

Mega-Life, Mega-Death, and the invisible hand of the Sun:

Towards a quasi-predictive model for the rise and fall of civilisations

Donna Howell, Neil Howell, Irene Howell, Bill Howell

www.BillHowell.ca Bill@BillHowell.ca

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"It is true that from the highest point of view the sun is only one of a multitude-a single star among millions-thousands of which, most likely, exceed him in brightness, magnitude, and power. He is only a private in the host of the heaven.

But he alone, among the countless myriads, is near enough to affect terrestrial affairs in any sensible degree; and his influence upon them is such that it is hard to find the word to name it; it is more than mere control and dominance. He does not, like the moon, simply modify and determine certain more or less important activities upon the surface of the earth, but he is almost absolutely, in a material sense, the prime mover of the whole. To him we can trace directly nearly all the energy involved in all phenomena, mechanical, chemical, or vital. Cut off from his rays for even a single month, and the earth would die; all life upon its surface would cease."

Charles Augustus Young in "The Sun" (1896) page 2

Citation provided by Oliver Manuel to CCNet 21Mar07

Note that this quote is from the same year as Arrhenius's paper on CO2 and the GreenHouse Gas effect!!



"Comox Potlatch II"

Neil Howell

This document is intended mainly as a reference and as an evolving working document. It is not written as a clear, simple and easy read. That will come later, if ever.

...fun and speculation, with a sprinkle of blasphemy, very incomplete...

At present, there are more gaps, blurs and loose ends than content in this paper.

Given the grandness of astronomy, then geology, then life, then history,
maybe it can only remain that way.

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Dedicated to the memory of Donna Rae Howell, 1952 to 1991

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version 0.1 (version 0 is the initial framework, incomplete conceptually, many gaps)

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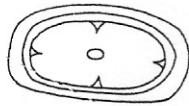
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Michael D. Coe, 1980
Mayan Sun God K'inich Ajaw



I. Introduction

This is an overview of a conceptual model "Butterflies in the Clouds, and Milankovic wandering of glaciers and greener pastures" that my father and I are developing to complement existing theories for the rise and fall of civilisations, and for a number of loosely associated processes that are broadly grouped as:

Mega-Life new societies & languages, population and wealth explosions, evolution of higher-level personal aspirations, advances in architecture, arts, sciences, engineering, management, politics; and

Mega-Death collapses, population decimation, 7 horsemen (floods, drought, pestilence (plagues, locust swarms, crop diseases, etc etc), famine, earthquakes, and the societal restructuring/renewal that goes with catastrophes)

Our hypothesis is that the combined effect of the predictable and chaotic components of solar activity, galactic rays, and Earth orbital parameters create short term shocks and longer term trends that can dramatically increase the probability of the emergence or collapse of civilisations, or can affect other major events and trends in civilisations. These shocks and trends result in:

- **a loose correlation between changes in different civilisations in different geographical areas** - Typically, big changes will occur for geographical regions that transition between important climatic states, such as desert & grazing, marginal agriculture to vast abundances, or very short growing seasons in cold areas to high productivity, more stable production with warmer temperatures for more of the year, or even a loss of productivity because of excessive humidity & heat. Shocks may affect other regions without disrupting them unduly.;
- **different timing for the effects in different geographical areas** - due to different "lag times" for various intermediate mechanisms such as regional glacial coverage and ocean current "memory" of past climatic conditions;
- **Mega-Life and Mega-Death**, as described above, either as shocks or trends.

For example, the "interregna" ("times of troubles") at the end of the Egyptian Old Kingdom, the Harrappan late ??, and the ?Sumerian? civilisation occurred within ?200 years?. All 3 regions were hit by extreme droughts, as their geographical-climate situations were presumably similar, whereas more northerly neighbors seemed to benefit from the trends and perhaps even the shocks, and the ??? civilisation in China was just starting.

An assumption of this paper is that galactic ray variability astronomy, geology, and evolutionary biology have a far greater role in the fortunes of civilisations than currently recognized, even though that was probably crystal clear to the first civilisations. And while their effects may have been attenuated since the time that they were among the greatest challenges of early civilisations, they are far from being insignificant. As an example, keep in mind that our sun is an especially stable (perhaps relatively boring) main series star, and should one day it behave even momentarily like some of its relatives are occasionally wont to do from time to time, we shall disappear in an instant!

There is absolutely nothing new in a general sense in our hypothesis - most of the core concepts probably all date back at least 5,000 years, albeit not in the same context nor with the same scientific sophistication available today. In a sense, our hypothesis is merely a call to re-incorporate knowledge that the ancients understood so very well, but which we seem unable to grasp in spite of our education and vast army of sages. (That's a completely different hypothesis in the making: Note 1.)

It seems unlikely that this effort is unique - there are probably hundreds of researchers looking at the exact same theme at the present time, all over the world, and many will have additional insights and data, not to mention emphasis. After all, to some extent this ties into a huge amount of Climate Change research in many of the same areas. A popular example is the book "Collapse" by Jared Diamond, in which you will find many of the concepts in this paper, but strangely it seems to us that his concepts are often portrayed in a reverse-causation arrangement so common to environmental and health themes. A much better example that encompasses to a far greater extent the objectives of this paper, and which is actually a prototype for work of its kind for the future, is Soon & Yaskell's book "The Maunder Minimum". Their book describes the context before, during, and after the Maunder solar minimum (referred to as a "freezer" in this paper) from approximately ?1645 to 1715? (plus or minus), and for societies and geographies right around the world. Hoyte and Schatten's book "The role of the sun in

climate change" is another excellent reference.

Recent information and concepts come from scientists who continue to throw light on the subject:

- Jacques Laskar and collaborators, Paris Observatory - solar insolation programs on the web
- Sami Solanki, ?Max Plank Institute?, Germany - Holocene epoch sunspots based on 10Be and 14C
- Ken Tapping, Nat'l Research Council of Canada, Penticton - he has been the leader of the Canadian solar physics revival (or attempted revival, we'll see if Canada kills its solar physics capability as part of a general trend to slip back into an new dark age of politically correct science).
 - sunspots -> F10.7 -> total irradiance relations
 - TMS theory of solar phase correlation with global influenza pandemics since 1700
- Nir Shaviv & Jan Veizer - Israel & OttawaU - galactic rays and climate over the Phanerozoic era (the last 570 My)
- Paul Charbonneau, Uof Montreal - solar modeling, and a univariate chaotic model
- ?? Absudamov, Russia and David Hathaway, NASA - solar minimum coming?

For lack of time, this draft version does NOT include concepts from many, many others including:

- David Boteler - geomagnetics, the intrinsic versus extrinsic components of the geomagnetic field
- Julio Valdes, - Computational Intelligence tools for advanced statistical/ modeling tools for highly non-linear, chaotic, discontinuous and non-stationary systems;
- David Thomson - Advanced classical statistical/ modeling tools for highly non-linear, chaotic, discontinuous and non-stationary systems; frequency splitting between driving and driven systems with non-linear couplings; seismic link to solar activity
- James Kelly, Cambridge University - material properties in the outer core of the Earth (extreme Poisson ratios), and the possibility that the outer core is solid, and that we need totally different theories for geomagnetism (the geologists don't like this idea!)
- Missing sages - geographers, historians, and archeologists. We haven't yet been successful in involving/entrapping people from these areas, as the work was at too early a stage, and our targets ran away.
- Wikipedia-like approach to research - this may be crucial to "opening up" the theme to everyone who really wants to participate.

For some reason, most of us focus on the downside of everything (Mega-Death), but this is clearly a skewed and incorrect view of history. The much bigger story is the upside (Mega-Life) - the cumulative effects of triumphs and progress. The future belongs to those who cast aside the imprisoned thinking of the polyannas, and who decide to cast aside their constraints and customs, and who seize the opportunities that life and times present (and of course - only some of these people - notably the ones who guess right and who lead and implement effectively). If I remember correctly, this is one of the central themes from the historian Arnold J. Toynbee.

While much of the content in this paper relates to galactic rays, solar activity, Earth orbital parameters, climate change and agriculture, please keep in mind that these are not the only drivers, mechanisms, and effects related to natural systems and people. For example, allusion is made to the direct effect of solar and galactic radiation/ particles in the sections on pandemics and space weather forecasting. But there is likely far more beyond that to discuss. This paper is just a start, so keep in mind a much broader context of astronomy, geology, and evolutionary biology when you are thinking about these issues.

Finally, it may be strange to hear that the theme of this paper is really a very small portion of a much greater theme - that of astronomical influences over all of life's evolution from its origins to the present [Wickson 2006]. In Wickson's work, galactic rays are again a central theme.

II. The Concept - "Butterflies in the Clouds and the Milankovic wandering of glaciers and greener pastures"

Astronomical Signatures in Historical Trends and Events (geology, evolutionary biology in future versions)

Believe it or not, the clumsy title for our concept is intended to make it easier to remember! "Butterflies" refers to the chaotic or unpredictable events and behaviour of the astronomy/ geology/ biology drivers of climate and other systems, and this hopefully reminds people of the popular expression "Butterfly Effect" for chaotic systems. For example, a popular and bad illustration is that a butterfly flaps its wings in an Indonesian jungle and causes a hurricane in Miami. Unfortunately, that bad example seems to have de-stabilised the thinking of many if not most scientists, whereas it is really important that scientists better understand this component of complex system behaviour.

The butterflies are "in the clouds" to emphasize the role of galactic rays on cloud cover, modulated in part by the chaotic solar variability. Galactic rays are also modulated by predictable, longer term trends.

Milankovic cycles are of central importance over the Holocene epoch, and for glaciations extending back over a million years (actually back to the beginning of Earth time). Milankovic was a Serbian scientist who calculated the parameters for these cycles in the early 1900's, and it is very important to remember his name and the effect. "Greener pastures" refers to geographical zones of very high agricultural surpluses, and part of the concept is that these wander in latitude, altitude, and geographical region according to solar insolation and the "climate reservoir" provided by ocean currents and glaciers, both of which have a "memory" of tens or hundreds of thousands of years respectively.

Detailed descriptions follow.

1. Wandering through the Spirals of the Galaxy

Our solar system apparently bobs in an out of the plane of our galaxy, the Milky Way, with a periodicity of approximately 70 million years, and additionally it wanders in and out of the spirals of the galaxy something like every 70 to 140 million years. This exposes our solar system (the sun plus its planets and asteroids etc) to greater and lesser amounts of very high energy galactic rays which originate from distant galactic events like super novas, quasars, and possibly a black hole. These events occur more frequently near the center of the Milky Way, and the galactic rays include much higher energy radiation/ particles than those produced by our sun.

Since the 1950s (ref) it has been shown that variations in galactic rays arriving at the surface of the Earth are correlated to cloud cover when averaged out over several months. Cloud, of course, has a huge effect on climate through the reflection of incoming solar radiation, and probably through trapping of some of the re-radiated energy from the Earth's surface. Even a few percentage change in cover would be expected to have a significant climate effect, and this seems to be confirmed by climate studies (or are the results still coming in?). A recent series of experiments will soon show (or not) a

direct experimental physics basis to the theory (?Svendsen? etal).

Extremely important recent work by Shaviv and Veizer has shown that cloud cover variations caused the our solar system bobbing up and down through the plane of the Milky Way, and wandering through its spirals could explain the BIG temperature swings that have occurred during the last 570 My (Million Years), or Phanerozoic era, as illustrated in Figure 1. As the supporting data is limited there is still considerable uncertainty in the model, but there are no alternative theories at present for the major temperature swings during the Phanerozoic era.

Furthermore, there is increasing evidence that galactic ray exposure, modulate by the magnetic fields of the Sun and the Earth, best correlates to climate changes at all time scales (more of that in several later sections). That includes the Modern Warm period (1850 to present), with possible exception of the last 10 or twenty years (comments by Veizer). In other words, as pointed out in Appendix 1, there may not be anything unusual about recent climate change.

So why are we discussing climate trends over 570 My, when the focus of this paper is the Holocene epoch, which is only the last 11,000 years? Because:

- its nice to start at "the beginning";
- galactic rays appear to have an important influence over all time scales; and
- the "long-term predictable" component of a factor is often extremely important to confirming or understanding "short term random or chaotic" variations that occur in the factor; and furthermore
- comparison of recent glaciation periods with those in the distant past (when CO₂ was 10 times or more than current concentrations!) may help to shed light on current trends and possibilities.
- a larger context helps us to avoid errors from myopic thinking, for example throwing out key variables.

Is the galactic ray theory for climate change true? It certainly looks very good based on the limited data and the coherent analysis available to date, but its always best to be aware that theories come and go. At least it is not yet a science fashion, but perhaps there is a chance that Star Trek maniacs could turn it into a cult. And who could blame them? It's sheer fun as a concept!

2. The Milankovic wandering of glaciers and greener pastures on Earth

Figures 2 & 3 (Milankovic cycles and glaciation over the last ~3/4 My),

Figure 3

Glaciations over the last 1 million years seem to relate best to eccentricity, more than the total insolation (Figure 4), whereas from 1 to 3 My ago, it was apparently the precession signal that related best. It isn't known why.

However, as shown later in Figure 8b (Annual average solar insolation over the scale of the eleven plus thousand years of the post-glaciation Holocene epoch that encompasses all civilizations, but shown for the Mayan latitude) over periods of several hundred years, the regular, predictable effects of the astronomy on climate change in a slight and continuous manner that is swamped by turbulent short-

term climate changes and shocks. Perhaps for that reason, the importance of the regular, predictable astronomical changes for civilizations are extremely under-appreciated even by modern scientists.

Figure 5 shows the relatively large changes in solar insolation that occur for certain months of the year. So even if the total annual insolation is relatively constant, its distribution between the seasons can change dramatically.

So when it comes to explaining the rise and fall of your own civilisation, the nice, regular changes due to Milankovic cycles will be "invisible". But one of today's themes is that the Milankovic forcings are very large and important for the fate of civilisations, and we'll later present a concept that puts the overall geographical shifts of the centers of civilisation into perspective.

3. Butterflies in the Clouds

There is an "unpredictable" side to solar variability over short-term timescales of seconds to thousands of years. As shown in Figure 6, the most obvious and well-known are the sunspot cycles (Hale half cycle of 8 to 14 years - average 11 years, Schwartz ~22 year full cycle), during which the magnetic pole of the sun flips. Notice the beautiful "butterfly-like" pattern for the sunspot occurrences when plotted by latitude and time. This was discovered by the British scientist Maunder in the 19th century, and I'll draw a metaphor from this effect later on.

A second well-known "unpredictable" component of short-term solar variability are the solar minima, as shown in Figure 7. Best described by accounts of the Maunder minimum from ~1645 to 1715, rapid, drastic changes in climate can occur. One expects the effects to vary drastically from one geographical region to another, beneficial to some societies, but also a terrible blow for other societies. Possibly the effects will be most noticeable for geographical regions at a "climatic borderline" that can "tip" easily one way or another. Figure 11 shows how the independent analysis of temperature (ice core) and solar (sunspot) time series indicates that phase changes in both system tend to occur at roughly the same time.

A third unpredictable component are short-term variations in galactic rays that aren't accounted for by solar variability. But I don't have a data series for that. Nor will I get into the apparent "changes in phase or state" of the sun that might occur, judging by the behaviour of the sun itself and other stars. We really don't know very much!

4. Relative importance of Solar variability, Galactic rays, and Milankovic trends

5. Missing Drivers

Our personal conviction is that a HUGE driver of history, and indeed perhaps even the dominant one, may some day prove to be evolutionary biology as it specifically relates to the human brain and what is in it. Simply put, people drive history one way or another, and our minds have likely evolved far faster than we can imagine, and not just through straight biology. For example vastly more comprehensive education and knowledge/ skill development is passed around the world, and allows for extremely rapid

learning/ adaptation that we take for granted, and it is . Furthermore, hybrid human-machine systems will likely become far more powerful in the future (even though they have already transformed our society to date!), and these will break through limitations of human intelligence and complexity of thought. . These statements clearly go beyond any solid data , analysis or theory currently on hand, but they are still worth considering. Although this theme is not elaborated in this paper, initial thoughts that form part of a basis for thinking in this direction can be found in [ref ??].

Evolutionary psychology appears to be making some headway, which is a bit surprising given the virulent attacks against earlier forms of the concept such as ?socio-biology?. It takes time for ideas like this to become acceptable to mainstream scientists. Another danger is the rampant mis-interpretations, suppositions and scientists' belief systems that are biasing the interpretations. I suspect that very few of the scientists would be strong in very simple, basic evolutionary theory as illustrated by Evolutionary Computation in the field of Computational Intelligence. Quantitative results are very often completely counter-intuitive or non-intuitive, and there seems to be a complete lack of real analysis in many of these areas. Given the continual and ongoing fiascoes associated with the General Circulation Models in Climate Change (a vastly more simple style of analysis from a conceptual point of view!), one should be very careful of believing any of the results, as they will most likely be the result that people have been trying to generate, rather than being related to reality in any great way. However, we also should be enthusiastic for the long term prospects of these tools, and hopefully credible scientists will emerge over time.

Apart from the obvious omission of a quantitative effect of galactic rays (probably our first attempts will involve a simple leveraging factor!), there are many, many aspects to the astronomical, geological, and evolutionary biological drivers of climate change. Clearly the geological and biological drivers aren't covered in this draft version.

Preliminary research has suggested that high-level clouds respond to solar plasma winds [ref. Prikryl], and that intense extra-tropical weather events tend to occur within a few days of the arrival of a high-speed solar wind.

It is vastly over-simplistic to represent solar influences only by the total irradiance, as different parts of the sun's spectral band behave quite differently. For example, the ?ultra-violet? portion of the band has a variability on the order of a factor of two, as compared to only 0.1 % for the total irradiance [ref??].

It is also assumed, and it is the implicitly assumption in this paper, that components of solar activity vary in harmony, but while that may be a reasonable first assumption, it is the type of assumption that has gotten us into trouble so often. For example, the primary basis for this entire paper is that the small ~0.1% variability of total solar irradiance is a key driver for climate and civilisations, something that has been ill-appreciated by the vast majority of the scientific community.

For a quick comment about evolutionary biology and the mind, see the introduction.

Geomagnetics

6. The Bigger Picture

Figure 8 shows two views of combining the predictable Milankovic effects with the unpredictable sunspot effects, taking into account ONLY solar insolation for a given latitude on Earth. It is clear from the results that regional insolar insolation is dominated by Milankovic effects. On the other hand (refer to Figure 2 again), it is also clear that Milankovic cycles are not the whole story. Here is where galactic rays come in. As a "highly leveraged" driver affecting cloud cover and perhaps other processes, one might expect that the "unpredictable" sunspot driver would have a relatively larger effect on climate than insolation alone would suggest. Furthermore, galactic rays can themselves vary independently of solar activity, and these movements may not appear in the data shown.

When looking at a large-scale time-line of history (Figure 9, but see my website for a much larger and more clear updated version), I am reminded of the solar insolation effects in two ways:

a) Mega-Life and Mega-Death events, here mostly indicated as the rise and fall of civilizations, seemingly occur with greater frequency during solar minima, and perhaps solar "maxima". (Lesser shocks (positive and negative) of many types, including pandemics, droughts, floods, locust swarms seems to correlate somewhat (but not entirely) with the ~11 year sunspot cycles, as we'll see in the next section. I haven't yet worked on architecture, the arts, science etc. but expect to see some of the same loose, apparent connections (again, the sun isn't a primary driver!).

Solar minima seem to typically last a couple of hundred years, but the recent Little Ice Age appears to have occurred over something like 800 years, with a couple of "scorchers" to break the routine. Solar maxima ("scorchers") seem more often to last only a few decades. However, with the chaotic behaviour during the Holocene, any kind of simple description or classification approach is suspect, other than tools like Charbonneau et al's chaotic "simulation" that reproduces the characteristics of solar activity. Most of us weren't educated in the formal analysis of dynamic systems, let alone chaotic systems, so our descriptions likely fall far short of the mark.

b) Civilisation/society dominance and leadership among early agricultural-based civilisations, seems to drift with the predictable, Milankovic component of solar insolation, either by latitude, altitude, or other geographical features that determine regions of agricultural and forestry fertility. Not too hot nor humid, not too cold nor dry. This is reminiscent of the sunspot butterfly diagram, but of course this applies to the predictable Milankovic changes over the Holocene epoch (as opposed to the unpredictable sunspot behaviour). Of course, the unpredictable short term trends and shocks can cause a reversal of the Milankovic trends (as with the Viking die off in Greenland).

What is really needed here is a geographical model for solar-climate variability. General Circulation Models (GCMs) as used in climate change studies, may ultimately provide a framework, but these models are currently unreliable and misleading for anything except the extremely short time-frame of less than a few weeks. A better approach would be to stick with regional models tied into global drivers (astronomy, geology) and geological/ historical data.

III. Shocks and Trends

In this sections, "shocks" refers to rapid changes that occur over a few hundred years or less, and which can be very beneficial, detrimental, or neutral for a society or civilisation. As stated elsewhere, for some reason we focus on the catastrophes, but the benefits and positive aspects are actually far more important over the course of history.

You'll notice that we haven't actually elaborated on most themes that are listed. That will have to come with time!

