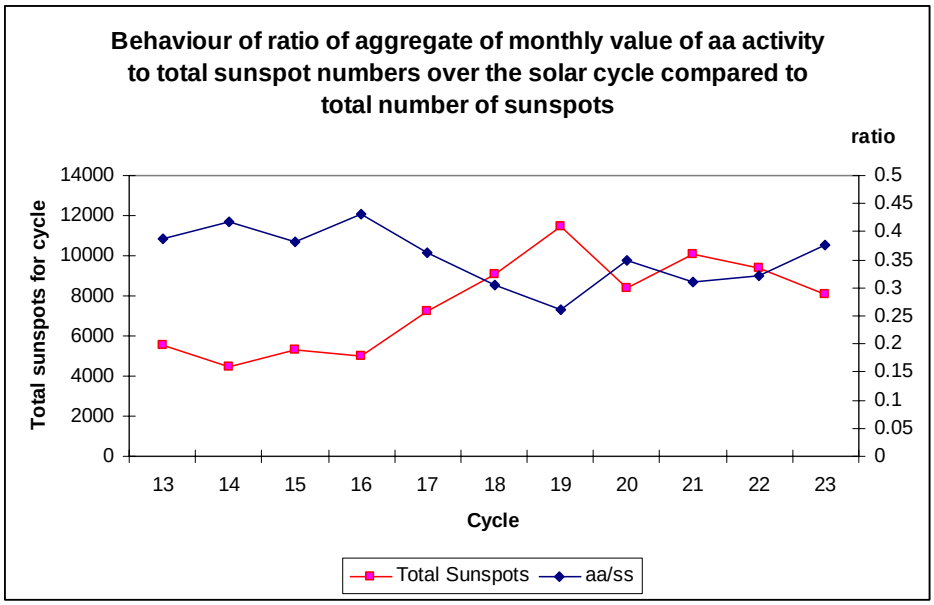


Figure 4 demonstrates that as sunspot numbers increase the ratio of geomagnetic activity to sunspot numbers tends to decrease and vice versa. This suggests that the force driving sunspot activity can express itself in sunspots or as enhanced solar wind, the one to an extent exchanging for the other, and that high sunspot activity tends to reduce the expression of the solar wind. The collapse in aa activity and its anomalous expression during solar cycle 20 following the extreme

sunspot activity of solar cycle 19 confirms the point as can be seen in **figure 2.** This pattern of exchange explains the heavy fluctuation in temperatures that has occurred in the past at times when sunspot activity was low. If sunspot activity falls in solar cycle 24 we can still expect big swings in temperature even as La Nina activity becomes more dominant.

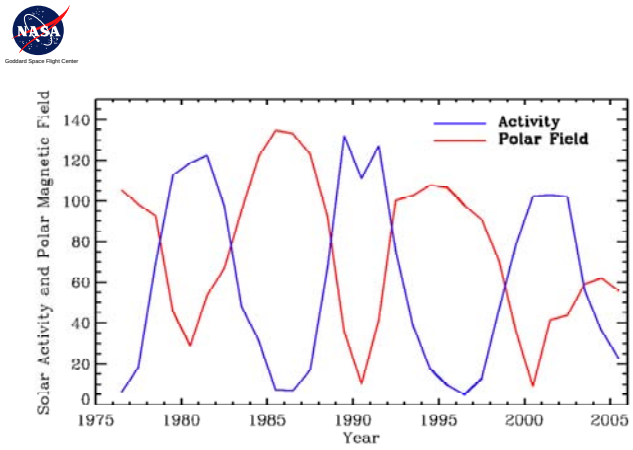
Figure 4



The disturbance to the Earths atmosphere is obviously minimal during La Niña events because it is at this time that temperatures fall. In these events cloud cover over the subtropical regions probably increases with the loss of impetus driving the Hadley cell. Other factors can amplify the change as explained above. It is probable that, as the suns poloidal field further declines over coming sunspot cycles the base load of the solar wind will decline with it. El Niño will not disappear because geomagnetic activity will continue and become a relatively more important expression of the suns activity but La Niña will become dominant and the Earth will cool. That is strongly implied by projection of trend in **figures 1 and 2.** The Earth has warmed slightly after the peak El Niño year of 1998 but the rate of warming has been slight. As a result temperatures have not exceeded those of 1998. The last great El Niño year occurred at the earliest upswing in sunspot and aa activity during the relatively weak solar cycle 23. This next is likely to occur in 2009-10.