A. The bright side of shocks and trends - Listing only of some, but not all, of the themes to date (obviously there's been a lot of thinking and not so much data analysis nor writing):

1. Bountiful surpluses
2. Architecture and arts
3. Mathematics, science
4. Political advances
5. Personal aspirations (escape from poverty, war etc; education; good job; standard of living; travel; hockey; personal aspirations; spiritual; etc, etc)

B. The hard side of shocks and trends - Only pandemics and droughts have any detail at present.

1. Pandemics - The cleansing of our sins, the promise of the future

This whole paper is really based on extending the Tapping, Mathias, and Surkan (TMS) theory of solar influence over global influenza pandemics since 1700 (ref). That theory shows an association between the incidence of pandemics and a certain phase of the solar cycle, as illustrated in Figures 10 through 12. Figure 10 shows that, as one would expect, pandemics occur irrespective of the phase of solar activity. However, the solar signature is surprisingly high. Why would the risks of a world wide pandemic be over twice as high in one phase of solar activity compared to lower-risk periods? Other datasets (unpublished, but with not quite as high a confidence level) may indicate an even higher risk.

Moreover, dynamic and solar-pandemic phase analysis has not even been tried, and this appears to be a key question posed by Figure 11. Why are some solar cycles skipped? Is this just a random thing, is it dependent on the solar-climate phasing, or is it dependent on other dynamics?

The "skipped cycles" issue is especially interesting right now, as Figure 12 shows that the last two solar cycles were "skipped by influenza", so:

- has modern medicine and technology conquered the pandemics, or
- is the ~2010 peak period going to go badly, or
- is the oncoming solar cycle, expected to be the second highest in at least 120 years and perhaps in 8,000 years, going to effectively prevent any pandemic from occurring?

We'll find out soon enough, but my assumption is that the strong reactions that we've seen in recent years to stamp out potential sources of pandemics, together with the high temperatures of the solar-

driven Modern Warm Period, do not favor a pandemic anyways.

Whether the sun-pandemic correlation is causative isn't really known yet, and it is still possible that the apparent relationship is a chance occurrence, although it is significant in a statistical sense. So the discussions above should not be taken as meaning that a causal link has been established.

If one does assume that the relationship is causative, then why? The most obvious potential link could be the indirect role of the sun as a primary driver of climate changes, and the disease-climate linkage is a very intensive area of research and a key activity of climate science. That may provide much of the basic information needed, albeit for a theme in direct contradiction to the CO₂ based thinking upon which the research is justified. However, another sun-pandemic link could be the solar magnetic field modulated variations in high energy (galactic) and lower energy (solar) radiation/particles. ?Aussie physicist? seems to have established a link between UV and non-melanoma skin cancers. Another TMS concept is the possible effect on the immune system, and "evolutionary epidemiology". In other words, perhaps there is a strong evolutionary advantage to having occasional epidemics of higher virulence, followed by relatively quiescent periods of more peaceful co-existence between disease and host.

Of course, it is inappropriate to jump to too many hard conclusions on mere associations, but it is even worse to totally ignore data, especially when alternative theories are less well based.

Other diseases have been looked at in a very preliminary fashion, without statistical analysis (see Howell "Ring around the rosies"). There are strong "visual indications" on the basis of extremely limited data that malaria, the bubonic plague, and cholera have a "solar signature", but not so much smallpox (although perhaps due to a lack of data). Measles and a couple of other diseases were recommended subjects of study, but nothing has been done for them.

As far as cancers are concerned, preliminary searches didn't find anything beyond the Australian solar UV - non-melanoma link, but others may have already worked in this area. One interesting parallel is the concern over air crew exposure to circum-polar flights, especially during periods of peak solar activity (coronal mass ejections etc). Apparently, Lufthansa may have even implemented precautionary grounding of pregnant stewardesses even though there may not be convincing data of significant effects on the crews.

But while we're on the subject of pandemics, Figure 13 is a very interesting illustration of the use of "virtual plagues" for evolutionary computation approaches to the solution of complex scientific and engineering problems that are "too difficult" for classical methods. The virtual plagues wipe out most of the population (we'll call these "solution agents" for simplicity, even though they're not "agents in the normal computational sense). The improve effectiveness of populations for finding solutions can be significant, and it makes one think if human disasters naturally accomplish the same thing! (At least there is some good that comes from the depths of despair?)

There is much more to "Mega Life" and "Mega Death" than just pandemics as discussed in this section, but preliminary work has not been pulled together for locust swarms, crop diseases, floods, droughts, and natural factors that drive huge increases in agricultural productivity. And major campaigns of conquest are also of interest. These are for ongoing research.

2. Droughts and "desertification" -

?????Note that this is also a major initial theme to elaborate...

3. Floods and "excess humidity & precipitation"

The immediate theme that comes to mind here is that we can't think of any major civilisations that arose in the Congo or Amazonian tropical rainforests. Are there any examples of a collapse of society because of increase "temperature and humidity" to the point where productivity collapsed? Perhaps the Mayans, Kymer (Angor Wat)? Perhaps some of the early African societies?

At least one comment (Jared Diamond's Collapse) is that the maximum corn storage time was drastically reduced in the more humid areas. Another very intriguing, but unsubstantiated theme is the "Air conditioner theory for foreign aid", as described in the "Crazy Ideas" section.

In colder regions, extensive marshes may be slow to develop. In extreme heat and humidity, there is the additional question of how well the human brain works, and we do see work habit adaptations to mitigate the oppressive climate. (At least, that' my guess for now - based on noon-hour siestas, night work, and what else???)

4. Pestilence and disease (crops and livestock)

a) rot, rust etc

b) locust swarms - This seems to be a natural fit to solar activity, but we haven't done our homework!

5. Geotechnical risks - earthquakes, tsunamis, slides, and volcanoes (need Thompson's input!!)

6. Wars of Affluence

Most of the major military conquests seem to have been "affluence driven", rather than being driven by desperation. An explosion in agricultural surpluses, population, and power, together with breakthroughs in military technology (materials, strategies, logistics etc) seem to provide a basis for projecting power over adjacent societies/ civilisations. The unification of Egypt, Macedonian campaigns, Phoenicia, Roman Empire, Viking swarms, and even relatively recent European conquests seem to fit into that category (along with many other examples!!).

However, an analysis will have to wait for later... to tie this to the theme "Butterflies in the clouds and Milankovic wandering of glaciers and greener pastures".

7. Wars of desperation

Are there any examples of this? Did Atilla the Hun, Gengis Khan, have to invade to survive? We have no information to support any examples yet. (time to do this is the problem, plus a lack of historical, archaeological knowledge).

8. Angst and desperation

A loss of pro-active attitude seemingly can accompany demoralisation due to shocks or long-term downtrends. No detail yet... as related to the theme of this paper.

IV. Civilisations, adaptations, and the Sun

Part of the purpose below is to delineate some of the adaptations, successful or otherwise, of societies in dealing with the shocks and trends as related to astronomical influences (geology and evolutionary biology have not yet been addressed in this draft). But a basic starting point is the realisation that, judging by history, no matter how well prepared our civilizations have little hope of leaving us totally unscathed by hiccups in the sun's behaviour, nor with its more gradual trends over time. And if our sun was ever to behave as most of its brethren...

- 1. Agricultural techniques**
- 2. Food preservation and storage**
- 3. Irrigation and diversion of rivers**
- 4. Trading patterns**
- 5. Space weather forecasts**

V. "Butterflies in the Clouds": Scorchers, Freezers, Smoothies, and Rocky Roads, and their imprints on history

In this section, the major apparent solar chaotic short-term events are described in terms of the influence they may have had on civilisations of the time, or even how anticipated events in the future might affect our societies and future generations. The emphasis is on the relatively short term (decadal to several centuries) solar events or "behaviours", and to describe how they may have influenced civilisations. The actual time periods are listed in Table "Civilization dates" in the Appendix, and that list is not complete. Nor for that matter are any of the analysis in this section!

As mentioned in the section "Comparison to major theories for the rise and fall of civilisations", **Willie W-H Soon, S.H. Yaskell's "The Maunder Minimum and the variable sun-earth connection"** is the key book that we are aware of that established the "sun-centric" analysis of historical periods across civilisations and geographies. Because it already covers the Maunder minimum (~1645 to 1715) in great detail, and in a manner we cannot match even for other periods, only a very summary description of that "freezer" is given in this paper. Readers are strongly encouraged to read that book to see how an analysis across civilizations and geographies around the world can describe co-incidental shocks and changes affecting the course of history.

"Scorchers" refers

"Freezer"

"Smoothies" -

"Rocky Roads" - describes periods of ongoing, large changes in solar irradiance. Typically these
Most of these

1. Mid-Holocene epoch, just as the solar insolation was bottoming out

Prior to the rise of the first primary civilisations (Egyptian, Mesopotamian, Indus valley) we can see very "violent" solar events and behaviours.

-8300	-8150	freezer
-7910	-7650	smoothie
-7610	-7400	freezer Dikpati - ? Dikpati, National Ctr for Atmospheric Research, Colorado
-7240	-7200	scorcher
-6400	-6320	freezer Laskar - Jacques Laskar, Paris Observatory, France
-5930	-5650	smoothie
-5440	-5195	smoothie
-5090	-4900	smoothie
-4670	-4480	smoothie
-3545	-3220	rocky Clark - Ian Clark, geologist, Uof Ottawa

-2960 -2810 freezer Covington - ? Covington, solar physicist, Natl Res Council Canada
 -2810 -2600 smoothie
 -2600 -2450 rocky
 -2320 -1990 rocky Patterson - Tim Patterson, geologist, Uof Ottawa
 -1470 -1350 freezer Baliunas - Sally Baliunas, solar physicist, Harvard
 -1330 -970 smoothie Lomberg - Bjorn Lomberg, Netherlands something
 -870 -695 freezer Solanki - Smai Solanki, Max Planc Inst, Germany
 -690 -420 smoothie McIntyre - Steve McIntyre, statistician, Guelf University, Canada
 -420 -305 freezer Tapping - ken Tapping, Natl Resrch Council, Canada
 -210 175 smoothie
 200 285 freezer Soon - Willie W-H Soon, solar physicist author of "The Maunder minimum"
 520 880 smoothie
 930 1080 freezer (minor) Oort - ??
 1080 1260 smoothie
 1270 1330 freezer Wolf
 1330 1380 scorcher Clark2 - Brad Clark, Uof Southern Queensland
 1380 1550 freezer Spoerer - ?? Spoerer, ??
 1550 1625 scorcher
 1625 1720 freezer Maunder - ? Maunder, solar physicist, London Observatory?, UK
 1720 1790 scorcher Paillard - Didier Paillard, ?climatologist?, France
 1790 1825 freezer Dalton - ?? Dalton
 ~1970 presentscorcher Modern Warm Period
 2035 2125 freezer Absudamov-Hathaway
 ~2300 ~2350 freezer Charbonneau - Paul Charbonneau, solar physicist, Uof Montreal

V. The "Milankovic wandering of glaciers and greener pastures" and its imprint on history

Essentially, the "Milankovic wandering of glaciers and greener pastures" refers to the drifting of the major zones of agricultural surpluses according to latitude, altitude, and other geographical factors over the Holocene epoch. An extremely important associated trend has been the gradual retreat of Northern hemisphere ice caps and glaciers, and the uprising of land no longer burdened with up to 3 kilometers or so of ice. The best theories for glaciations during the "???" geologic period from 3 My to present, is that these are driven primarily by astronomical (Milankovic) cycles. Figure ?? "Milankovic insolation cycles and 1 My of glaciations" and Figure ?? "Paillard's Milankovic threshold model for 1 My of glaciations", show just how well very simple glaciation models based on Milankovic cycles work. Paillard's model incorporates the ice volume buildup and melt in a surprisingly simple and effective glaciation model.

Strangely, although Milankovic cycles are smooth and predictable, climate changes in the 1 My record undergo huge, abrupt changes, in particular at the end of a cycle of glaciation when temperatures "crash up" from their lowest point and rise "immediately" (in geologic terms) to the maximum of the cycle. The geologic record shows that abrupt climate changes are common. So it's quite possible that abrupt climate "events", especially on the regional scale occur often but NOT as a result of solar variability as described in the last section.

I do not agree with Paillard's over-emphasis on CO₂'s role in the "crash up" of temperatures at the end of glaciation. It is inappropriate to consider GreenHouse Gas (GHG) effects without first analysing water vapour's role as the dominant and most highly variable GHG. CO₂ is a relatively minor gas with low variability, and unfortunately the current science "fashion- cum cult - come religion" leads to inappropriate and partial analysis. I think that while CO₂ may play a role, I suspect that it is simply a lagging function of the temperature with only a minor or insignificant impact on trends, and especially on the turning points. Even water vapour, as the dominant and possibly most variable GHG (methane is another contender for the most variable, but it is much less important as a GHG) might be in the same situation. But here are our guesses without any work in them:

- water vapour - rapid change
- "dirty snow" - once there is a net melting of glaciers, there will likely be a large effect on albedo and heat transfer even from thin dirt/ dust/ ash covers. This could be exacerbated by huge dust storms from fine, drying glacial tills as glaciers retreat.
-

Clearly, glacial distributions will dramatically affect temperatures and precipitation for the world, and for specific regions. But we have not yet looked on the internet for specific models of the de-glaciation process over the Holocene epoch, but surely they must be on the internet. Paillard's model is global in nature, whereas regional information is essential for history. For example, the rise of the Vikings may have been possible only some time after major glaciers retreated and the climate allowed a significant society to develop (but that is conjecture at this point).

Although the Milankovic cycles (described elsewhere in this paper) are predictable and smooth, solar "events and behaviours" as described in the last section can overwhelm and reverse these trends, making them even more difficult to pick out from historical information. In other words, while solar "freezers and scorchers" have an obvious and identifiable historical impacts as described in the last section, "smoothies, and rocky roads" as longer term solar behaviours are perhaps more difficult to analyse. However, even they are very short-lived as compared to Milankovic cycle trends, and for that reason we suspect the effects of the latter are grossly missing from historical accounts other than the occasional reference to post-glacial warming trends.

What are some examples of this? The current transition from the Little Ice Age to the Modern Warm Period should be the most accurate and plentiful source of examples, but perhaps it is too convoluted with industrial and technological changes, and our own belief systems may prevent us from properly judging the results.

The Medieval Warm Period - Little Ice Age transition may be the safest source of examples.
Easter Island, the Vikings in Greenland (and their overall dominance)

As the theory of galactic rays and cloud cover is relatively recent (since the mid-1900's?, but really being developed since the early 1990's), and as it seems to best account for climate changes (in combination with other drivers), one can expect further significant developments related to the effects of galactic rays on civilisation, either through climate change or other direct (eg cancer) or indirect pathways.

These points are the central theme of our concept, and we can't help thinking that we are missing other major themes.

Examples of Paillard-like abrupt climate impacts on history resulting from smooth Milankovic trends:

V. The Prophecies of the Sun

So what awaits us in the future, for our lives, the lives of our children and grandchildren, and for a million years to come? All of the comments below assume that the solar behaviour will resemble the "recent past", but there is certainly no guarantee of that!!

Short term weather forecast to 2100 - Solar physicists Absudamov and Hathaway have commented on the possibility of a major solar minimum starting somewhere in the 2020 to 2050 time-frame, but keep in mind that these scientists are acutely aware that any forecast of solar activity beyond the next Hale half-cycle is very iffy. Eventually, there will be another solar minimum, but exactly when and how severe is another question. Some feel that the 8,000 year high in solar activity over the last 50 years may give rise to a particularly severe and prolonged minimum.

An interesting question is whether our advanced society is robust enough or insulated enough from climate shocks to weather the solar minimum comfortably. We'll have to wait and see! But the two examples discussed earlier leave some doubt as to how well insulated we will be:

- the solar signal in influenza pandemics; and
- the Kondratieff cycles of investments.

Ultimately, the work of Dikpatie et al at NCAR in Boulder Colorado, and especially of Paul Charbonneau and team at the University of Montreal, is the type of effort that is critically important to developing an understanding of the sun and to make forecasts of how the sun may behave in the future. Its effect on climate is the subject of the French Picard Mission (and hopefully a Canadian component of that initiative). Pulling together information from climate change studies like Picard may help illuminate sun-civilisation links, but what we really need to do is shift a big chunk if not the majority of climate funding to the study of the astronomy/geology link with climate and other important influences on civilisation.

Mid-Term forecast (10ky) - Some researchers (eg Ruddiman) have commented that the descent into the next ice age should occur right about now, while at least one other (?name?) has suggested that the next won't occur for another 650,000 years! By looking at the bottom part of Figure 4, it seems that temperatures tend to "crash up" at the end of a glaciation period, and "dipsey-doodle down" as the Earth slips into an ice age. Perhaps this is due to the combination of temperature stabilization by extensive glaciation dissipating rapidly as the major temperate regions "break free", somewhat as happens every spring when temperatures skyrocket as the last of the "main" snow cover melts away. By looking at Figure 4, your guess about the onset of the next glaciation may be as good as the specialists. At the very least, one should never shy away from working with the data and analysis with whatever tools one can muster - it gives you a more critical vantage point for judging scientific work, and you will probably learn something and have fun at the same time.

Long term forecast (to 1My)- Astronomical factors that will affect our climate and perhaps other systems include:

- predictable Milankovic (incl lunar), galactic & other "cycles"
- chaotic astronomical variability (solar, Milankovic, galactic), interaction with the stars

- random events - meteorite impacts over the next 1 My
- the unknown - what really is going on under our feet? (geothermal and geo-magnetic)

However, over timescales of a million years, one really has to be worried about the changes that have occurred in the last 2 to 8 My, and whether whatever mechanisms involved will induce quite different results in the future.

VI. Comparison to major theories for the rise and fall of civilisations

1. Arnold J. Toynbees themes of "successful challenges and responses" and "resting on one's oars", mixed with a better description of how and why we develop dysfunctional and/or dishonest and/or delinquent belief systems, and how to destroy these, sees to me to be the best avenue of pursuit to combine with the astronomy/geology/evolutionary biology and climate theme. Toynbee's major "Study of History" seems to include detailed descriptions of the environmental themes, in a very balanced way. It also covers many of the other dominant drivers in a thorough manner.

Given that I read most of Toynbee's work 30 years ago, I don't actually remember much of it. And I never did make it through the last books, starting with religion. That is normal, as I wasn't ready for it then, nor am I now. But it's clear that religions have a huge influence over history, so a section has been reserved for comments on the theme of this papers as it relates to religions at a very basic and superficial level.

2. Spengler, Gibbons etc - We haven't read them <blush>.

3. People in history - It's hard to think of historical accounts that ignore the leaders, followers, customs, thinking, and battles of people at the time. To some extent, historical theories on the scale of Toynbee's are immune to the vagaries of personalities, and indeed, that is probably one reason for the way in which he defined civilisations. But this whole area cannot be explained by the themes of the current paper, which is just one more reason that these themes are only complimentary to other interpretations of history.

4. Willie W-H Soon, S.H. Yaskell "The Maunder Minimum and the variable sun-earth connection" - Although certainly not as well known as many of the other works referred to in this section, this is the key book that we are aware of that established the "sun-centric" analysis of historical periods across civilisations and geographies. It is a superb analysis, and a good read as well, albeit not as "easy" a read as many popular historical accounts, but perhaps far more important than most. In essence, I don't think that an overall historical analysis of a period or civilisation would be complete without incorporating this approach as one of the basis on which to build (together with technology, politics, culture etc).

There is no attempt in this paper to repeat their analysis for the Maunder minimum, not can this paper compare in scope or depth to their book in the section on solar "freezers, scorchers, smoothies, and rocky rods". Possibly because of the timing of the Maunder minimum, there is little discussion of the rise and fall of civilisations. After all, Europe was hard hit, but this was a period of great advances for European societies, and to some extent that perhaps indicates that solar influences are becoming more and more marginal as influences on civilisations. The reader is urgently directed to their book!

5. Evolutionary theory - A major and fundamental failure of all concepts for history, management

theory, politics, and psychology has been their glacially slow incorporation of evolutionary concepts, which includes Mendelian and Lamarckian hereditary mechanisms (and a host of other sub-themes such as punctuated evolution, multi-objective optimization, pandemics, cultural and immune systems programming, etc etc). Stuart Kaufman's [ref] description of optimal evolutionary positioning being at the "Edge of Chaos" is an excellent example that is being applied to research related to the origins of life, and it should be considered for civilisations as well.

6. Joseph Tainter's Complexity theories - I've provided comments in the main text. I like the idea, but it has not been developed sufficiently, nor have the tools and measures been developed to make it applicable for full-fledged states (tools such as evolutionary theory, complexity theory, dynamic and asymmetric economics, or perhaps more importantly cognitive economics, information theory, etc etc). His complexity is limited to the transitions between tribes, big Chiefs, ???, states, and the concept must be extended far beyond that crude distinction.

Hybrid-man and Hyper-complexity - Hybrid human-machine intelligence and advanced machine intelligence, together with improved understanding of Computational intelligence themes such as evolutionary theory, neural networks, fuzzy systems, particle swarms, chaotic systems, quantum computing etc etc and whatever new major concepts arise, all of these promise that societal complexity will go far, far beyond Tainter's imagination. What then, are the next conceptual roadblocks or constraints to civilisations? One can rest assured that any such system will quickly evolve to its limitations, and onto the next generation of abstract advances.

7. Jared Diamond's themes of domesticable animals and human environmental destruction - While I see these themes as being interesting, I see them as being limited to a supporting complement to the major theories (a bit like this paper's concept, but perhaps even more limited). I personally don't buy the "ease of domestication" theme for animals or "bountiful harvest" theme for plants, and in any case the concepts from "Guns, Germs and Steel" are applicable mainly to pre-historic societies/ tribes, or the crushing of "lagging" civilisations.

Like many historians before him, it is clear that Diamond has considered the central theme of this paper (as so many others have throughout history), as can be seen on his chapter about the Mayan collapse [ref?Collapse? page 174]:

"...Careful analysis of the frequency of droughts in the Maya area shows a tendency for them to recur at intervals of about 208 years [author note: this is a well known quasi-periodicity of the sun]. Those drought cycles may result from small variations in the sun's radiation, possibly made more severe in the Maya area as a result of the rainfall gradient in the Yucatan (drier in the north, wetter in the south) shifting southwards. One might expect those changes in the sun's radiation to affect not just the Maya region but, to varying degrees, the whole world..."

It is our opinion that Diamond probably has cause-and-effect and sequencing backwards. That is, even though human activity can destroy a local environment, it is more likely that a natural driver renders a society/ civilisation desperate, which in turn results in a known and unavoidable destruction of the environment. Furthermore, ANY size of population in ANY geographical region is susceptible to the worst of the natural changes, as these can be extreme. The only way to avoid this is to have no people in the region, which clearly isn't an option for those who wish to live. So the whole concept of avoiding

"excessive impact on the environment" is of limited usefulness, especially when proponents provide no means to realistically estimate a "sustainable" population for a limited time period in a specific geographical location. Almost every such estimate over the last several hundred years has been laughably wrong. Will someday our populations face a shock? That is guaranteed - shocks always have happened and they always will. Can it be managed to some extent, yes, and that is up to the locals.

With respect to Diamond's theme regarding animals and plants as being more or less "domesticable", judging by the difference between cats and dogs as pets the argument sounds attractive, but in the end is not convincing to us. Neither oxen nor horse etc "wanted" to be domesticated to begin with, but they simply had no choice. We suspect that bison would have been a cinch to domesticate over time, admittedly not based on knowledge nor experience, but the raising of bison for meat is already a big step in the right direction, and that has happened relatively quickly.

But its extremely important to provide the historical context of people's lifestyle, how they managed the challenges that faced them, how they were organized, leadership, commerce, and religions. Diamond odes a superb and entertaining job of that, and the current work doesn't even try to get there.

8. Cleansing of our sins - Even in modern times many believe that catastrophies befall societies that have fallen into sin or which fail to adhere to the appropriate behavioural norms. Ironically, maybe this is correct in a round-about fashion, and maybe its backwards, in the sense that modern computer science has shown the effectiveness of "plagues" as a tool to improve the solutions for some complex problems (Figure ??).

VII. The Treason of the Sun, and the Treason of Man (Religion, Science, and Astronomy)

The predictable side of astronomy probably had a great deal to do with the rise of logic and science early in civilisation, along with military and civil engineering applications. The ability to model and predict the complex movements of the planets and eclipses was based on quite sophisticated efforts very early in history. No wonder that this near-absolute predictability must have seemed super-natural to early societies, as so much of the rest of their lives was unpredictable and tumultuous.

It is this great un-predictability of the sun that I call it's treason - while the sun and planets helped to draw mankind into the rational frame of mind and matha & science, this un-predictability seemingly flew in the face of rational analysis. However, it may only appear to be treason. Like a mother bird pushing its fledgling to the next stage in life, this type of chaotic behaviour (together with quantum mechanics and many other areas of mathematics and science) is now drawing our science to another philosophical level - beyond the classical sciences. So it only seems like treason until some day we are better equipped and educated to once again learn by the sun's lead.

The prominence of sun gods in early civilizations suggests that the ancients were well-aware of the major long-term solar changes, and the vicious disruptions that could result from unpredictable solar variability. With the advent of reliable long-term food storage, irrigation systems, and other technological and political advances, perhaps populations became less and less exposed to "normal" solar variability, and their increasing understanding of the world led them to perhaps reject their ancient gods, including the sun-gods. This I call this "the treason of man".

VIII. What's Missing?

Obviously, this paper is quite preliminary, and major portions have not been addressed. In addition to "missing concepts" mentioned elsewhere in this paper, here are a few obvious lines of future investigation.

Climate reservoirs or Accumulators - Oceans, Glaciers and Sea Caps - The temperature modulation effect and "long-term memory" of these major systems, plus many other very local systems, should have a major effect on local, regional and global climate dynamics. The easiest examples to think of are how the freezing point "halts" temperatures in the fall until precipitation reduces the air moisture content, and in the spring until the snow has substantially melted. After those turning points, the temperature is much more free to continue its upward or downward seasonal trend.

Geographical model for regional climate change - This is the most urgent issue, as an historical based model for each geographical region would really be the basis for assessing our concept over the Holocene epoch. By geographical model we are thinking of a crude, simple regional analysis of climate effects taking into account global drivers (astronomy, geology, evolutionary biology), climate "reservoirs (notably the ocean currents and glaciation), and regional geography. We certainly don't have the resources to do much here, and hope to find a ready-made geographical context for this.

General Circulation Models - However, at present our faith in the GCMs is low, as they are better suited to weather forecasts up to 2 weeks out, and seem inferior to other methods for the 3 month to year timeframe, and of dubious reliability beyond that. For example, without fudging inputs, the GCMs do not survive the recent modest climate trend reversal that occurred ~1940 to 1970 or 1980 when temperatures trended down. Solar/galactic models do work to at least some extent over all timescales back to the beginning of the Phanerozoic (570 My ago).

Proxy data for climate, radiation, and other civilisation-relevant astronomical, geological, and evolutionary biological phenomena - Annual data is especially important for phenomena that are related to the ~11 year Hale half solar cycle. The Solanki reconstruction of sunspots for the Holocene epoch is presented as pseudo-decadal averages, but that isn't sufficient to glean phase relationships over time between solar activity and phenomena (pandemics are a great example, but locust swarms, flooding, El Ninos etc are but a few of the other examples).

Obvious data sets include: tree ring data going way back, marine sediments, etc etc.

Precipitation and Humidity - Precipitation, how much and when it occurs, is of fundamental importance to agriculture, and big changes in precipitation are probably the dominant mechanism for an astronomical influence on civilisations. But so far NO models or mechanisms have been included in this study.

Volcanoes - Major volcanoes can disrupt sunlight for a year or so. While this may not be long enough to materially affect a civilisation's long-term prospects, it might still be worth tracking.

Geomagnetics - We have had no time to go into this. For a future version! An especially interesting issue is the relationship between the "intrinsic" (Earth origin) geomagnetic field, and the solar influence on the field. There seem to be open challenges in explaining the origins and changes in the intrinsic field, and we also seem to have very little understanding of "magnetic jerks" - years where the lazy wandering of the magnetic poles "jump" to other locations. Another (speculative) idea is that the outer core of the Earth isn't liquid at all, and therefore we would have to induce theories like spin glasses, solar influences, and symmetry breaking to explain the orientation, strength and changes in the geomagnetic field [ref?James Kelly].

Geothermal variability - We didn't find much on this, but as a long shot there may be a story here like items in the past, whereby "factors far too small to have an effect", somehow end up having an effect. At least, that has been the story of ALL of the major real climate drivers (astronomical in particular ..).

Time series analysis and control theory - Again, so far we've had no time for this, although references by Valdes and Bonham-Carter; and Kuo, Lindberg, and Thomson, are mentioned briefly. Tools for strongly non-linear, chaotic, discrete/continuous systems that are non-stationary are clearly needed, and our own gut feel is that modern Computational Intelligence tools (machine learning, statistical learning theory, etc etc) are required. The physical models alone will be inadequate for a long time to come.

Modern Era analysis - Is the "Butterflies in the clouds and the Milankovic wandering of glaciers and greener pastures" concept suited for the modern Era? (actually since trade then industrialisation significantly reduced regional dependence on agriculture). We simply haven't done enough work to quantify the trends (pandemics are one example described in this paper). The "Prophecies of the Sun" section does comment on expected outcomes in the future.

Analysis of economic, commodity and financial systems - One of the earliest observations linking solar activity to terrestrial phenomena was the observation that wheat commodity prices fluctuated with the sun [ref?Soon or Hoyte & Schaten?]. A very quick look at the famed "Kondratieff cycle" of long-term financial markets (itself questionable) did not reveal much (Figure ??). However, we haven't investigated this, and the effects might be really interesting for ancient civilisations!

endsection

IX. Caveats

Veracity of the concept - Is our concept of short-term "Butterflies in the clouds and the Milankovic wandering of glaciers and greener pastures" correct? That's easy to answer: NO! There's no question in our mind that if the concept survives at all it will be in a dramatically different and improved form with more of a base than just qualitative, superficial information. Still, it's a fun idea that will hopefully provoke much better concepts in the future. The nightmare scenario would be if it somehow got mixed up in a science fashion trend, becoming a science cult and finally a science religion (like the Kyoto Premise). That would be horribly disappointing to us.

Cyclomania is the disease of finding endless patterns in a chaotic time series or image. If you look closely enough, there don't seem to be many time periods that don't have a name (OK, I exaggerate a little). I am always trying to bring myself back from the edge on this one.

Correlation-phobia is the disease of refusing to investigate or consider statistically valid correlations for fear of the causality mistake that we all make on occasion. This is especially noticeable when, in extreme cases like the Kyoto Premise, obvious data fits are avoided like the plague in favour of believing phenomena that don't relate either at all to the data, or which require reverse-causality assumptions that clearly violate the tendency of the data. Judging by the religious acceptance of the Kyoto Premise, a strong majority of scientists suffer from correlation-phobia.

Multiple conflicting theories phobia - For some reason, scientists seem to be reluctant to retain multiple conflicting hypothesis when the data and analysis at hand really do not justify retaining one theory and discarding the rest. I feel that it is important to retain diverse theories, and to keep the different perspectives in mind when considering old and new data. It should be clear from this paper that the "Butterflies in the clouds and Milakovic wandering of greener pastures" doesn't displace any theories of history. Hopefully it will either be of some use if not just to stimulate thinking that leads to much better theories.

X. Conclusions

Although work is very preliminary and incomplete, initial results provide very circumstantial qualitative encouragement for the concept that short-term chaotic astronomical variability has caused shocks every several hundred years that are sufficiently severe to be involved in the collapse of some civilisations, while helping to spark new civilisations or the spread and advance of existing civilisations. Variability of galactic rays, geological factors (especially geo-magnetic, but also geothermal etc), and evolutionary biology (including the human brain and its attributes!!!) have not yet been addressed

Longer-term, typically more predictable Milankovic "cycles" (plus other astronomical/ geological "cycles" and their effects on galactic rays) provide what may be a strong overall influence on which areas of the Earth had civilisations that flourished or declined.

These themes are intended to compliment existing theories for the development of civilisations, and as such they will only provide a part of the story. It will be interesting to see how important a shock like a major solar minimum or maximum will affect advanced societies that have been stabilised by advanced technologies, politics, management and very strong global trade. One would expect our societies to be considerably more robust than those of the past, but it would not be surprising to see a considerable "solar signature" on events of the time. Perhaps we will see the results of such a test in our lifetimes.

Perhaps as we master the new sciences of complexity, in part pulled by our need to understand our sun, our respect for its role in our lives will grow and we will come back on our recent "treason against the sun" - perhaps not to the point of the religions and sacrifices of the ancient civilisations, but at least to a revived appreciation of the role of astronomy (and geology and evolutionary biology) in the destiny of our civilisations, and a slightly diminished role for modern gods. However, its likely that future gods will respond to more abstract and advanced human questions and challenges, and less and less to natural variations. But the natural "signal" may persist in spite of our advances, just as it is clearly present now.

But at the least, perhaps as a result of themes like this, solar physicists will no longer be among the most politically-incorrect of scientists given their intrinsic threat to the religion of the Kyoto Premise. From the battle cry in the 2007 film "300", about the 300 Spartans:

Solar Physicists - Prepare For Glory!

(Of course, the 300 Spartans all died... via paths to glory such as -> conquest, martyrdom, and Hollywood. Most likely any recognition of solar physicists will be post-humous and by future generations. Refer to Table 1 to see our guess as to who is most likely to be martyred by who.)

Appendix 1 - References

[Red - I haven't read most of the red references yet, but some I have!]

We have referred to the work of many scientists in this paper, and in particular solar physicists (Tapping, Chabonneau, Laskar, Solanki, Hathaway, Absudamov, Baliunus, Thomson, Boteler). Don't blame them for the content of this note - they think we're nuts!!!

1. 2007 film "300", about the 300 Spartans:
2. Habibullo Abdusamato 2007 "Russian scientist says CO2 not to blame for global warming" RIA Novosti, 15 January 2007, <http://en.rian.ru/russia/20070115/59078992.html>
3. Edouard Bard, Martin Frank "Climate change and solar variability: What is new under the sun?" Earth & Planetary Science Letters 248 (2006) pp480-493
4. Eric Bélanger, Alain Vincent, Paul Charbonneau "Predicting solar flares by data assimilation in avalanche models I - Model design and validation" 2007 Springer Science + Business Media, Printed in the USA ?unpublished as of early 2007?
5. Reid Bryson, Thomas Murray "Climate of hunger" University of Wisconsin Press, Madison WI, 1997 171pp
6. Norman F. Cantor "In the wake of the plague: The Black Death and the world it made", The Free Press, New York, 2001, pp245
7. Paul Charbonneau "Multiperiodicity, chaos, and intermittency in a reduced model of the solar cycle" Solar Physics v199: p385-404 2001, Kluwer Academic Publishers, Netherlands
8. Michael D. Coe "The Maya" original 1966, seventh edition 2005, Thames & Hudson, New York USA 272pp
9. Patrick S. Daniels, Stephen G. Hyslop "Almanac of world history" National Geographic, Washington DC, 2003, 384pp
10. S. Davis, M. Begon, L. De Bruyn, V.S. Ageyev, N.L. Klassovskly, S.B. Pole, H. Viljugrein, N. Chr. Stenseth, H. Leirs "Predictive Thresholds for Plague in Kazakhstan" Science, Volume 304, Issue 5671, 30 April 2004, Pages 736-738
11. Kenneth De Jonge "Evolutionary computation???"
12. Jared Diamond "Guns, germs, and steel: The fates of human societies" New 2005 edition, W.W. Norton Publishing, 512pp
13. Jared Diamond "Collapse: How societies choose to fail or succeed" Penguin Group, New York USA, 2005 575pp
14. Dikpati, Hathaway "Scientists Issue Unprecedented Forecast of Next Sunspot Cycle" Nasa website 10Mar06 http://science.nasa.gov/headlines/y2006/10mar_stormwarning.htm
15. John M. Dunn "Life during the black death" Lucent Books, San Diego 2000 96pp
16. S.M. Enzler "History of the greenhouse effect and global warming" <http://www.lenntech.com/greenhouse-effect/global-warming-history.htm>
17. David Fisher "The water isotope (D/H) history of the strata of the North polar cap: inferences about the water cycle" (for the planet Mars) unpublished as of early 2006?
18. L. J. Gray, J. D. Haigh, R. G. Harrison "Influence of solar changes on the Earth's climate" Hadley Centre, UK, Technical note 62, January 2005 www.met-office.gov.uk/research/hadleycentre/pubs/HCTN/HCTN_62.pdf (Note: the Hadley Centre is considered to be the "Mecca" of the pro-Kyoto modelling religion. That they acknowledge the sun at all is surprising <joke>.)
19. Dianne L. Groll, David J. Thomson "Incidence of influenza in Ontario following the Universal Influenza Immunization Campaign" Vaccine xxx (2006) xxx-xxx (Elsevier journal in press as of Sep06)

20. David Hathaway, reported by journalist Clay "Solar Cycle 25 could be one of the weakest in centuries" 11May2006 <http://www.easternuswx.com/bb/lofiversion/index.php/t94927.html>
21. J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, C.A. Johnson, Editors "Climate Change 2001: The scientific basis" Published for the United Nations Intergovernmental Panel on Climate Change, Press syndicate of the University of Cambridge, UK 2001
22. Donna Rae Howell "MA thesis 'Mayan civilisation or something?'" Trent University, Peterborough 'date?' unfinished
23. Bill Howell - Previous, simpler presentations related to this paper:
 1. "Ring around the rosies" (pandemics) Beltline Toastmasters presentation 04Oct06
 2. "Mega-Life, Mega-Death, and the invisible hand of the Sun" RiskTalkers Toastmasters presentation, Calgary 17Jan07, again with greatly expanded content 04Apr07
 3. "'Mega Life, Mega Death, and the invisible hand of the sun'" Presentation to Rebecca Bradley's course "Collapse of civilisations" Uof Calgary, 04Apr07
 4. see www.BillHowell.ca/docs for these presentations.
24. Bill Howell "Genetic specification of neural networks" Feb06
25. [http://www.billhowell.ca/Neural nets/Howell 2006 - Genetic specification of neural networks, draft concepts and implications.pdf](http://www.billhowell.ca/Neural%20nets/Howell%202006%20-%20Genetic%20specification%20of%20neural%20networks,%20draft%20concepts%20and%20implications.pdf)
26. William Neil Howell "Genetic specification of recurrent neural networks: Initial thoughts", Proceedings of WCCI 2006, World Congress on Computational Intelligence, Vancouver, paper#2074, IEEE Press, pp 9370-9379, 16-21 July 2006
27. Douglas V. Hoyt, Kenneth H. Schatten "The role of the sun in climate change" Oxford University Press, Oxford UK, 1997, 279pp – superb background book
28. Lena Huldén, Larry Huldén, Kari Heliövaara "Endemic malaria: an 'indoor' disease in northern Europe. Historical data analysed" Malaria Journal 2005, 4:19 doi:10.1186/1475-2875-4-19
29. Huybers & Curry 2006 - Links between annual, Milankovitch and continuum temperature variability 2006 doi:10.1038/nature04745 <http://www.people.fas.harvard.edu/~phuybers/Doc/Annual2Milankovitch.pdf>
30. James Kelly "Title?" Pextreme Poisson ratios and the geomagnetic field
31. Madhav L Khandekar "Questioning the Global Warming Science: An Annotated bibliography of recent peer-reviewed papers" 32pp [www.friendsofscience.org/documents/Madhav bibliography LONG VERSION Feb 6-07.pdf](http://www.friendsofscience.org/documents/Madhav_bibliography_LONG_VERSION_Feb_6-07.pdf)
32. Stuart Kaufman? "'At home in the universe'" ?Publisher, date, pp etc"
33. Cynthia Kuo, Craig Lindberg, David J. Thomson "Coherence established between atmospheric carbon dioxide and global temperature" Nature, vol343, 22Feb1990, p709-714
34. J. Laskar, P. Robutel, F. Joutel, M. Gastineau, A.C.M. Correia, B. Lestrade 2004 "A long term numerical solution for the insolation quantities of the Earth" Astronomy & Astrophysics manuscript no. La_2004 May 23, 2004 http://www.imcce.fr/fr/presentation/equipres/ASD/preprints/prep.2004/La_2004_prep.pdf
35. J. Laskar "A comment on 'Accurate' spin axes and solar system dynamics: Climatic variations for the Earth and Mars" Astronomy & Astrophysics manuscript no. 'comment 2003' V2 November 24, 2003 http://www.imcce.fr/fr/presentation/equipres/ASD/preprints/prep.2003/comment_2003.pdf
36. Laskar, J., Joutel, F., Boudin, F. 1993 "Orbital, precessional and insolation quantities for the Earth from -20 Myr to +10Myr" Astron. Astrophys. 270, 522 <http://www.imcce.fr/Equipres/ASD/insola/earth/La93/README.TXT>
37. Norman Longate "King cholera" 1966 Hamish Hamilton, London 271pp
38. Salvatore Marra, Francesco C. Morabito "Solar Activity Forecasting by Incorporating Prior Knowledge from Nonlinear Dynamics into Neural Networks" 2006 International Joint Conference on Neural Networks, Sheraton Vancouver Wall Centre Hotel, Vancouver, BC, Canada, July 16-21, 2006, paper #1234, p7113-7119
39. Russell E. McDuff, G. Ross Heath "A Model of Glacial-Interglacial Cycles: Phasing of Proxies" <http://www2.ocean.washington.edu/oc540/lec02-22/>