Figure 5 from NASA traces the decline in the poloidal magnetic field of the sun.

Figure 5



Space Weather Workshop, April 2007, W. Dean Pesnell, GSFC

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Figure 6

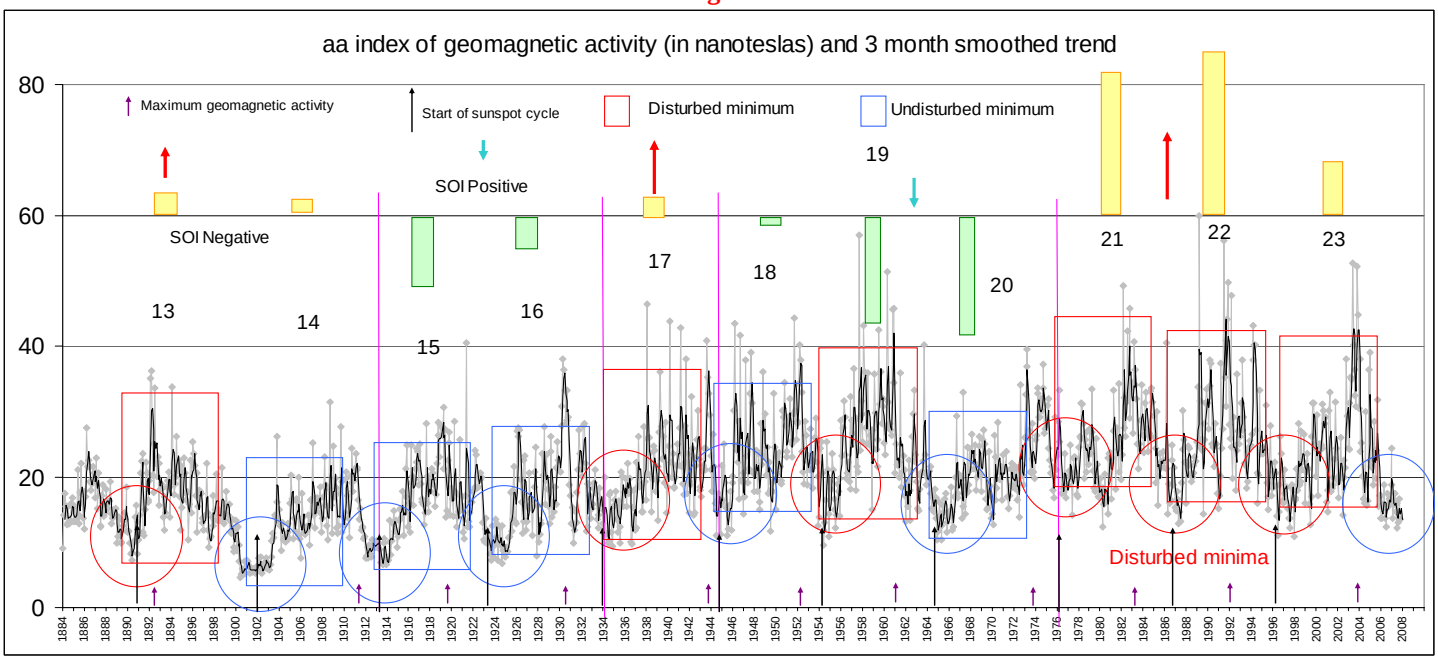


Figure 6 reveals that cycles that begin with relatively undisturbed aa activity at solar minimum (blue circles and rectangles) generally exhibit a smaller gyration in aa activity during the cycle. The blue circles and squares are associated with cycles exhibiting a neutral or positive Southern Oscillation Index and periods where the Earths temperature has remained fairly stable or even declined. The red circles and squares are generally associated with periods of El Niño dominance and increasing surface temperatures. The rectangles show the aggregate of the monthly values of the SOI for each solar cycle.

It is plain that the strength of the suns poloidal magnetic field is in decline and with it the base load strength of the solar wind. Geomagnetic activity during the solar cycle will also decline but as an expression of the suns magnetic disturbance it will become increasingly important at the expense of sunspot activity. The decline in the base load of the solar wind will allow the atmosphere to exclude more solar radiation. Fluctuations in aa index should diminish but fluctuations in the SOI index will be as violent or more so than in the recent past. Overall, the Earth should cool.