40. Neil Morris, Neil Grant, Lisa Isenman, Hazel Martell, Lynn McRae, John Malam, Michael Pollard "The illustrated history of the world: From the big bang to the third millenium" Mercury Books, London, UK, 2004 288pp
41. Patrick O'Brien, general editor "Oxford atlas of world history" Oxford University Press, New York, 2002 312pp
www.oup-usa.org/atlas
42. Didier Paillard, Frédéric Parrenin "The Antarctic ice sheet and the triggering of deglaciations" Earth and Planetary Science Letters 227 (2004) 263-271 <http://glaciog.ujf-grenoble.fr/~parrenin/publications/download/articles/paillard-parrenin-EPSSL2004.pdf>
43. Germán Poveda, William Rojas, Martha L. Quiñones, Iván D. Vélez, Ricardo I. Mantilla, Daniel Ruiz, Juan S. Zuluaga, and Guillermo L. Rúa "Coupling between Annual and ENSO Timescales in the Malaria–Climate Association in Colombia" Environmental Health Perspectives, vol 109, no5, May 2001
44. Paul Prikryl "Solar wind plasma streams, high-level clouds and extra-tropical storms" 30Nov06 Canadian Solar Physics Workshop, University of Montreal, poster
45. Monty Python, producer "The Life of Brian"
46. Nikolai Dmyitriyevich Kondratieff (1892 - 1938), The Kondratieff Theory - http://www.kwaves.com/kond_overview.htm
47. William F. Ruddiman "The anthropogenic greenhouse era began thousands of years ago" Climatic Change 61: 261–293, 2003
48. Scherer, Veizer, Shaviv et.al. 2006 "Interstellar-Terrestrial relations: variable cosmic environemnts, the dynamic heliosphere, and their imprints on terrestrial archives and climate" Kluwer Academic Publishers, Netherlands, 2006 ~163pp
49. M. Sharma 2002, 'Variations in solar magnetic activity during the last 200000 years: 3917 is there a Sun-climate connection?'. Earth Planet. Sci. Lett. 199, 459
50. Nir Shaviv, Jan Veizer "Celestial driver of Phanerozoic climate?" GSA Today, July 2003, pp4-10
51. Solanki & Schüssler 2004 - The Sun is More Active Now than Over the Last 8000 Years <http://www.mpg.de/english/illustrationsDocumentation/documentation/pressReleases/2004/pressRelease20041028/genPDF.pdf>
52. Solanki, S.K., et al. 2005. 11,000 Year Sunspot Number Reconstruction. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series #2005-015. NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.
53. Sami K. Solanki, Ilya G. Usoskin, Bernd Kromer, Manfred Schüssler, Jürg Beer "Unusual activity of the Sun during recent decades compared to the previous 11,000 years" Nature, 28 October 2004
54. Willie W-H Soon, S.H. Yaskell "The Maunder Minimum and the variable sun-earth connection" World Scientific Publ, Signapore, 2003 278pp
55. Harold Szu "title - Information theoretic derivation of Hebbian learning" IJCNN02 Hawaii?
56. Joseph Tainter "?Complexity?"
57. K.F. Tapping, D. Boteler, A. Crouch, P. Charbonneau, A. Manson, H. Paquette "Solar magnetic activity and total irradiance since the Maunder minimum" ?Journal vol/n/pp? Springer Science & Business Media. Printed in the USA 2006 27pp
58. K.F. Tapping, R.G. Mathias, D.L. Surkan "Pandemics and Solar Activity – Extended paper" Unpublished as of 09Mar06
59. K.F. Tapping, R.G. Mathias, D.L. Surkan, "Influenza pandemics and solar activity". Canadian J. Infectious Diseases, vol 12, no 1, pp 61-62, Jan-Feb 2001
60. John Teeple "Time lines of world history" D.K. Publishing Inc., New York, USA 2002 656pp
61. D. J. Thomson 1990 "Time Series Analysis of Holocene Climate Data" Philosophical Transactions of the Royal Society of London, Series A, Mathematical and Physical Sciences, V330 i1615 p601-616

62. Arnold J. Toynbee "A study of history" ?Publisher etc etc?
63. Eli Tziperman, Maureen E. Raymo, Peter Huybers, and Carl Wunsch 2006 "Consequences of pacing the Pleistocene 100 kyr ice ages by nonlinear phase locking to Milankovitch forcing" PALEOCEANOGRAPHY, VOL. 21, PA4206, doi:10.1029/2005PA001241, 2006 http://www.people.fas.harvard.edu/~phuybers/Doc/Phase_Locking.pdf
64. www.thelongwaveanalyst.ca/cycle.html - Kondratieff cycles in financial markets
65. I. G. Usoskin, M. Schulz, S. K. Solanki, K. Mursula "Solar activity, cosmic rays, and Earth's temperature: A millennium-scale comparison" Journal of Geophysical Research, vol 110, A10102, doi:10.1029/2004JA010946, 2005
66. Julio Valdes, Graham Bonham-Carter "Time dependent neural network models for detecting changes of state in Earth and planetary processes" Proceedings of IJCNN 2005, International Joint Conference on Neural Networks. Montreal, paper #1439, pp1439-1444, 31 July – 4 August 2005.
67. Jan Veizer "Celestial climate driver: A perspective from four billion years of the carbon cycle" Geoscience Canada, vol32 n1, pp13-28, March 2005
68. Spencer Weart "The Discovery of Global Warming" <http://www.aip.org/history/climate/index.html> also published by Harvard University Press, Sep 2003
69. Steven Wickson "Galactic influences over the last 65 million years" presentation to a Uof Calgary Astrophysics class, 2006?
70. Steven Wickson "The solar system's motion in the galactic tidal field" Uof Calgary Astrophysics course 599, Final Report 19Jan06
71. Wikipedia 2007 - Milankovitch cycles.htm http://en.wikipedia.org/wiki/Milankovitch_cycles
72. Zhen-Shan, L. and Xian, S. 2007. Multi-scale analysis of global temperature changes and trend of a drop in temperature in the next 20 years. Meteorology and Atmospheric Physics 95: 115-121.

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Appendix 2 - Climate Change: A current and controversial view

In a nutshell, the major climate drivers appear to be astronomy, geology, and evolutionary biology, and this is discussed in more depth on the web-document: www.???ca as well as many other sources such as the references in Appendix 1 (notably Khandekar, Weart, Shaviv & Veizer, etc). These major drivers are discussed according to various timescales below.

Phanerozoic Era (~570 My to present) - The really BIG swings in temperature occur in quasi-cycles of somewhere on the order of 70 to 140 million years (My). The best (?only?) theory for this is that the interaction of galactic rays and the helio- & geo- magnetic fields drives cloud cover variability, which has a huge influence on Earth temperatures (Shaviv and Veizer ???). Galactic ray exposure vary because the solar system bobs above and below the plane of the Milky Way galaxy (that's ours) with a period of roughly ?70? My, and because the solar system passes through the spirals of the galaxy roughly every 140 My. These changes in the relative position of our solar system within the galaxy change our relative exposure to galactic rays. However, galactic rays can also because of galactic events (short term for sure, perhaps long terms as well).

Intermediate timescale (5 to 20 My to present) - nothing to put here right now.

Last 1 My - The dominant theory for recent glaciations is the role of Milankovic cycles - that is, the variation of solar insolation (the amount of solar power that reaches different latitudes) according to the eccentricity of the Earth's orbit, and the tilt and recession of the Earth's axis (other components are not yet covered in the data that we are using, although it should be noted that the moon's influence is, I believe, included). Refer to Wikipedia for an excellent description of the limitations and problems with the theory Milankovic theory of climate forcing.

Holocene epoch (last 11 to 15 ky) - Right now it appears that Milankovic trends are the #1 influence and these occur gradually, but the effects occur through cloud, glacier and ocean circulation time-lags which can "flip" rapidly. Solar variability provides significant shocks and mid-term trends that are significant to civilisations. The relative impact of solar variability is certainly underestimated, as leveraging factors such as galactic rays and clouds

Modern Warm Period (1850 to present) - It seems clear that solar variability/ galactic rays explain the situation, probably with some help from the glacier/ ocean circulation "climate reservoirs".

Last 20 years - The recent climate trends apparently seem anomalous, but then again so is the behaviour of the sun. I don't have data and analysis, but I'll still bet that Kyoto Premise (see below) turns out to be a turkey. In a nutshell: **Sun -> Cloud & Ice cover**

Kyoto Premise - The current science fashion/ cum science cult/ cum science religion regarding anthropogenic GreenHouse Gas (GHG - especially CO₂) emissions doesn't even seem to register at any time scale other than perhaps as one of many possible minor but likely insignificant contributors to climate change in the last 20 to 50 years. Separate, web-posted papers provide an analysis of the failures of the current consensus (including the UN-IPCC reports), and an analysis of why scientific consensus and be so wrong for so long a time (this same story has been a lament all the way through

history, and education and career long learning hasn't changed this).

Appendix 3 - Non-stationary systems: Beyond the grasp of the common scientist

Being a common scientist, I can relate to how easy it is to blindly apply classical or common analytical approaches to non-stationary systems (and especially where they are non-linear, strongly non-linear, chaotic, discontinuous, or hybrids of the preceding types). It's extremely easy to forget the huge assumptions that are typically made when looking at geologic/climate data going back 10s or 100s of thousand of years, and especially going back millions of years. Starting with the assumption that climate systems, astronomical variables, etc behave now as they did in the past is known to be wrong in detail, and yet I keep finding myself putting far too much faith in models even when I know many of the assumptions are probably incorrect.

Solar variability is clearly beyond the "competence/ familiarity" level of analysis of most scientists, judging by the constant repetition of the same catastrophic errors being repeated on the first, simple steps of analysis. It's very hard to come up even with a useful classification system for periods of solar variability. Furthermore,

solar variability on 10 100 years, 1 10 100 ky, Mys

Milankovic - stable annual average - but HUGE changes during year that tend to average out

Valdes & Bonham Carter - changes in phase or state of systems (one pager)

+ve or -ve power increase with periods of solar activity, and other stars

galactic ray variability

0-1 My eccentricity versus 1-3 My obliquity and climate

endpage

Appendix 3 - Crazy Thoughts

If you are wondering why I chose the title above, just try reading some of this...

1. **Lack of modern awareness of the relative importance astronomical/ geological/ evolutionary biology drivers** may be due to a number of factors (this part of a theme that is being worked on gradually by the author - but with no immediate priority):
 - (a) Technology and global trade has insulated us from all but the most extreme short to mid-term trends and events. While long-term trends are obvious, they seem to be outside our attention range (event scientifically). For example, peoples' eyes immediately glass over when you start to talk about a 100 year climate forecast, let alone 1 My!
 - (b) Blowing in the wind - A favorite and counter-intuitive theme of mine is that, apart from extremely rare people, logic and rational is not a dominant mode of thinking homo sapiens isn't very good at. Unfortunately I am not one of those rare people <grin>, and it is about as rare for scientists as any other group in society.
 - (c) Modern education, research careers, and wonderful opportunities for individuals to have the time and resources to tackle challenges, do not seem to be able to change this from a rarity to a general skill for significant portions of the population (including me).
2. **Relative changes in complexity are a result and measure of collapse, but they are not a primary driver**, although complexity may be a more direct long-term driver for growth (as an "enabler", but even here I suspect that it is more of a measure). I am not at all convinced by arguments and examples that I've seen that there are many, if any, historical examples of collapse driven by excessive complexity. I suspect that there is always a "to and fro" of relative complexity, and that when conditions are right excessive complexity may contribute to or even trigger a major collapse, but it would rarely be a basic cause or driver. Not having even read Tainter's book, these are dangerous and reckless statements, so this should just be considered to be an impression without conviction. It is also the result of my natural tendency of playing devil's advocate: people must be given respect, but ideas must be torture, mutilated, dismembered, bent, blended and separated. Unfortunately, a major problem arises when people self-identify with their ideas, or when such appropriate treatment of ideas is extended to how people are treated.
3. **Robustness of organisations, societies and civilisations.** (see point 1 as well) It seems to me that a far more important driver of collapse would be the one-two punch of new internal or external environmental changes (including business, trade etc) combined with an inability of a group to reject conventional or politically correct thinking
 - (a) Most people are believers, there are very, very few critical thinkers. Most scientists are like most people. (They are, after all, people!)
 - (b) Blowing in the wind - Real changeovers in beliefs seem to occur when people sense subtle changes in the speed and direction of the prevailing "politically correct scientific fashion/ cult/ or religion". Once aligned in the new direction, there is no better basis for their beliefs than in the past, right or wrong.
 - (c) Cheats, Parasites and Fools - see my website (we're all stupid - it's a complex world out there)
4. **Astronomy, geology, and evolutionary biology are primary drivers of climate.** It is my belief

that anthropogenic greenhouse gases (eg CO2 emissions etc) will prove to be at most a minor contributor, but more likely are an insignificant contributor to climate change during the Modern Period thus far. However, politically-correct but false belief systems may persist for thousands of years, and the vast majority of modern scientists are no different than the ancient priests in this adherence to beliefs (this includes the present author).

We don't normally think in terms of the biological / mental evolution of homo sapiens (via Mendelian hereditary mechanisms or even perhaps via Lamarckian heredity). I suspect, however, that our politically-correct, highly emotional stand that all humans are the same and we have been for some time is just flat wrong. In spite of our relatively benign modern economies and freedoms, I suspect that we are evolving very quickly - for now diversification is perhaps the runaway theme, but only modest advances in cognitive function could have a huge impact on society.

5. **Earthquakes and volcanoes** - It sounds crazy, but could it be that solar activity (or more general astronomical activity) also influences major geophysical catastrophes? This is very speculative at the present time, but "low-level" seismic activity has been linked to solar activity by one scientist, and with many other climate-related questions we have persistently misjudged the importance and relevance of seemingly negligible changes.
6. **BGI datum, a politically-correct dating basis** - It is clear that the use of "years BC or AD" are racist and exclusive of much of the world's population. Unfortunately, simply changing the term to BCE and CE (Common Era) is just as racist because it is clearly still based on the date of Christ's birth. In order to avoid this racist basis and thereby to treat other people with respect, we propose dating from an arbitrary year in the early part of the Holocene epoch, somewhat before solar insolation bottomed and levelled off. The chosen date is equivalent to 11,000 BC, and is called the year BGI, for "Before Gods were Invented". That should keep us out of trouble <grin>....

Note: Without clear written records, whether true gods existed or not before BGI will be difficult to prove and isn't much of a concern to us anyways. Politically correct thinking doesn't have to be chained by reality, data, or coherent analysis, so neither should we on this point. Moreover, on this theme we have adopted the un-thinking approach from standard practice in environmentalism, health remedies, and Hollywood, and everybody loves them.

7. **The Air Conditioner theory for helping developing nations and for explaining some of the the rise and fall of civilisations** (Too hot & humid for serious empire building?) - Harold Szu's information theoretic derivation of Hebbian learning.....

Admittedly, I can't pass this off as a legitimate, known theory of history, but it's too fun to resist.

8. **The Life of Brian** - We were taught about history partially through the eyes of this film, and I agree that there is more to what Brian says than he realizes. I just don't know what it means, other than we should always "Look on the bright side of life".
9. **A solid outer Earth core** - James Kelly's hypothesis is that based on his observations of the behaviour of extreme material properties, that the outer core of the Earth may actually be solid rather than liquid. One basis for this is that the "s" seismic wave would typically "disappear" for extreme Poisson ratios, leading one to assume that the outer core is liquid. Geologists who I have

spoken to don't seem to like this idea, and it would destroy our common belief as to the origins of the Earth's magnetic field (circulating, conducting liquid iron in the outer core). One alternative theme would be spin glass theory and symmetry breaking as applied to rock and electrolytes well below the magnetic "glass transition temperature". One consequence may be that the magnetic field is susceptible to variances in deep temperatures, losing and gaining magnetic field periodically as influenced mostly by the small internal thermal variances, but as a long shot perhaps also due to solar magnetic field imprinting during the process of symmetry breaking.

10. Scum rises to the top, and nice guys finish last - Historians continually comment on how rough things get as civilisations collapse (or mere regional politics, states and societies). However, in the context of evolutionary psychology, little is said about how that shapes our mentalities.

Irrational advantage - For example, a major theme I have from the "Kyoto Premise" is that the vast majority are not or cannot think very well, judging by the catastrophically bad thinking underlying most of their positions. Perhaps logic is not a great forté of homo sapiens because other modes of thinking (aggressive self interest, pattern recognition, signal analysis, stochastic search through state space, cunning, ruse, deception, fast assembly of frames of approximate analysis that are often faulty, etc) are far more important to survival in times of trouble (pandemics, war, starvation). A massively rich repository of hugely diverse pre-programmed behaviour may be far more important to reacting successfully to a whole range of events, especially events that are important on an evolutionary scale, but to which no living member of a society has ever experienced.

Why "Blowing in the wind" beats logic - The concept of "Blowing in the wind" as the dominant mode of thinking by homo sapiens is explained in point 23? above and elsewhere [ref Howell ?] (aka Zeitgeist, the madness of the crowd, etc etc). Essentially it means that the vast majority of scientists align their thinking with the prevailing, politically correct consensus, and go from there. Tying this to evolutionary theory is easy (also misleading, but here we go).

Why "Consensus thinking" is invariably wrong - If you foolishly believe the themes immediately above, it shouldn't be a surprise that consensus thinking is usually a disaster, especially if its in a politically correct area (all of the humanities, arts, religion, lifestyles, and more and more science and engineering - soon perhaps all of it). But rather than trying to find the "real answer", the best real example to inductively support the point is "contrarian investment strategies" in the financial markets. When everybody agrees very strongly and there is a powerful consensus, much more often than not they are wrong. And these are people with a lot of money at stake, not to mention mega-egos!

In order for a consensus to be even close to the truth, one should wait until all of its original proponents and their progeny are dead, that there have been a massive amount of data and critical assessments of the theory, and that nobody cares about the theme behind the consensus any more. This could take thousands of years (just look at religions, politics, and warfare).

Asymmetric leadership - Contrary to the current politically correct view, my guess is that strong leadership must be founded on an asymmetric personality, one that lacks or has a reduced "mirror reflection" property (do unto others as you would have others do unto you).

More to develop later...

endlist

Figure 1: Galactic plane-bobbing, spiral jumping, and eccentricity of our solar system in the Milky Way

Reference: Jan Veizer & Nir Shaviv, Steven Wickson photos:

(I couldn't find top and side photos of our Milky Way... let me know if you find some)
<http://160.114.99.91/astrojan/Ngc/eso60.jpg> http://www.space.com/scienceastronomy/astronomy/spiral_galaxy_011002.html

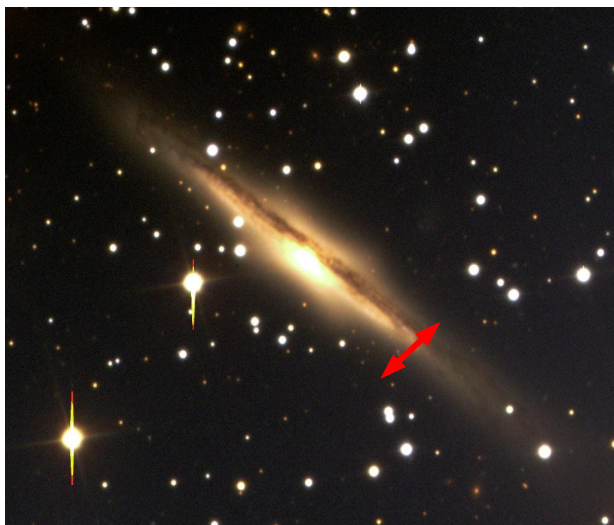


Figure 2: Predictable galactic-driven climate cycles

Reference: Shaviv & Veizer

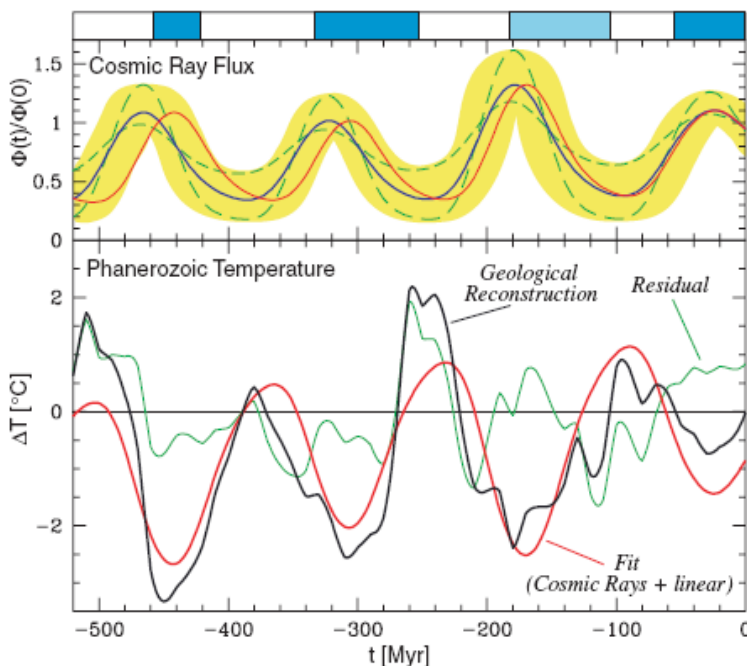


Figure 2. The cosmic ray flux (Φ) and tropical temperature anomaly (ΔT) variations over the Phanerozoic. The upper curves describe the reconstructed CRF using iron meteorite exposure age data (Shaviv, 2002b). The blue line depicts the nominal CRF, while the yellow shading delineates the allowed error range. The two dashed curves are additional CRF reconstructions that fit within the acceptable range (together with the blue line, these three curves denote the three CRF reconstructions used in the model simulations). The red curve describes the nominal CRF reconstruction after its period was fine tuned to best fit the low-latitude temperature anomaly (i.e., it is the “blue” reconstruction, after the exact CRF periodicity was fine tuned, within the CRF reconstruction error). The bottom black curve depicts the 10/50 m.y. (see Fig. 1) smoothed temperature anomaly (ΔT) from Veizer et al. (2000). The red line is the predicted ΔT_{model} for the red curve above, taking into account also the secular long-term linear contribution (term $B \times t$ in equation 1). The green line is the residual. The largest residual is at 250 m.y. B.P., where only a few measurements of $\delta^{18}\text{O}$ exist due to the dearth of fossils subsequent to the largest extinction event in Earth history. The top blue bars are as in Figure 1.

Figure 3: Illustration of Milankovic cycles

Reference: www.Wikipedia.com encyclopedia,

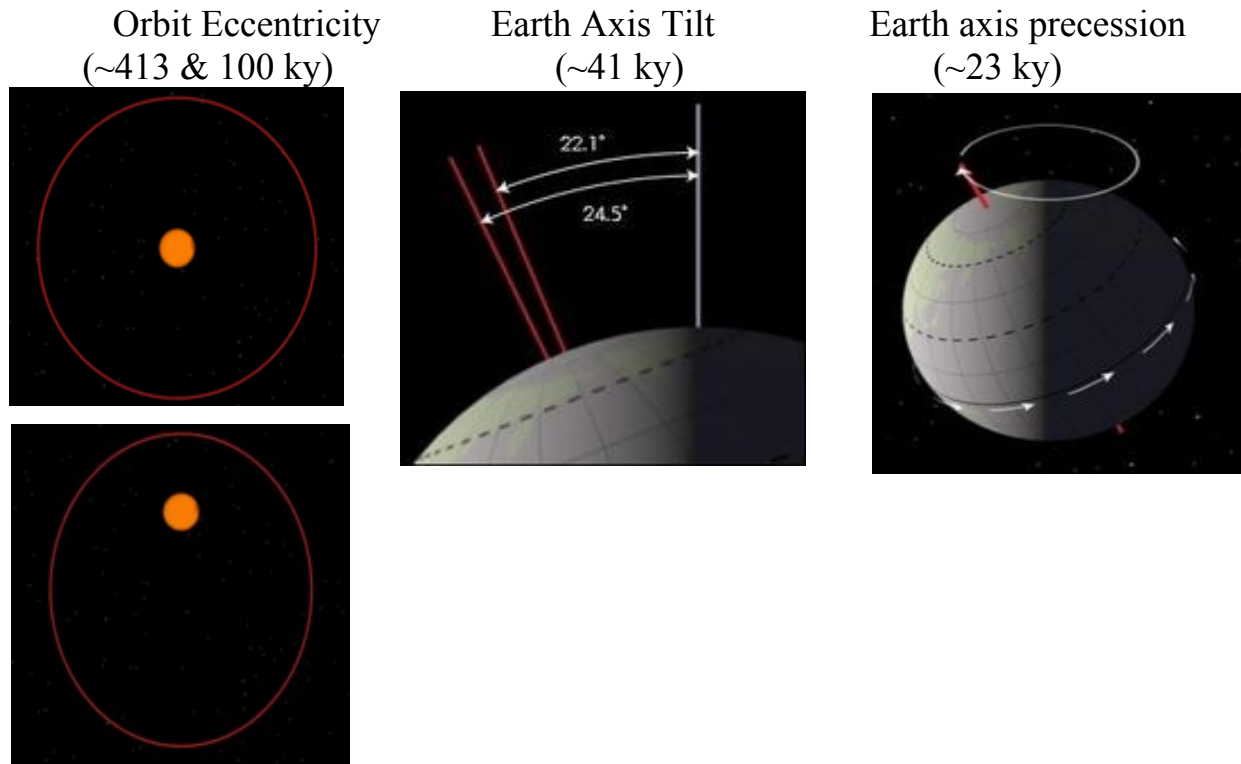


Figure 4: Predictable, smooth, mid-term Milankovic cycles

Reference: www.Wikipedia.com encyclopedia 65 degrees North latitude

Illustration is intentionally flipped to see time increasing to the right, as per normal convention. This is important, as temperatures "crash up" coming out of a glaciation, and dipsey-doodle down.

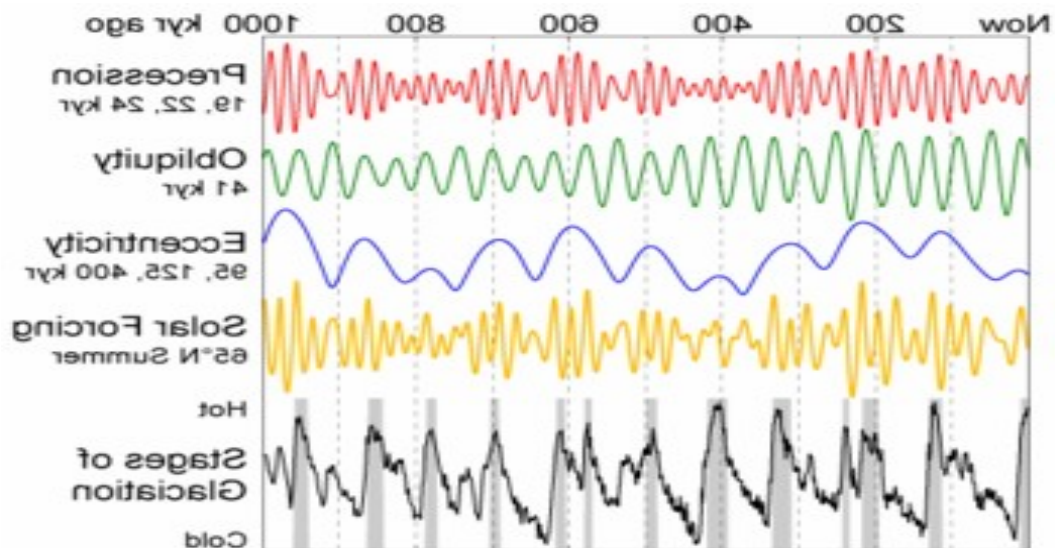
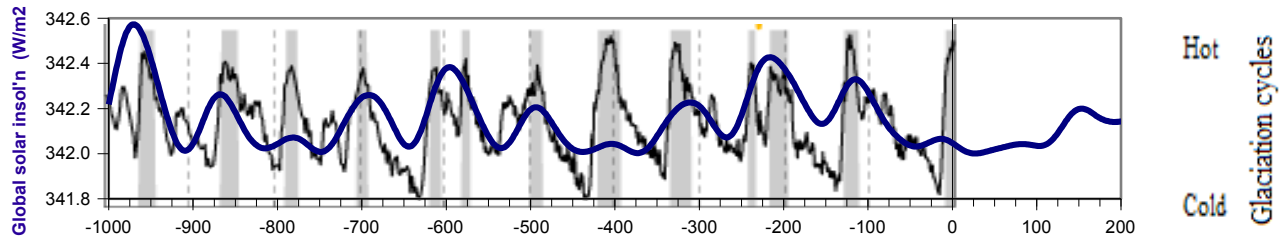


Figure 5: Milankovic insolation cycles and 1 My of glaciations

Reference: Laskar et al www.Wikipedia.com www.BillHowell.ca



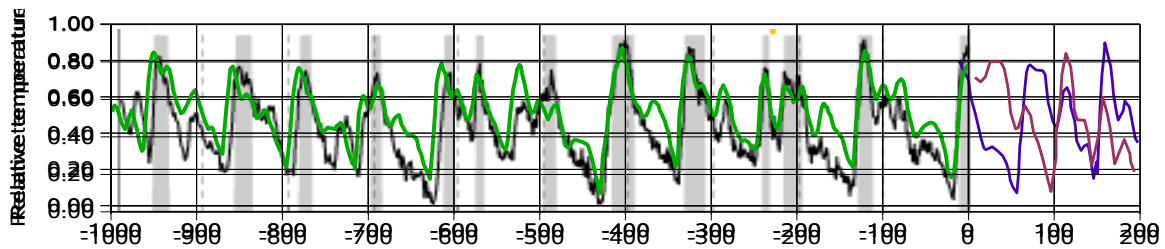
Global average solar insolation clearly relates to glaciation trends...but the theory isn't adequate! Some [ref Tziperman et al 2006] have suggested nonlinear or chaotic "phase locking", but... (dates in ky BP)

Figure 6: Paillard's Milankovic threshold model for 1 My of glaciations

Reference: Frédéric Parrenin, Didier Paillard 2003

<http://glaciog.ujf-grenoble.fr/~parrenin/publications/download/articles/parrenin-paillard-EPSL2003.pdf>

Forecasts: Didier Paillard (2001)



Black curve: glaciation data, Green curve: best fit,

Burgundy: Paillard 0.75 forecast, Blue: Paillard 0.50 factor

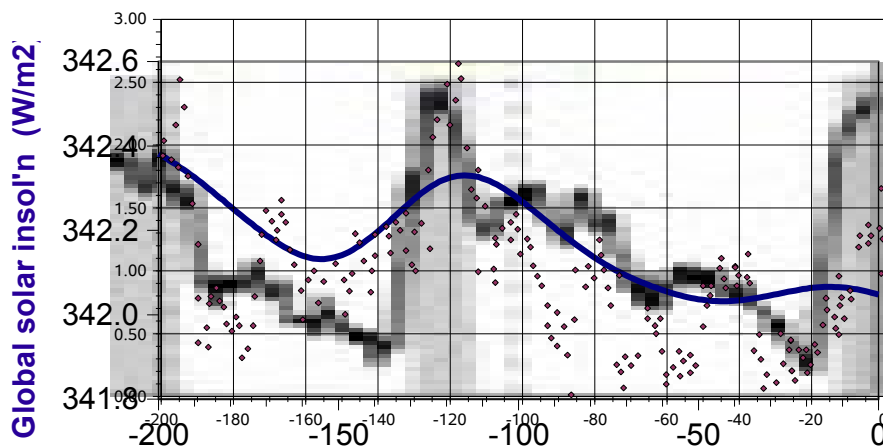
Note: Paillard used a different temperature series based on marine delta 18O, whereas that shown is from ice core data (great generalization).

Data values hand entered from literature graph (approximate only).

Multiple conflicting hypothesis - the ONLY way to go with forecasting!!

Figure 6: Milankovic insolation, Solar variability and temperatures over 200 ky

References: Laskar etal, Sharma, www.Wikipedia.com, Scherer etal



Obviously, actual data points would be best for the temperature proxy at these magnifications!!

The blue curve is the global annual average solar insolation as calculated on the basis of Milankovic cycles. The brown points are solar irradiance values from Be10 measurements, and the black (low-resolution) background graph is the ice core temperature proxy trend, which is similar to the trend in marine sediment δ_{O18} . The spreadsheet "morphs" from Milankovic to irradiance variability.

The solar irradiance (chaotic) time series better matches the peaks in temperature. But if one considers the similar general trend in chaotic irradiance and Milankovic insolation time series, it doesn't seem to make much sense - as it almost infers that somehow Earth-specific insolation trends could be correlated to sun-specific irradiance variability. Of course, the simple explanation is that the ^{10}Be proxy is strongly influenced by Earth processes/effects.

ATMOSPHERE: What Drives the Ice Age Cycle? Didier Paillard Science 28 July 2006: Vol. 313. no. 5786, pp. 455 - 456
DOI: 10.1126/science.1131297

Between 3 and 1 million years ago, ice ages followed a 41,000-year cycle. Two studies provide new explanations for this periodicity.

The author is at the Laboratoire des Sciences du Climat et de l'Environnement, Institut Pierre Simon Laplace, CEACNRS-UVSQ, 91191 Gif-sur-Yvette, France. E-mail: didier.paillard@cea.fr The editors suggest the following Related Resources on Science sites: In Science Magazine

RESEARCH ARTICLES

Plio-Pleistocene Ice Volume, Antarctic Climate, and the Global δ_{18O} Record

M. E. Raymo, L. E. Lisiecki, and Kerim H. Nisancioglu (28 July 2006)

Science 313 (5786), 492. [DOI: 10.1126/science.1123296]

| Abstract » | Full Text » | PDF » | Supporting Online Material »

REPORTS

Early Pleistocene Glacial Cycles and the Integrated Summer Insolation Forcing

Peter Huybers (28 July 2006)

Science 313 (5786), 508. [DOI: 10.1126/science.1125249]

| [Abstract »](#) | [Full Text »](#) | [PDF »](#) | [Supporting Online Material »](#)

[ATMOSPHERE: What Drives the Ice Age Cycle?](#) By: Paillard, Didier. *Science*, 7/28/2006, Vol. 313 Issue 5786, p455-456, 2p, 1 graph; Abstract: The article discusses the causes of glacial cycle in earth. It has been stated according to the Milankovitch theory that the changes of insolation is the cause of ice age cycle. Insolation is described as the exposure of the earth's surface to the rays of the sun. It varies on time scales of thousands of years as a result of regular changes in earth's orbit around the sun, in the tilt of earth's axis, and in the direction of earth's axis of rotation. An example has been cited that between 3 and 1 million years before present, glacial oscillations follows a 41,000-year cycle and that these oscillations correspond to insolation changes driven by obliquity changes. Other information related to the topic are discoursed in the paper.; (AN 22979978)

¹Laboratoire des Sciences du Climat et de l'Environnement, Institut Pierre Simon Laplace, CEA-CNRS-UVSQ, 91191 Gif-sur-Yvette, France

?? **Didier Paillard** at paillar@asterix.saclay.cea.fr ??

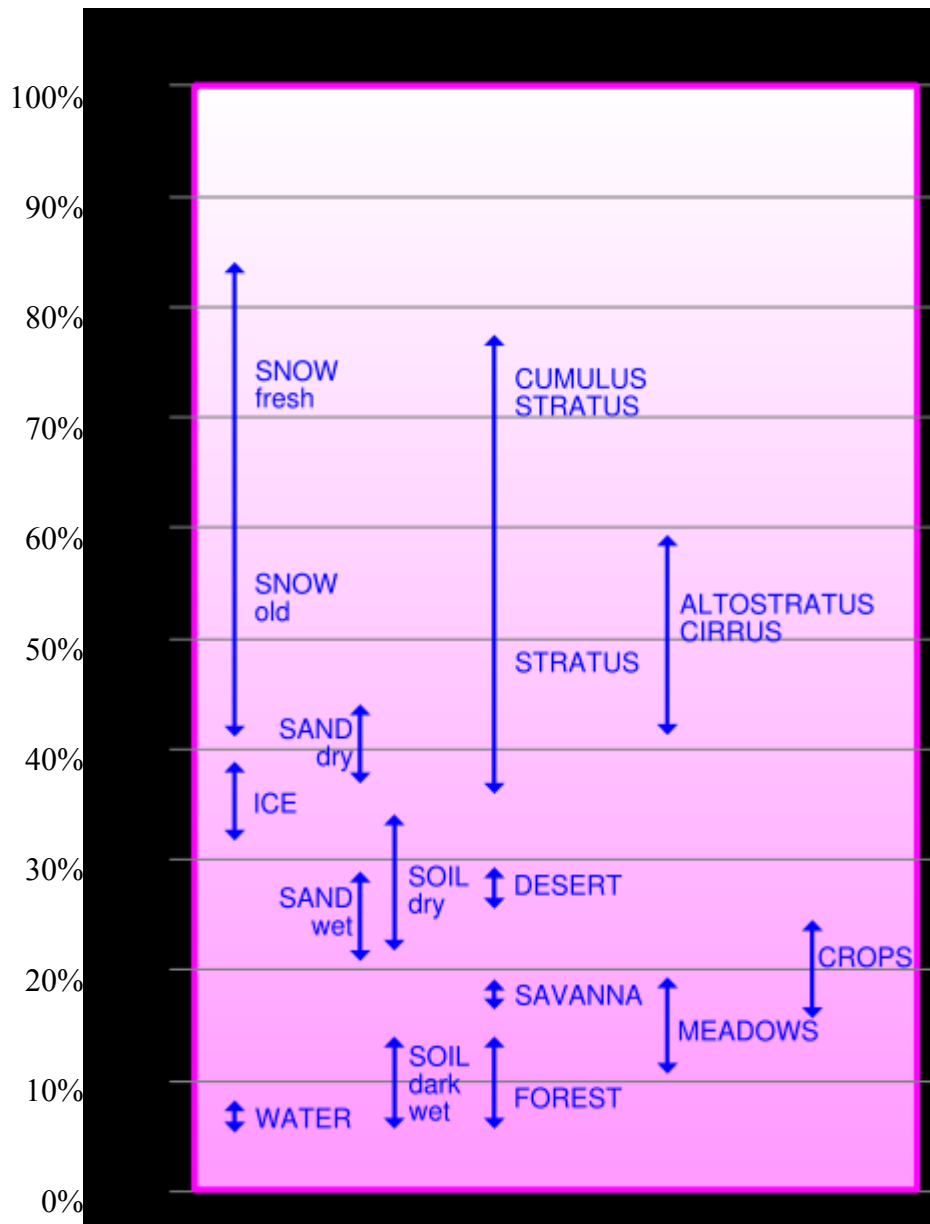
Figure 8: Albedos

Reference: From Wikipedia, the free encyclopedia <http://en.wikipedia.org/wiki/Albedo>

The text is quoted directly from Wikipedia.

"Albedo is the ratio of reflected to incident [electromagnetic radiation](#) power. It is a [unitless](#) measure indicative of a surface's or body's diffuse [reflectivity](#). The word is derived from *albus*, a [Latin](#) word for "white". "

Percentage of reflected sun light in relation to various surface conditions of the earth:



"The albedo is an important concept particularly in [climatology](#) and [astronomy](#). In climatology it is sometimes expressed as a percentage. Its value depends on the [frequency](#) of radiation considered: unqualified, it usually refers to some appropriate average across the spectrum of [visible light](#). In general, the albedo depends on the direction and directional distribution of incoming radiation. Exceptions are [Lambertian](#) surfaces, which scatter radiation equally in all directions, so their albedo does not depend on the incoming distribution. In realistic cases, a [bidirectional reflectance distribution function](#) (BRDF) is required to characterise the scattering properties of a surface accurately, although albedos are a very useful first approximation." [Wikipedia]

Figure 7: Sun, cloud, and snow

Reference:

Figure 8: Holocene epoch - regional insolation by season

Reference: Laskar etal www.BillHowell.ca

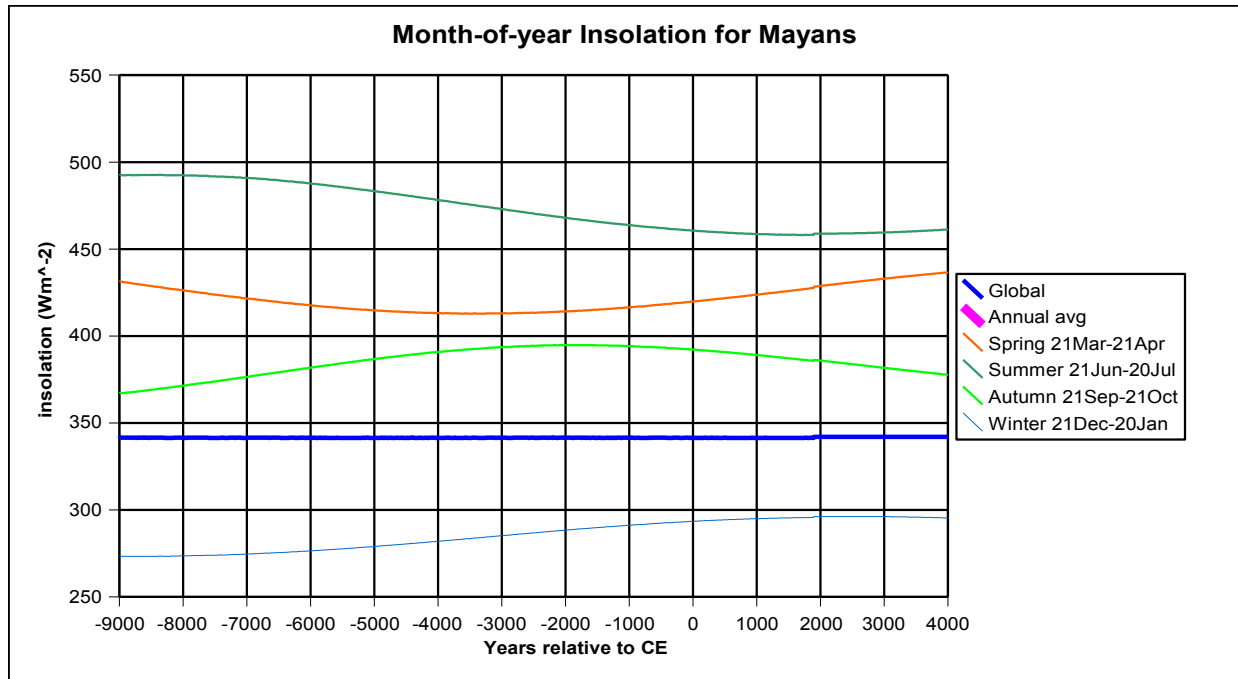


Figure 9: Holocene temperatures: Pick a proxy. Any Proxy!!