Conclusion

It is plain that the sun is mainly if not completely responsible for temperature fluctuations at the surface of the Earth. The mechanism involves, not variations in solar electromagnetic emission as has been suggested in the past but variations in the suns emissions of coronal plasma that we call the solar wind.

The extent of the forcing of climate by the solar wind can not be judged by the relatively small change of air temperatures that occurs at low latitudes. Much of the electromagnetic energy received in the tropics drives evaporation and thereby the circulation of the atmosphere. Much is devoted to increasing the temperature of the ocean waters that ultimately influences rainfall and temperatures at middle and high latitudes, particularly in the Northern Hemisphere. In doing so, the radiative strength of the sun in low latitudes is not completely manifest in a contemporaneous increase in infrared radiation in the tropics. The utilisation of energy in driving of the circulatory system facilitates the transfer of warmth from place to place, the cooling of warm surfaces and the convectional transport of heat into the upper atmosphere where it dissipates harmlessly to space. Atmospheric densities of the upper troposphere are too low to interfere with this process. Where

air remains relatively still radiation is uninhibited. To the extent that this transferred oceanic warmth manifests in infrared energy it does so in places that would otherwise be uncomfortably cool. The transfer of warmth is a fortunate thing rather than something to be concerned about. It is the return to La Niña dominance that should concern the worriers.

The presence of the cooling influence of water is the characteristic that makes this planet habitable. Extreme temperatures are associated with the arid zones. These extreme temperatures are a product of solar insulation untrammelled by atmospheric filtering. On the nightside, radiation swiftly reduces temperatures producing an extreme diurnal range. This is the product of atmospheric effects. The atmosphere is primarily a heat shield. Greenhouse notions are nonsense.

Australians will no doubt rejoice in the fact that the rainfall regime will improve as the swings and roundabouts of the El Niño regime becomes less loaded in the El Niño direction.

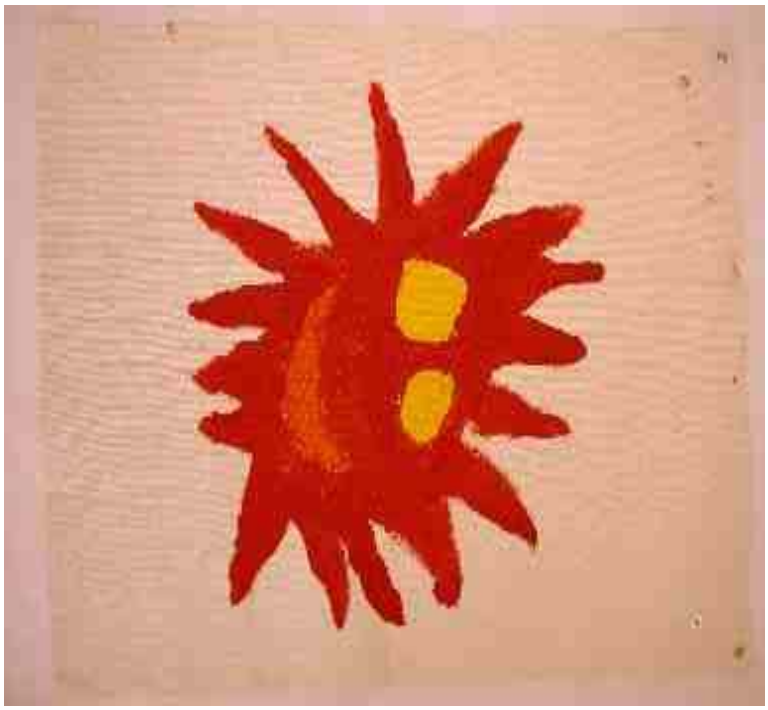
Man can continue to enjoy the use of fossil fuels in the knowledge that plants will absorb carbon dioxide as fast as it is created. In time he will undoubtedly develop technologies to convert coal to convenient and cheap forms of energy in liquid or gaseous form to burn in the internal combustion engines that have made such a difference to his mobility, ability to provide electrical power and cheap communication, ability to move mountains and generally increase his standard of living. For many in the developing world this will be a great relief. The overbearing attitude of those who can afford a fall in living standards without the threat of starvation is to be regretted and the sooner these enthusiasts for economic depression and depopulation come to their senses the better. This sort of distraction is unnecessary.

There are many good reasons to conserve fossil fuels, develop new sources of energy and to deliver energy as cleanly as possible but the state of the diverse climates and seasons across the globe is quite unrelated to the rate of delivery of carbon dioxide to the atmosphere. The proportion of carbon dioxide in the atmosphere is currently sub optimal for plant growth and too small to make any difference to surface temperatures. Surface temperatures depend upon the reception of solar energy, particularly in tropical latitudes, the presence of water as liquid to absorb energy via evaporation, the presence of water in the form of reflective clouds and the manner in which that energy is distributed by the ocean currents.

Water vapour is Earths refrigerant gas and the oceans are a great buffer against temperature change. The atmosphere is mere ‘ether’, vital for life by virtue of its oxygen content and a heat scrubber for the surface of the Earth. Evaporation is the means by which the surface cools and surface contact, convection and the release of the latent heat of condensation are by far the most critical processes for heat exchange between the surface and the atmosphere. Between the atmosphere and space radiation is the only process that will work apart from the loss of energised matter. Once delivered to the atmosphere heat is effectively lost to space because of the insubstantial nature of the gaseous membrane and its rapid loss of density with elevation. All these factors come together in a lapse rate of temperature with altitude that renders mountains of just a few kilometres in elevation rather uncomfortably cold for human habitation and the upper atmosphere a very effective release point for the transfer of energy to space.

Reference:
Fairbridge and Shirley Prolonged Minima and the 179-Yr rotation of the Solar Internal Motion
http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?1987SoPh..110..191F&data_type=PDF_HIGH&whole_paper=YES&type=PRINTER&filetype=.pdf

Expanding Tropics:
http://www.abc.net.au/science/articles/2007/12/03/2107763.htm?site=science&topic=latest
"Water for the Recovery of the Climate - A New Water Paradigm" /ENGLISH version/
http://www.waterparadigm.org/indexen.php?web=./home/homeen.html



Links of interest

ENSO, the SOI and the heat budget of the tropics

http://www.srh.noaa.gov/jetstream/tropics/tropics_intro.htm
http://en.wikipedia.org/wiki/El_Ni%C3%B1o-Southern_Oscillation
http://www.cgd.ucar.edu/ccr/publications/meehl_solar.pdf
http://ams.allenpress.com/perlserv/?request=get-document&doi=10.1175%2F1520-0442%281999%29012%3C0917%3ARSSTVD%3E2.0.CO%3B2&ct=1&SESSID=d1fabd56bc7adba72b02eb26b0622f13
http://ams.allenpress.com/perlserv/?request=get-abstract&doi=10.1175%2F1520-0493(1983)111%3C1244%3AGCVCWS%3E2.0.CO%3B2&ct=1&SESSID=1f449aa7874b6f33f32bf48c10cc5cb7
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http://ams.allenpress.com/perlserv/?request=get-abstract&issn=1520-0442&volume=007&issue=11&page=1719&ct=1&SESSID=e419fae55eddf0504a827d48b002b594
http://www.sciencemag.org/cgi/content/abstract/295/5556/841
http://www.sciencemag.org/cgi/content/short/295/5556/838?ck=nck
http://docs.lib.noaa.gov/rescue/mwr/056/mwr-056-10-0393.pdf
http://ams.allenpress.com/perlserv/?request=get-abstract&issn=1520-0442&volume=006&issue=11&page=2049&ct=1&SESSID=e985370ff6de67826caa23d3b0609702
http://ams.allenpress.com/perlserv/?request=get-abstract&issn=1520-0469&volume=038&issue=09&page=1928&ct=1&SESSID=c9a0b81705513684c1d0c319abf80625

PLASMA PHYSICS
http://www.oulu.fi/~spaceweb/textbook/plasma.html
Plasma Physics of the Local Cosmos Committee on Solar and Space Physics, National
http://www.nap.edu/catalog/10993.html
http://www.ametsoc.org/atmospolicy/ESSS/barker%20Fugro%20AMS%20SW%20Hill%20Briefing%202007.pdf
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THE MAGNETIC FIELD OF THE SUN AND THE SOLAR WIND