Reference: www.globalwarmingart.com/wiki/Image:Holocene_Temperature_Variations_Rev_png

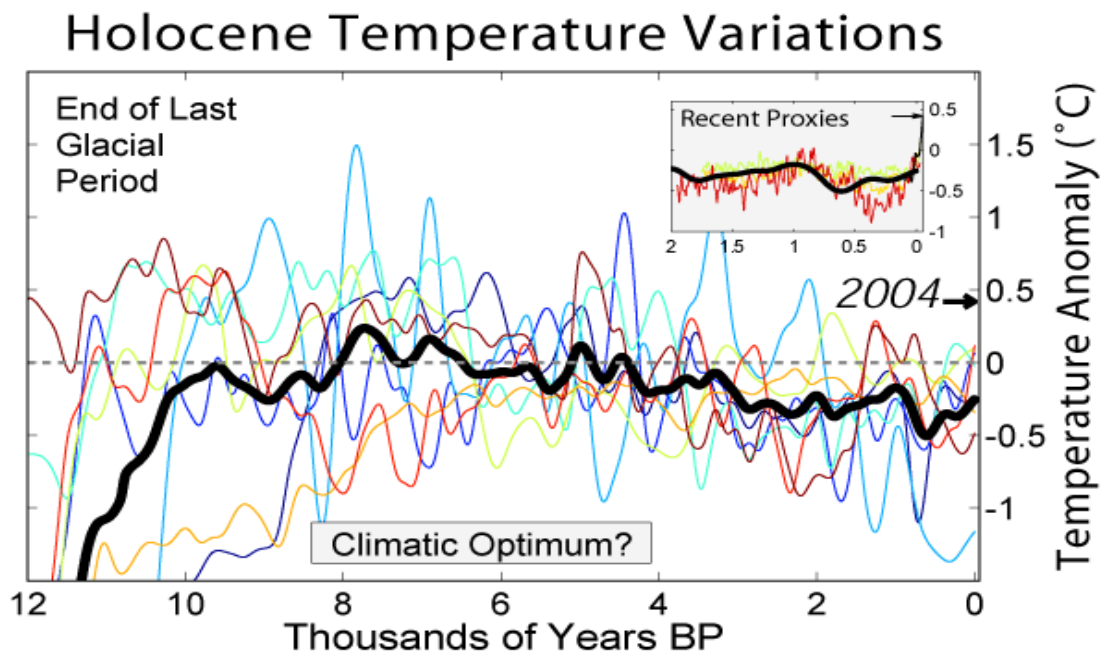


Figure 10: Un-Predictable, erratic, short-term solar cycles

Reference: Wikipedia encyclopedia,

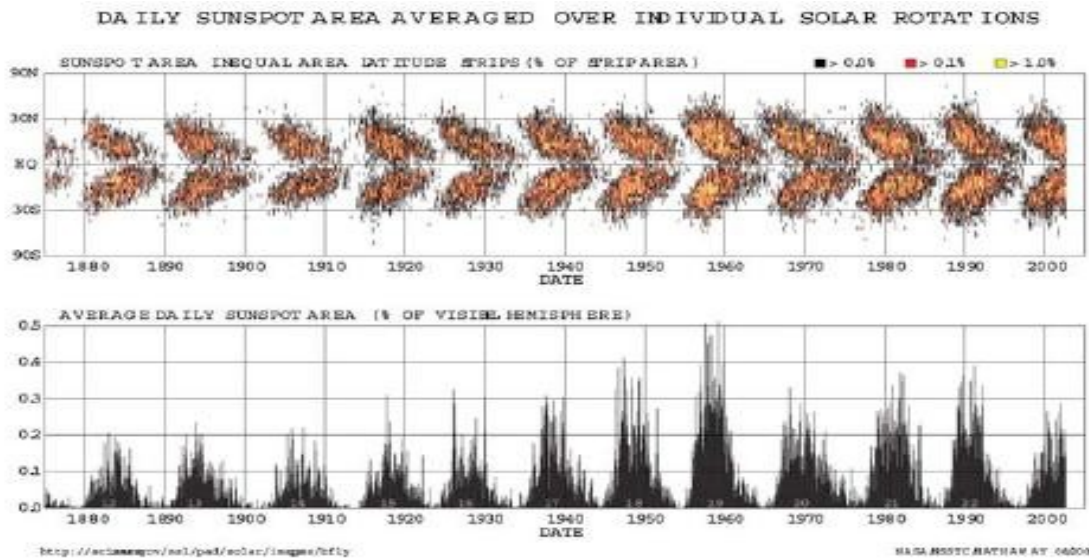


Fig. 2.1. Butterfly diagram (upper panel) and record of relative solar surface area covered by sunspots (lower panel). Upper panel: the vertical axis indicates solar latitude, the horizontal axis time. If a sunspot or a group of sunspots is present within a certain latitude band and a given time interval, then this portion of the diagram is shaded, with the colour of the shading indicating the area covered by the sunspots. (Figure courtesy of D. Hathaway, <http://science.nasa.gov/ssl/pad/solar/sunspots.htm>).

Figure 11: Solar minima

Reference: Ken Tapping et al 2007?

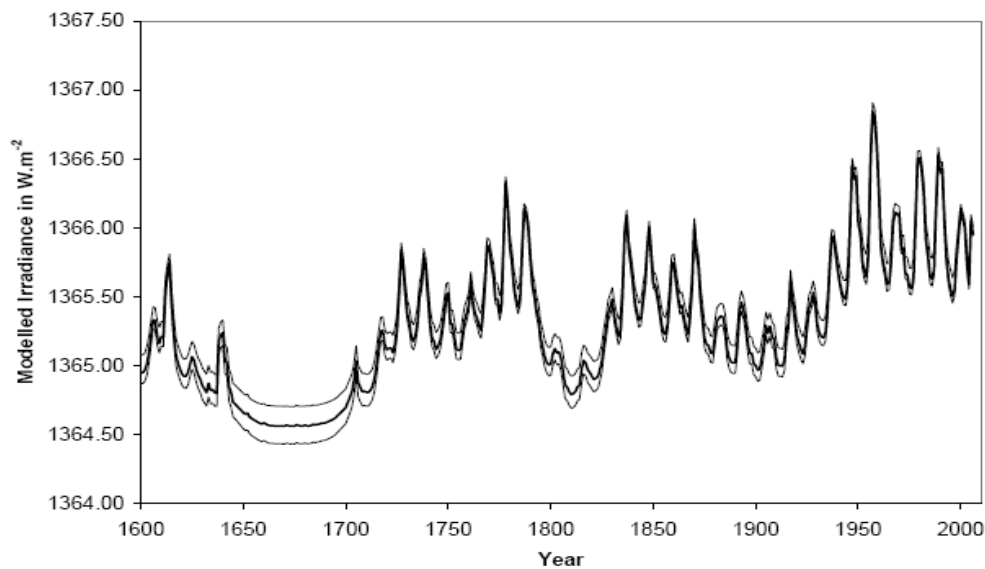


Figure 11: Changes of state in Earth and planetary processes

Reference: Julio Valdes & Graham Bonham-Carter

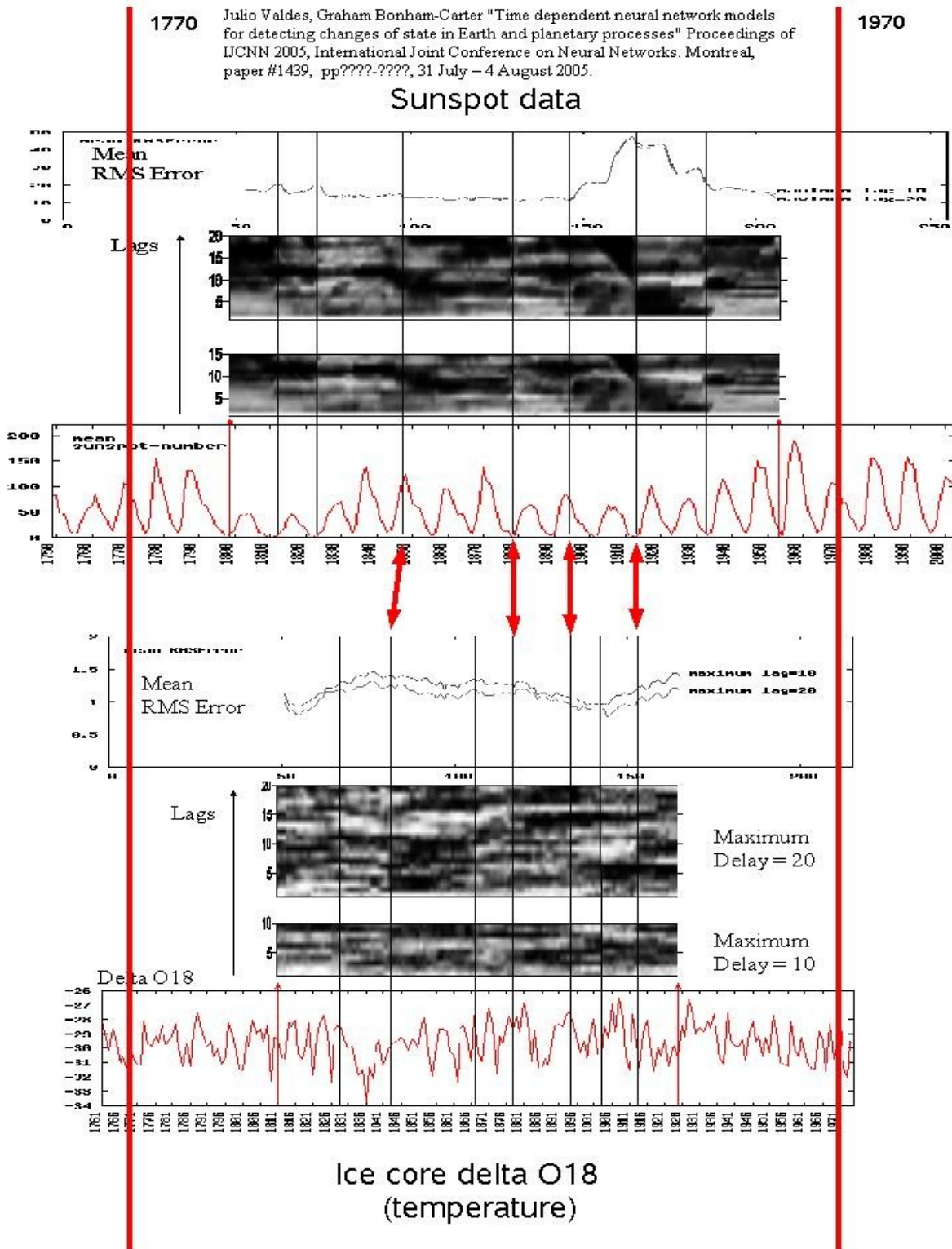


Figure 12: Holocene epoch - global and regional insolation

Reference: Laskar etal www.BillHowell.ca

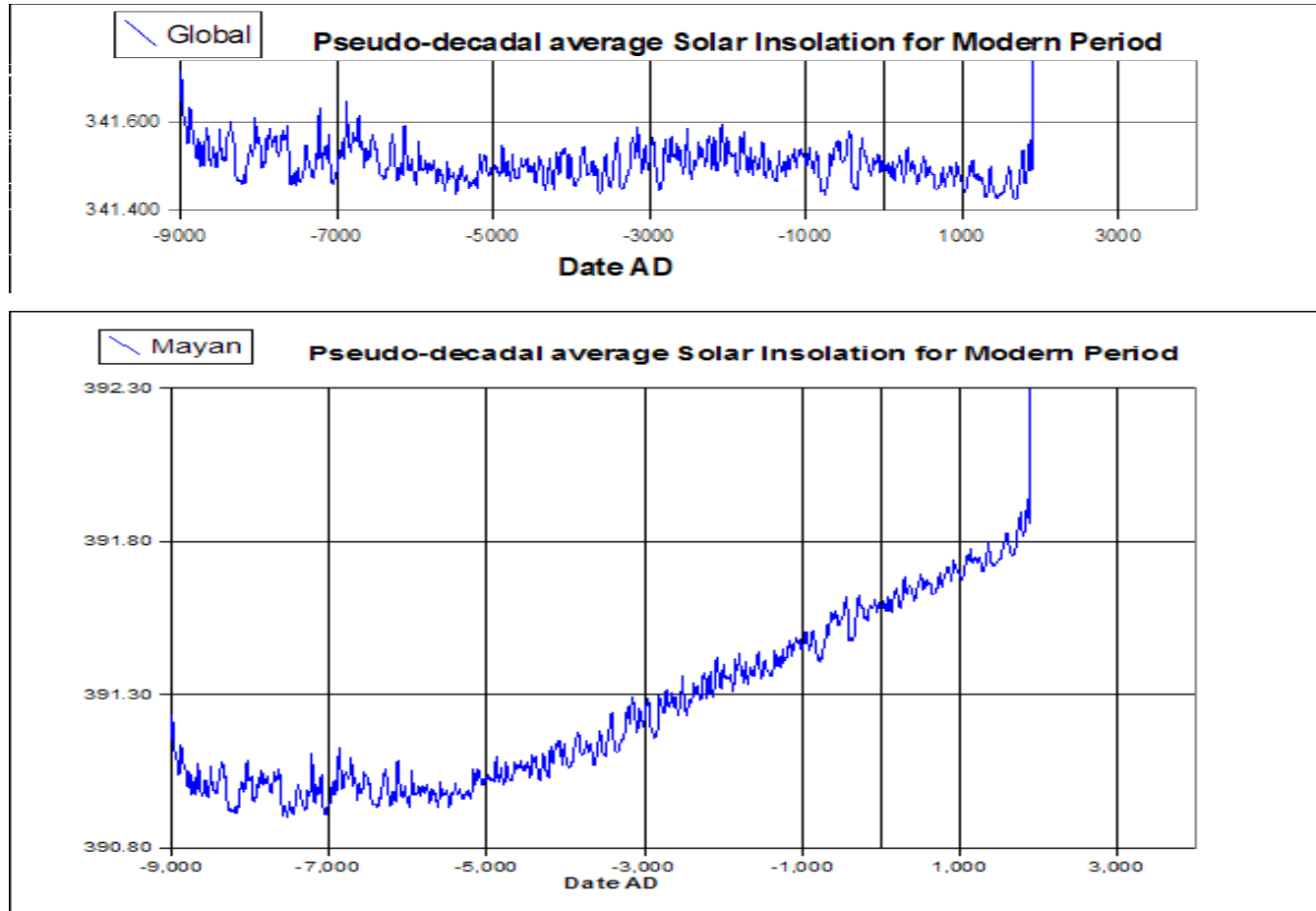
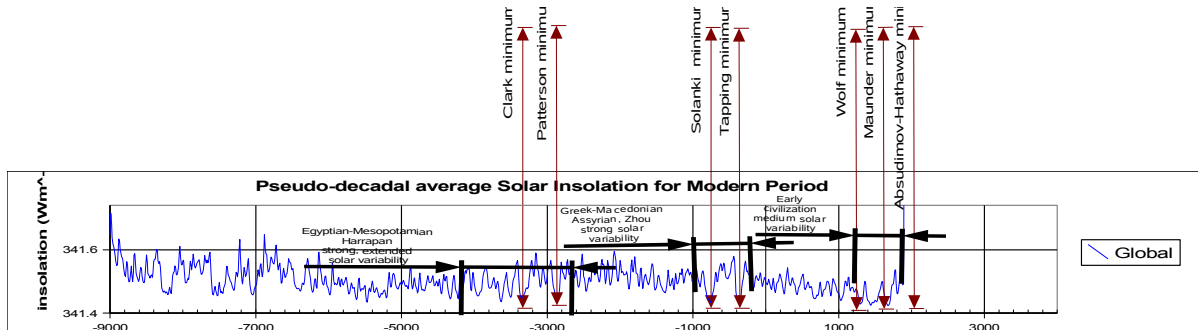


Figure 13: Holocene epoch - solar shocks

(Note: refer to the much larger chart on my website!)

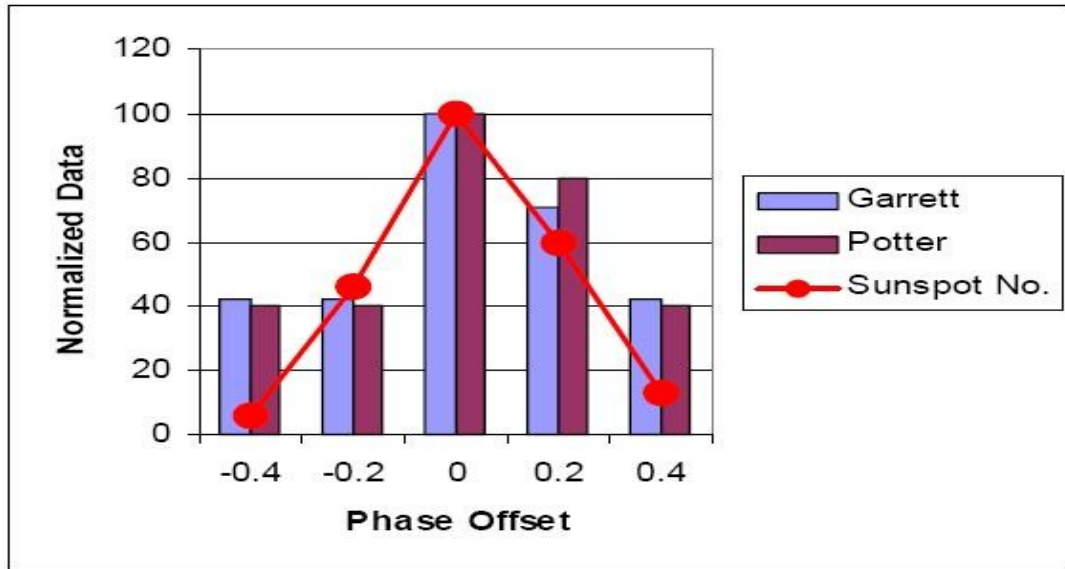
Reference: Laskar etal, Solanki etal, Tapping etal, www.BillHowell.ca



Historical Kingdoms, Ages, periods are not coherent nor well-defined. Even within small geographical areas there can be high diversity and divergence of fates. However, archaeologists/ historiens have found it useful to describe periods. If nothing else, it helps communication.

Figure 14: Influenza pandemics & solar phase

K.F. Tapping, R.G. Mathias, D.L. Surkan, Canadian J. Infectious Diseases, vol 12, no 1, pp 61-62, Jan-Feb 2001



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Figure 15: Influenza pandemics and solar activity

K.F. Tapping, R.G. Mathias, D.L. Surkan "Pandemics and Solar Activity - Elaborated" Unpublished as of 09Mar06

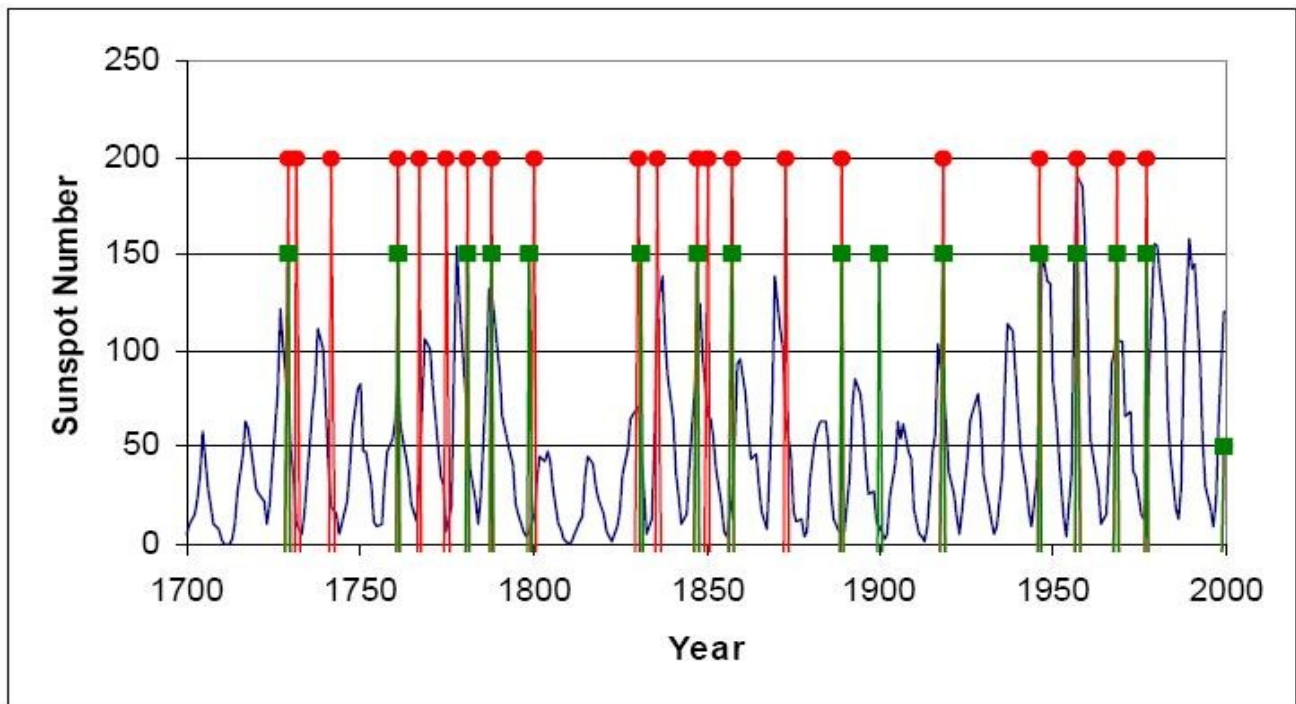
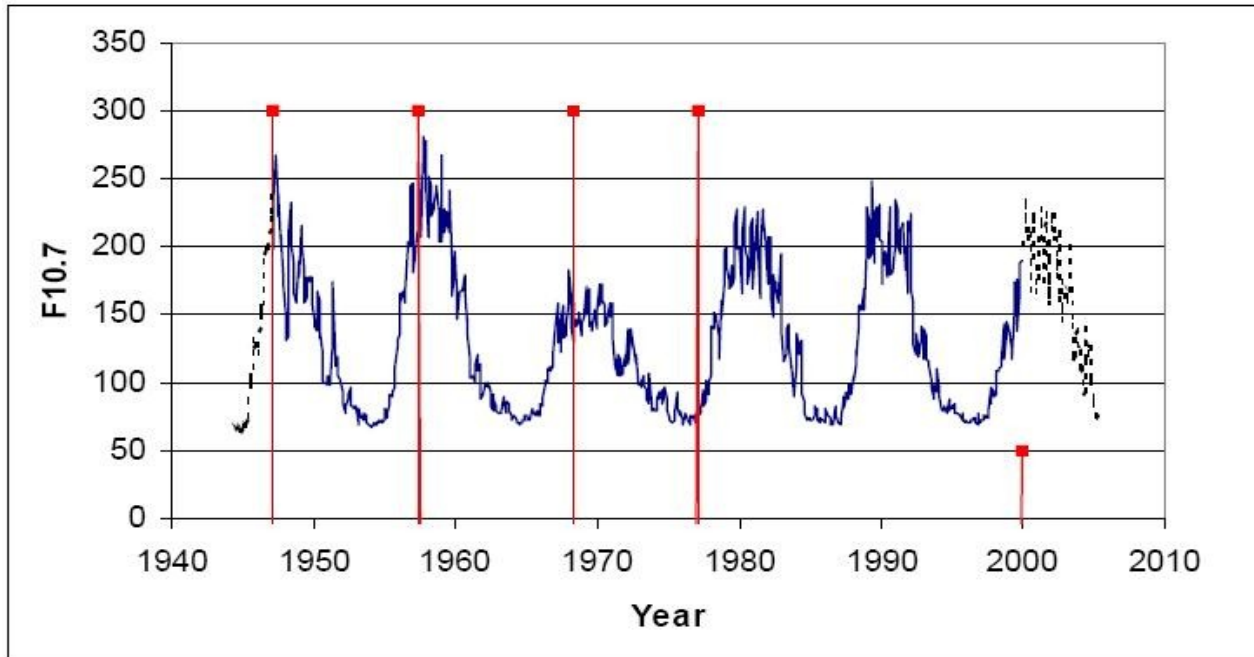


Figure 16: Recent Influenza Pandemics

K.F. Tapping, R.G. Mathias, D.L. Surkan "Pandemics and Solar Activity - Elaborated" Unpublished as of 09Mar06



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Figure 17: The use of Plagues in Evolutionary Computation

Reference: ?Turkish conference? (use Kenneth De Jonge's Book!!!)