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This list is brief in relation to the material consulted. The World Wide Web and Google have made this study possible. There have been many moments of quiet frustration trying to access full articles after seeing just abstracts or citations. Occasionally one hits the jackpot. The links above testify to that. Having authored a few papers I thought useful and been surprised at the deafening silence following publication I would urge all authors to seek publication on the web. The response in terms of feedback is unlikely to be any better but the speed of human progress will be optimised. Forget about the supposed advantages of peer review. I am for free spirited inquiry and thought uninhibited by the need to fit some mould of current opinion. Was it Lord Keynes who remarked that the politician is frequently the slave of a defunct economist? Galbraith it was who coined the phrase 'The Conventional Wisdom' or if it wasn't Galbraith he certainly used the term a lot. Somewhere, sometime we need to look at the big picture and forge a new synthesis. Although I can not thank people by name for the understanding of the atmosphere that I have gained in this search I thank them nevertheless. One resource well worth consulting is Wikipedia. It is a model for information exchange that will carry us far and fast.

A searchable repository of papers, by subject area, available in full via the web, would be an asset to humanity. Google Scholar is a great start.

Appendix 1 from a radio ham who provides an excellent weekly newsletter and is very much aware of the dependence of short wave radio reception on solar activity

From http://www.arrl.org/news/stories/2007/11/16/100/?nc=1

Many interesting emails this week, and one came from Bob Marston, K6TR, of Fremont, California. He mentioned the theory about magnetic polarity of sunspots, and how we expect them to shift as we move into a new cycle. But some time back, a reverse polarity spot appeared, and was hailed by some as the first spot of cycle 24, but it turned out this wasn't the case. Bob says about 3 percent of the spots in any cycle are rogue spots with reverse orientation. What will be significant is when we start to see spots appearing away from the equator.

Bob continued, "The second topic I want to address is the item Carl Luetzelschwab, K9LA, brought up referencing his communication with Mike Keane, K1MK. The 30.4 nm resonance line is the best indicator for gauging the state of ionization of the ionosphere. What I would like to point out is the future of the Solar and Heliospheric Observatory (SOHO). SOHO was originally intended to last a few years when it was launched in 1995 and has lasted four times as long. It has done yeoman's service and done more to increase man's understanding of the Sun than any other space-based solar observatory. But it is getting long in the tooth and in need of replacement. To that end, NASA will launch a replacement satellite observatory called the Solar Dynamics Observatory (SDO). It is currently undergoing final assembly at NASA's Goddard Space Flight Center near Greenbelt, Maryland. Launch date is currently scheduled for no earlier than December 1, 2008 and it is expected to be operational within 90 days of launch.

"The assembly team is in the early stages of construction with the first of three instruments delivered last month. That instrument is the Extreme Ultraviolet Variability Experiment (EVE). It is the analogous instrument to the SEM on SOHO. When you check out the specs of the new instrument, it is readily apparent the jump in capability the new instrument offers over the SEM on SOHO. Unlike SOHO, SDO will be placed into a geosynchronous orbit around the Earth. That is to provide better communications to handle the higher data rate coming from the new satellite. Images that are updated every five minutes on SOHO will be updated once a second on SDO. SOHO orbits the Sun at a Lagrange point, one million miles from Earth. This provides uninterrupted observation of the sun. SDO will have two 90 day periods per year where its observations will be interrupted for a maximum of 72 minutes while it passes behind the Earth.

Bob continues: "You might want to remind your readers, especially the younger ones, that while conditions may be challenging right now they will get better. And the set of new tools coming online in the next year and a half will provide us with the information to exploit F layer ionospheric propagation like never before, regardless of what the sunspot count at the peak of Cycle 24."

Appendix 2

News item at
http://money.cnn.com/news/newsfeeds/articles/prnewswire/AQTH06115112007-1.htm

Lockheed Martin Delivers Helioseismic and Magnetic Imager to Goddard Space Flight Center for NASA's Solar Dynamics Observatory

November 15, 2007: 09:00 AM EST

PALO ALTO, Calif., Nov. 15 /PRNewswire/ -- The Helioseismic and Magnetic Imager (HMI), an instrument for NASA's Solar Dynamics Observatory (SDO), has been delivered to NASA's Goddard Spacecraft Center for integration on SDO, which is scheduled to launch in December 2008. The HMI was designed in collaboration with Professor Philip Scherrer, HMI Principal Investigator, and other scientists at Stanford University. The instrument was built at the Solar and Astrophysics Laboratory of the Lockheed Martin Advanced Technology Center (ATC) in Palo Alto.

(Photo: http://www.newscom.com/cgi-bin/prnh/20071115/AQTH061)

"HMI combined with our partner instruments on SDO -- the Atmospheric Imaging Assembly and the Extreme Ultraviolet Variability Experiment -- will provide us with the data needed to first learn if predictions of solar activity are possible," said Professor Scherrer. "Then, if we and our colleagues in the solar physics community are clever enough, we'll actually develop forecast methods. This is an exciting time for studying the Sun and its impact on the Earth."

The primary goal of the HMI investigation on SDO is to study the origin of solar variability and to characterize and understand the Sun's interior and magnetic activity. Because of the turbulence in the convection zone near the surface, the Sun is figuratively ringing like a bell. By studying these oscillations of the visible surface of the Sun, considerable insight can be gained into the processes inside. In effect the solar turbulence is analogous to earthquakes. In manner similar to how seismologists can learn about the interior of the Earth by studying the waves generated in an earthquake. HMI's helioseismologists will learn about the structure, temperature and flows in the solar interior.

"This is a very satisfying milestone for us, as the delivery of HMI for mounting on the SDO spacecraft brings us a big step closer to having this spectacular instrument in space watching the Sun," said solar physicist -- and co-investigator on HMI -- Dr. Alan Title of the ATC. "HMI will provide us with sonograms of the Sun that will show us sunspots and magnetic fields before they appear on the visible surface. We'll even be able to see through the Sun and be aware of the birth of spots on the side facing away from us, allowing us to be ready for them as they rotate into our view. Moreover, HMI's high spatial resolution and full-Sun coverage will give us much more time to study magnetic field evolution in detail."

HMI will produce data necessary to determine the interior sources and mechanisms of solar variability and how the physical processes inside the Sun are related to surface magnetic field and activity. Because HMI can measure the strength and direction of the magnetic field on the surface, more precise estimates of the coronal magnetic field are possible. In addition, HMI observations will clarify the relationships between internal solar dynamics and magnetic activity, providing a better understanding of solar variability and its effects. The knowledge gained will enable a major advance in the development of a reliable predictive capability for solar flares and coronal mass ejections. The prediction of these violent solar events, how they travel through the solar system and where they are likely to impact is one of the key elements of the NASA's Living With a Star (LWS) program. It is also of critical importance to the NASA Vision for Space Exploration, and a human presence on the Moon.

The goal of SDO is to understand -- striving towards a predictive capability -- the solar variations that influence life on Earth and humanity's technological systems. The mission seeks to determine how the Sun's magnetic field is generated and structured, and how this stored magnetic energy is converted and released into the heliosphere and geospace in the form of solar wind, energetic particles, and variations in the solar irradiance.

The SDO spacecraft will also be a flagship in the Heliophysics Great Observatory, a series of missions designed to monitor the Sun and the heliosphere. As humans venture outward from Earth to the Moon, Mars and beyond their safety depends upon, at least in part, an ability to forecast energetic events on the Sun. Because both people and planets constantly move with respect to the Sun, it is also essential to understand how the energy released by these solar events travels through the heliosphere in order to properly access the impact on space travelers wherever they may be in the solar system.

The Solar and Astrophysics Laboratory at the ATC has a 44-year-long heritage of spaceborne solar instruments including the Soft X-ray Telescope on the Japanese Yohkoh satellite, the Michelson Doppler Imager on the ESA/NASA Solar and Heliospheric Observatory, the solar telescope on NASA's Transition Region and Coronal Explorer, the Solar X-ray Imager on the GOES-N environmental satellite, the Focal Plane Package on Hinode and an Extreme Ultraviolet Imager on each of the two spacecraft in NASA's Solar Terrestrial Relations Observatory. The laboratory also conducts basic research into understanding and predicting space weather and the behavior of the Sun including its impacts on Earth and climate.

The ATC is the research and development organization of Lockheed Martin Space Systems Company (LMSSC). LMSSC, a major operating unit of Lockheed Martin Corporation, designs, develops, tests, manufactures and operates a full spectrum of advanced-technology systems for national security, civil and commercial customers. Chief products include human space flight systems; a full range of remote sensing, navigation, meteorological and communications satellites and instruments; space observatories and interplanetary spacecraft; laser radar; fleet ballistic missiles; and missile defense systems.

Headquartered in Bethesda, Md., Lockheed Martin employs about 140,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services. The corporation reported 2006 sales of $39.6 billion.

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http://www.lockheedmartin.com
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http://sdo.gsfc.nasa.go