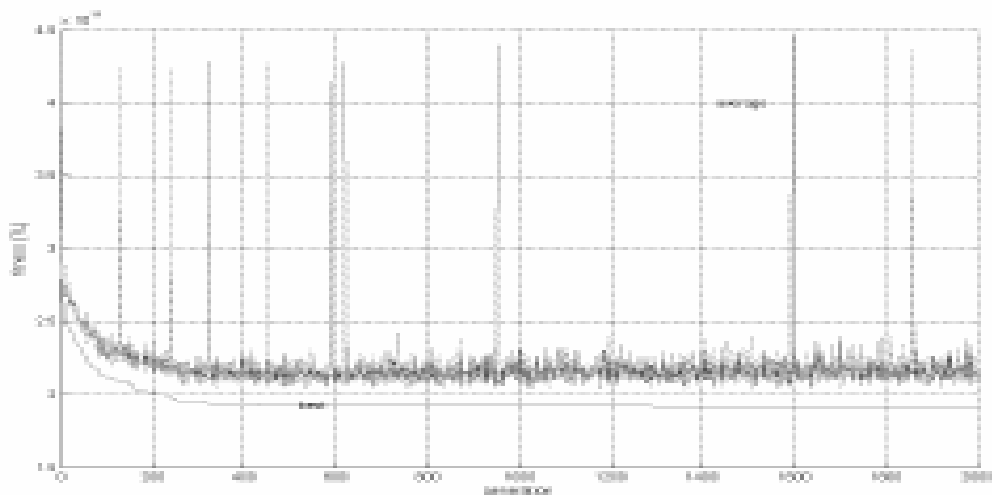


Figure 2
Fitness graphic

Figure 18: Kondratieff Investment Cycles

Reference: ?author? www.kwaves.com/kond_overview.htm

No apparent correlation?...

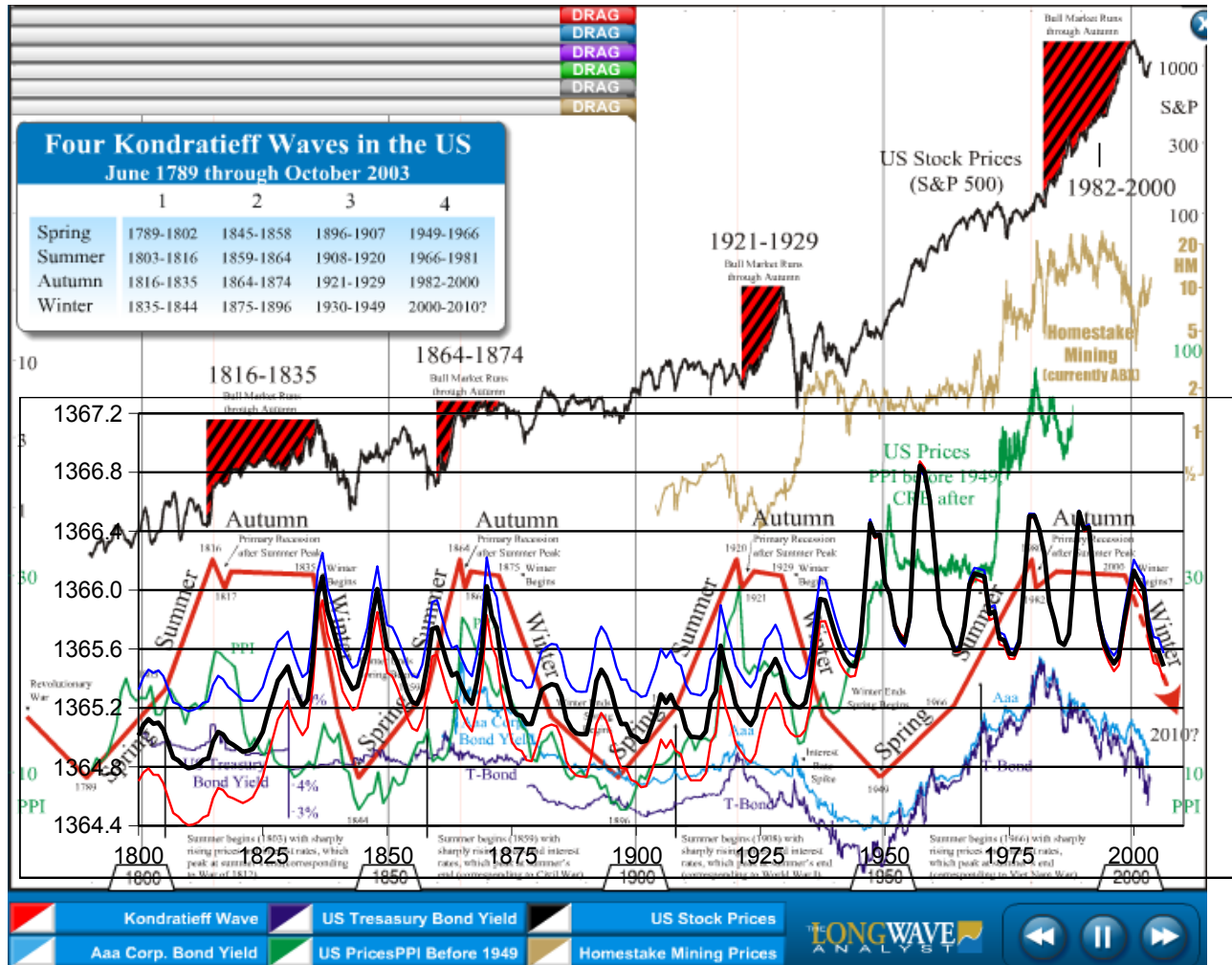


Table 1: A list of Solar scorchers, freezers, smoothies, and rocky roads

(Freezers: solar physicists; Scorchers: geologists; Smoothies: environmentalists, historians, geographers, faith healers; Rocky: pessimists)

Note: an 85 year error in dates is likely, due to misinterpretation of Solanki's data series.

Start	End	type	Name	Winners	Losers	Climate reservoirs
-8300	-8150	freezer				
-7910	-7650	smoothie				
-7610	-7400	freezer				
-7240	-7200	scorcher				
-6400	-6320	freezer	Laskar - Jacques Laskar, Paris Observatory, France			
-5930	-5650	smoothie				
-5440	-5195	smoothie				
-5090	-4900	smoothie				
-4670	-4480	smoothie				
-3545	-3220	rocky	Clark - Ian Clark, geologist, Uof Ottawa			
-2960	-2810	freezer	Patterson - Tim Patterson, geologist, Uof Ottawa			
-2810	-2600	smoothie				
-2600	-2450	rocky	Dikpati - ? Dikpati, National Ctr for Atmospheric Research, Colorado			
-2320	-1990	rocky	Covington - ? Covington, solar physicist, Natl Res Council Canada			
-1470	-1350	freezer	McIntyre - Steve McIntyre, statistician, Guelph University, Canada			
-1330	-970	smoothie	Lomberg - Bjorn Lomberg, Netherlands something			

Table 1: A list of Solar scorchers, freezers, smoothies, and rocky roads (cont'd)

Note: an 85 year error in dates is likely, due to misinterpretation of Solanki's data series.

Start	End	type	Name	Winners	Losers	Climate reservoirs
-870	-695	freezer	Solanki - Smai Solanki, Max Planc Inst, Germany	Northward/altitude drift of dominance, Greece, ?Anatolia? ???		
-690	-420	smoothie		Brilliance of ancient Greeks, Alexander the Great		
-420	-305	freezer	Tapping - ken Tapping, Natl Resrch Council, Canada	Romans	Greeks	
-210	175	smoothie				
200	285	freezer	Baliunas - Sally Baliunus, solar physicist, Harvard	Franks, Attila the Hun, etc	Romans	
520	880	smoothie		Charlemange, Islam, Vikings		
930	1080	freezer (minor)	Oort - ??			
1080	1260	smoothie				
1270	1330	freezer	Wolf		Vikings	
1330	1380	scorcher				
1380	1550	freezer	Spoerer - ?? Spoerer, ??	Mid-North Europe	Vikings again	
1550	1625	scorcher				
1625	1720	freezer	Maunder - ? Maunder, solar physicist, London Observatory?, UK	France, England, Germany	Spain, Portugal	
1720	1790	scorcher				
1790	1825	freezer	Dalton - ?? Dalton	USA	Napoleon Boneparte ultimately frustrated in Russian winter	
~1970	present	scorcher	Modern Warm Period	environmental nut-cases		
2035	2125	freezer	Absudamov-Hathaway	Islam, Hinduism, Egypt, Mesopotamia, Mediterranean, Northern Africa,	Canada, Russia, Northern Europe	
~2300	~2350	rocky	Charbonneau - Paul Charbonneau, solar physicist, Uof Montreal	Martian colonists	Tax departments in all countries	

Table 2: Civilization dates

Reference: Patricia S. Daniels "Almanac of World History" Oxford University Press: New York, 2002, 312pp

Empire	Dynasty	Page	Start	End	Civilization	Climate
Ancient		38, 39	-8000	-500	Settle in village	Domesticate plants, animals
Mesopotamia		38, 39	-5000			Irrigation, food surpluses
Egypt		50	-6000	-3500	Village, City-States	
					Dynasties, Empires	
Indus (Pakistan)		38, 39	-2200		Civilization	
China (Yellow River)						
Mediterranean		"	-2200		Trade and colonization	
Americas		"	-1200		Ceremonial Centres	
		"	-1500		IRON AGE	
Phoenicians:	Olmec	"	-1000		Colonizing	
Americas			-1000		Civilization strengthen	
Mesopotamia,		44	-3500	-500	First Cities	
Anatolia, Mid East						
	Sumeria	45	-3000	-2334	City States	
	Akkad	45	-2334	-1792	Mesopotamian Dynasty	
	Babylon	45	-1792	-1595		
	Hittites	45	-1595	-1200	Hittite Dynasty: From Anatolia	
	Assyrian	45	-1200	-900	Assyrian Dynasty: From Anatolia	
	Babylon	45	-900	-612	Babylonian Dynasty: Reconquer Empire	
	Persia	45	-539		Cyrus conquers Empire	
	Byzantine	111	527	1054		
Egyptian		50	-3000	-500		
		50	-6000		Irrigations & Cultivating Barley and Wheat : Villages	
	Old Kingdom	51	-3000	-2150	Narmer unifies Upper and Lower Nile	
		51	-2550	-2150	Pyramid of Giza	
	1st Intermed. Period	51	-2150	-1975		Drought Per
	Middle Kingdom	51	-1975	-1630	Thebians re-unite	
		51	-960		Expand to Nubia: second Cataract	
	2nd Intermed Period	51	-1630	-1550	Hyksos conquer Delta	
	New Kingdom	51	-1550	-1070		
		51	-1500		Thutmose T: Expands from 4th Cataract to Syria (today)	
	Nubian	51	-750	-500	Unstable period	
	Assyrian	51	-500			

Empire	Dynasty	Page	Start	End	Civilization	Climate
India-Harappan,						
Gupta, Mongol						
Indian		56	-2500	-500		
	Harrappan	57	-2500	-1500	Urban Centres	
	Mohen Jo Daro	57	-2000	-1500	Civil in decline; Pestilence	
	Arryan	57	-1500	-520	Invasde from North	
			-1000		Expand to Ganges	
	Persians	57	-520			
	Magadho	57	-500	-327	Ganges becomes centre of Harrappan	
	Alexander the Great	96	-327	-325		
	Maurya	96	-321	-185	Rules India Ganges Indes (-321-297)	
			-232	200	Declining	
			-200	320	"	
	Gupta	96	-320	550	(ca) Stable and apex of Dynasty	
		97	450		White Huns invade India	
	Gupta			550	Last ruler of Dynasty	
Mogul		194	1523	1537		
	Babur	"	1523	1530	Never consolidated - invade from Afghanistan (Babur)	
	Humayan	195	1530	1540		
	Sher Shan	"	1540	1555	Conquers Hindustan	
	Humayan	"	1555	1556	Retakes Hindustan	
	Akbar	"	1556	1605	Consolidate Empire	
	Jahangir	"	1605	1627		
	Jahan	"	1627	1658		
		"	1632		Taj Mahal	
	Aurangzeb	"	1658	1707	Harsh religious rule	
			1760			
				1857	Begining of British direct rule	
			1947		Independance	

Empire	Dynasty	Page	Start	End	Civilization	Climate
--------	---------	------	-------	-----	--------------	---------

Chinese		60	-2220	-500		
	Ancient	60	-5000		Villages, Yellow River	
					" Yangtse River – irrigation & flood ditcher	
	Shang	61	-1750	-1100	Yellow River Shang Dynasty overthrown by Yangtse Dynasty	
		61	-1300		Move capital to An Yang	
	Zhou	61	-1100	-771	Unites Yellow & Yangtse Rivers	
	Nomads	61	-771		Instability	
	Period of				"	
	warring	90	-403	220	"	
	Qin	91	-221	-210	Eastern Rule	
	Han	91	-206	220	Western rule from Chi-ang-an	
	Hon Wu Ti	91	-141	-87		
	Wang					
	Mang	91	9	23		
	Han	91	23	220	Eastern Han rules	
	"	91	91		Invade Mongolia	
	"		184	192	Revolt of 3000,000	
	"					
	"	91	220		Divided into 3 regional Kingdoms	
Christianity		98	27	392	Teaching in Judeo	
	Jesus	98	30		Pontius Pilate condemns	
	"		45	62	Saul travels to Caesarea	
					AAntioch & Ramo - Jail	
	"		64	260	Roman persecutions Edict of	
					Milan	
	"		313			
			392		Official religion of Rome	
Byzantine		111	527	1054		

Mediterranean						
China						
Meso-America						
North America						

Timeline 1: Global pseudo-decadal average solar insolation + irradiance for the Holocene epoch

Reference: Laskar, Solanki, Tapping

NOTE: A much more clear version can be downloaded from:

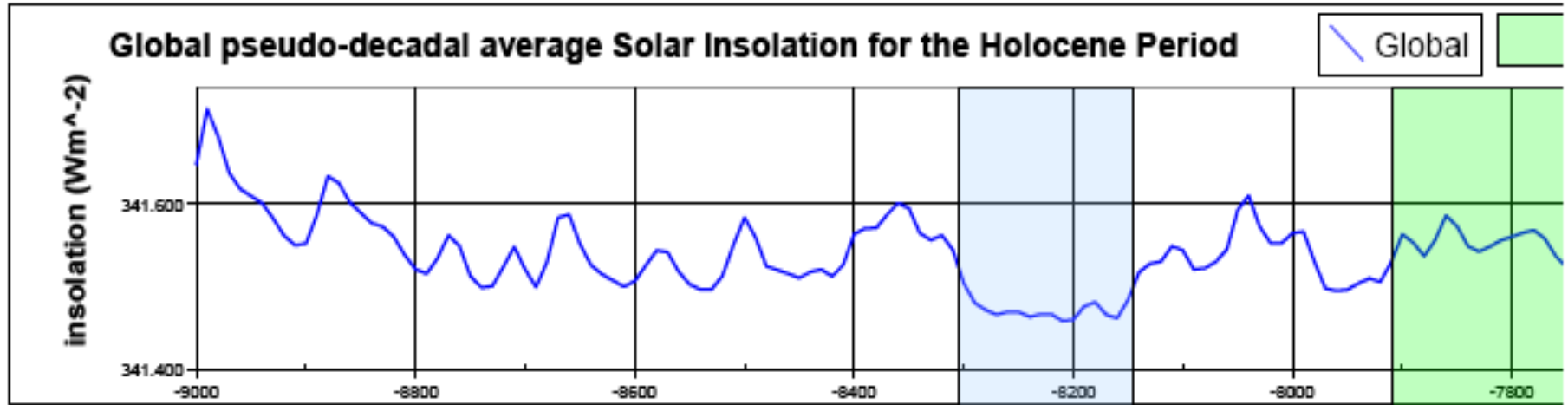
www.BillHowell.ca/docs/Howell - Solar insolation for civilisations.ods

or

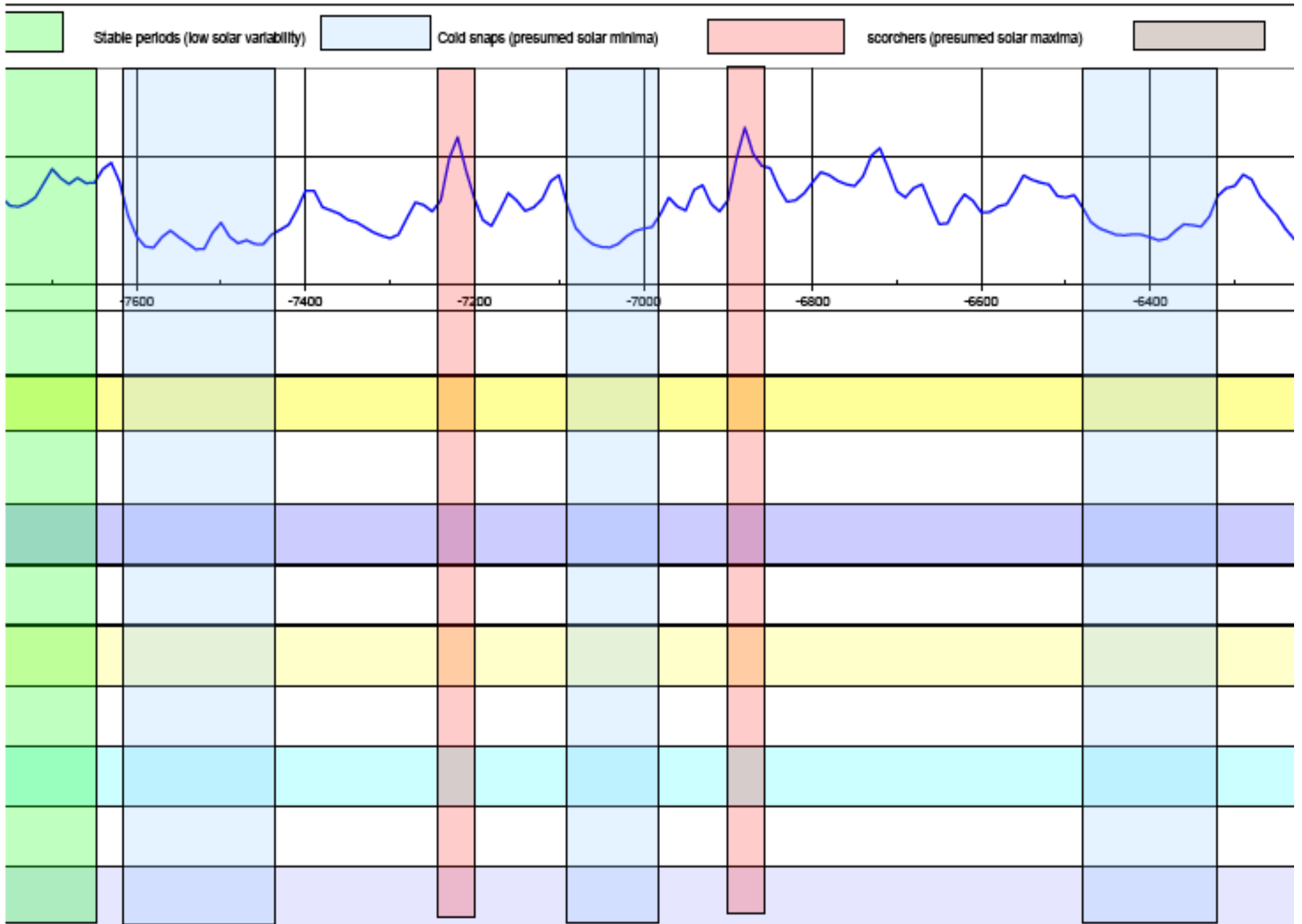
[Howell - Solar insolation for civilisations.pdf](#)

We support open file formats, such as ".ods" for spreadsheets, to improve the openness, diversity and competitiveness of the software industry. (Microsoft Excel may not be able to load the file - try Sun StarOffice or other S/W providers).

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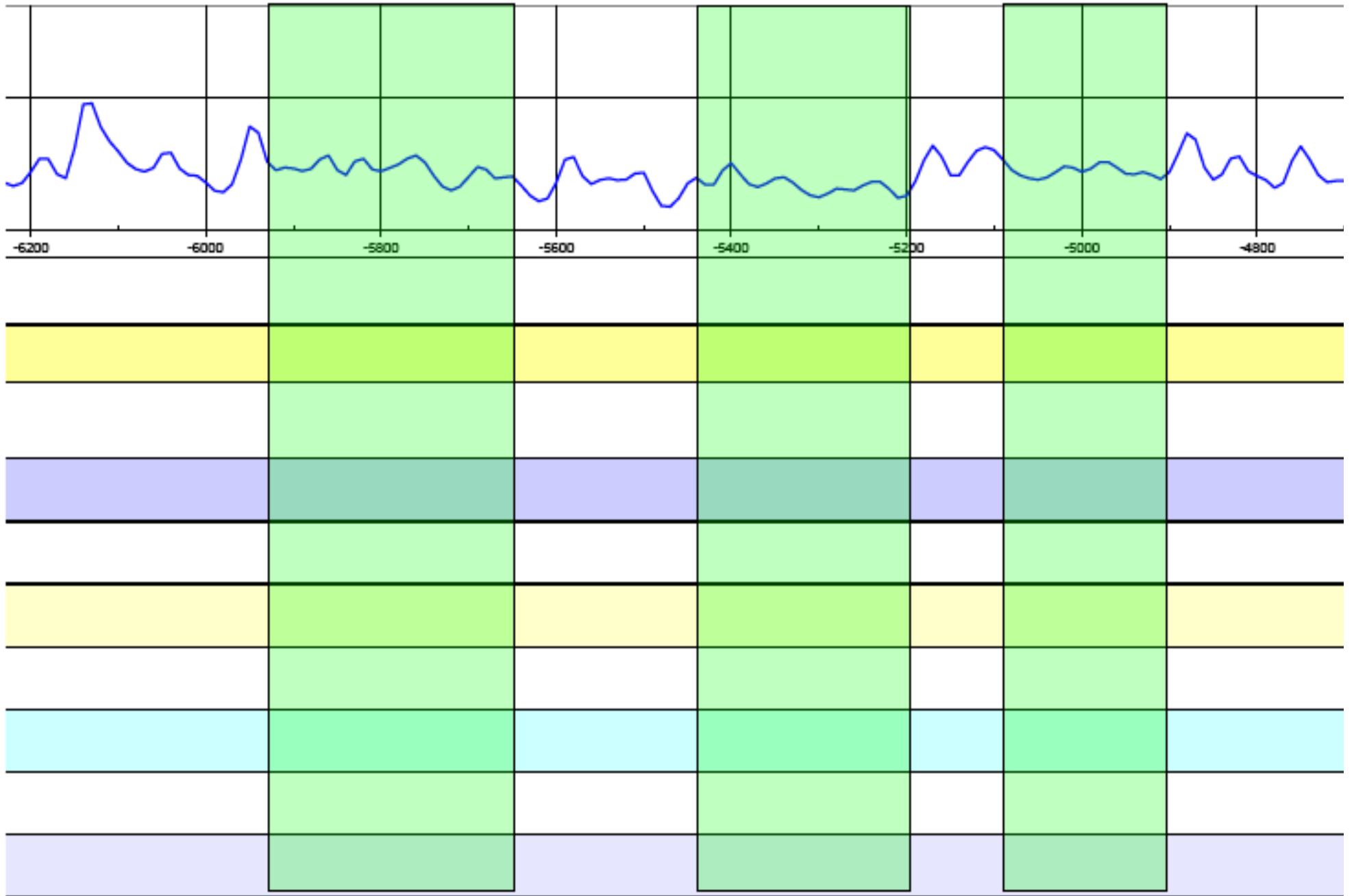


Mesopotamia			
Egyptian - then Persian & Muslim			
India - Harappan, Gupta			
Mediterranean			
China			
MesoAmerica			
Anasazi, Mississpl, Hopewell Ohio			

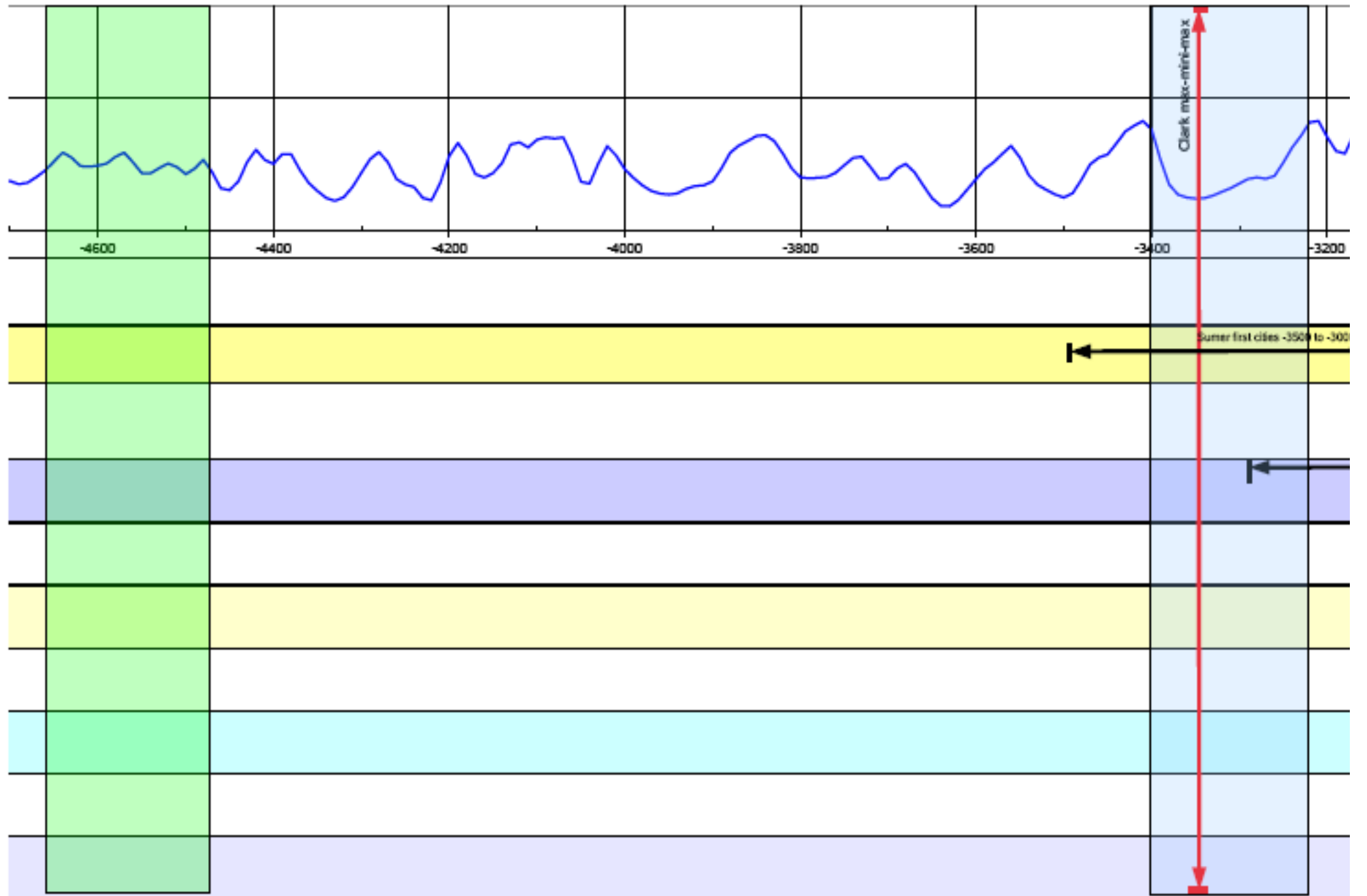


drought

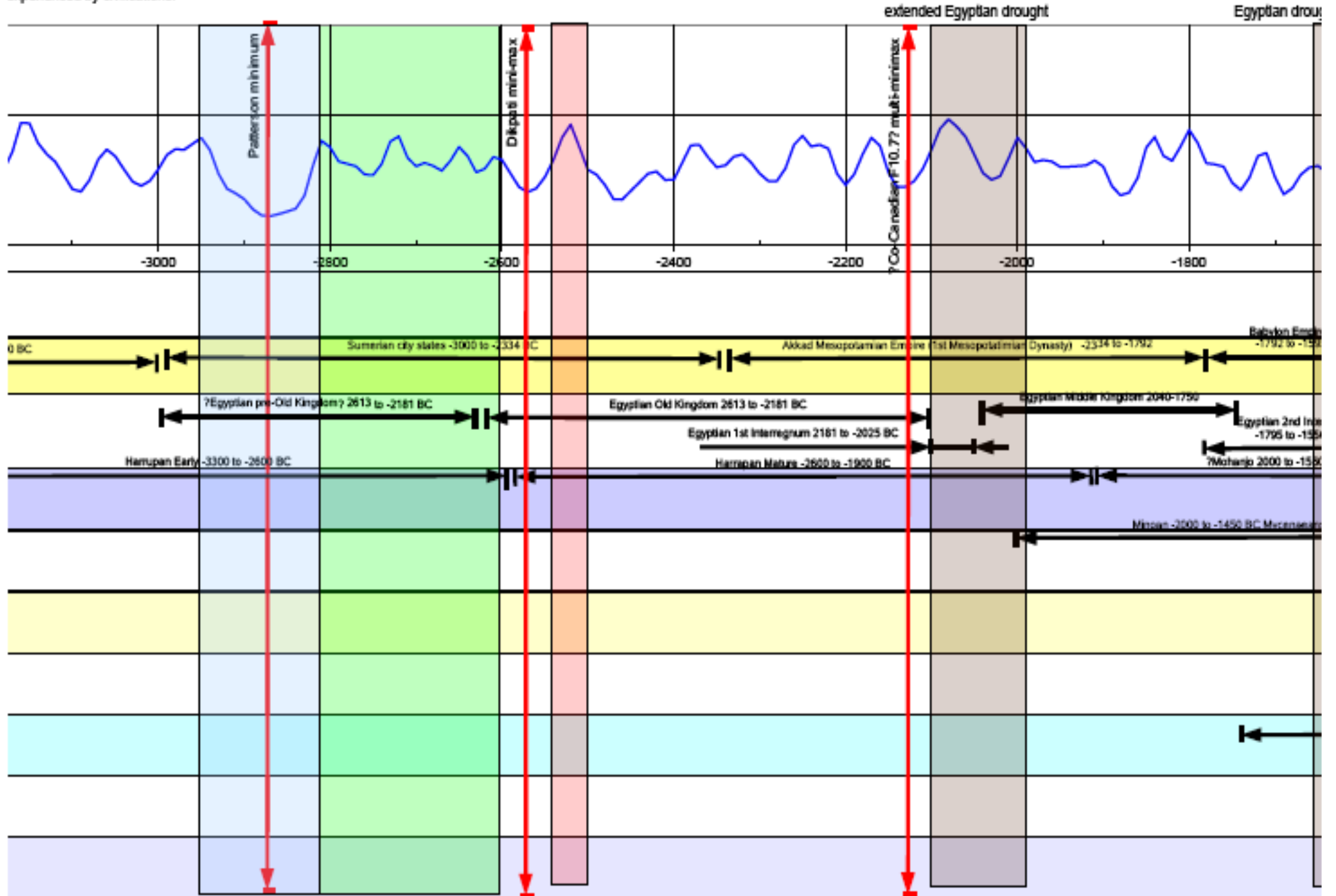
WARNINGS: (1) Likely error that the insolation curve is shifted 85-years to left due to misinterpretation of Solanki's data table. (2) The sunspot variances as shown through insolation ha

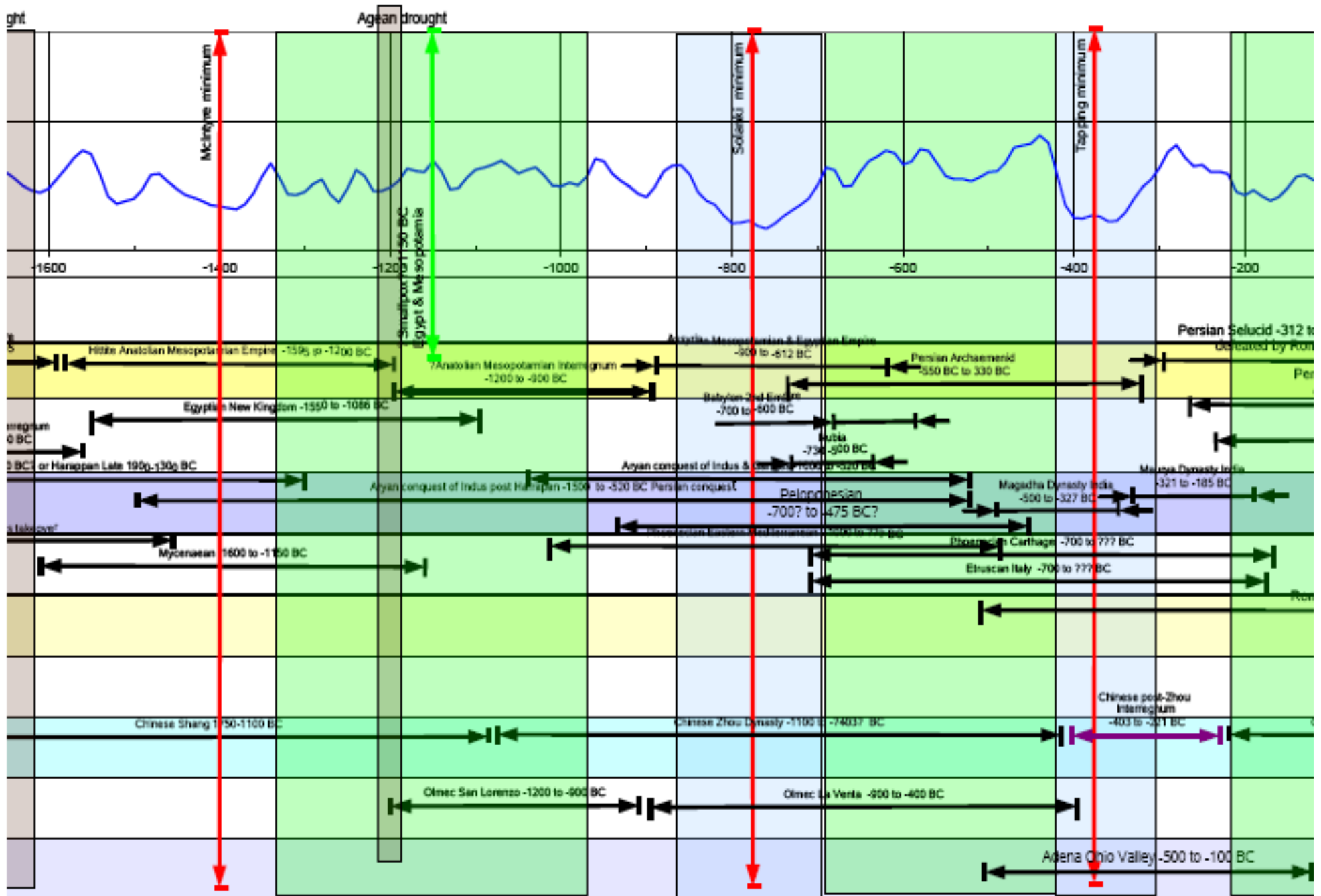


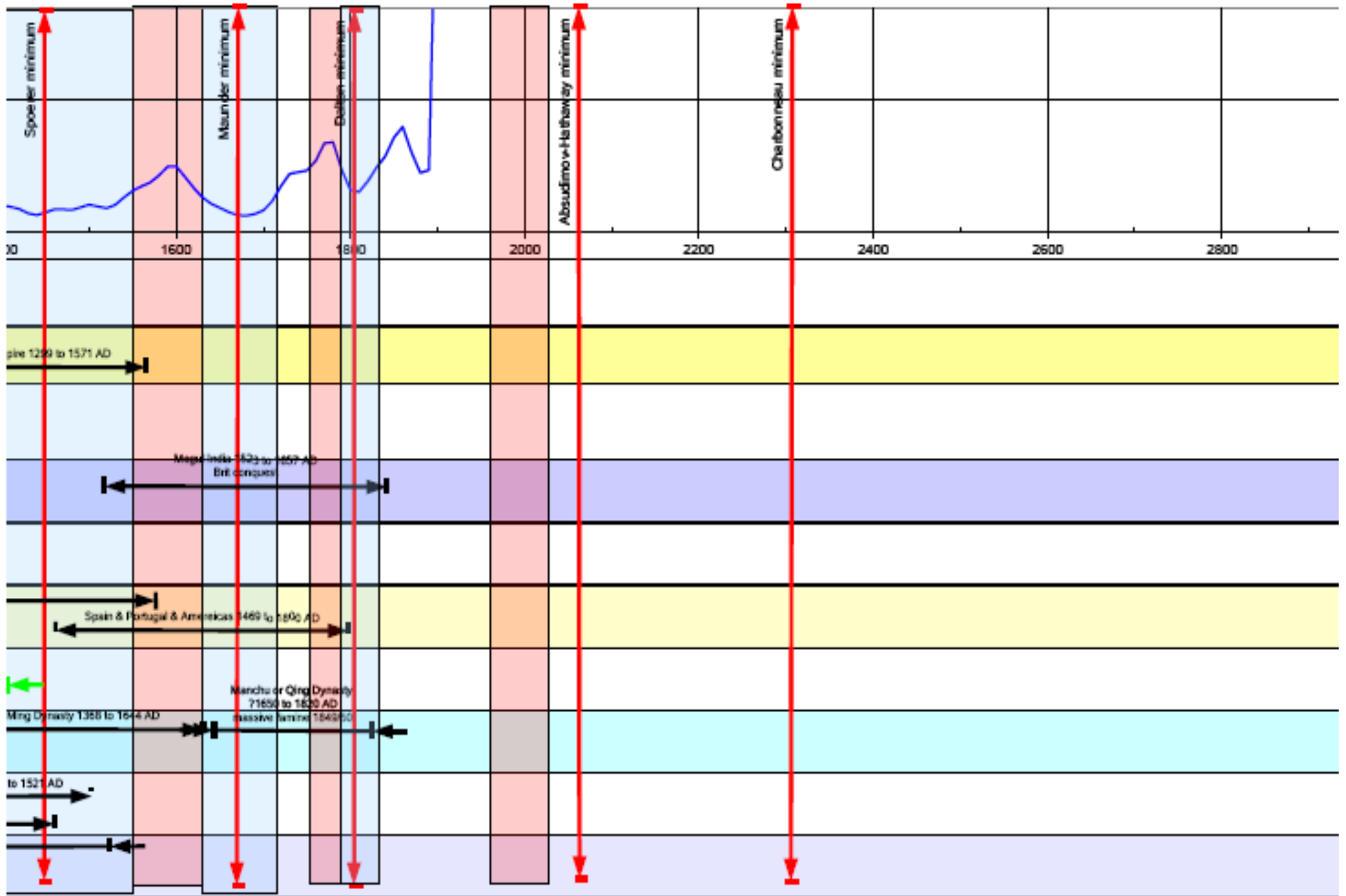
ve been exaggerated to show what the Hale 11-year half-cycle peaks and troughs would look like (no galactic ray-cloud impact!!). This would skew energy perspectives, but may give an idea of shorter-term shocks as

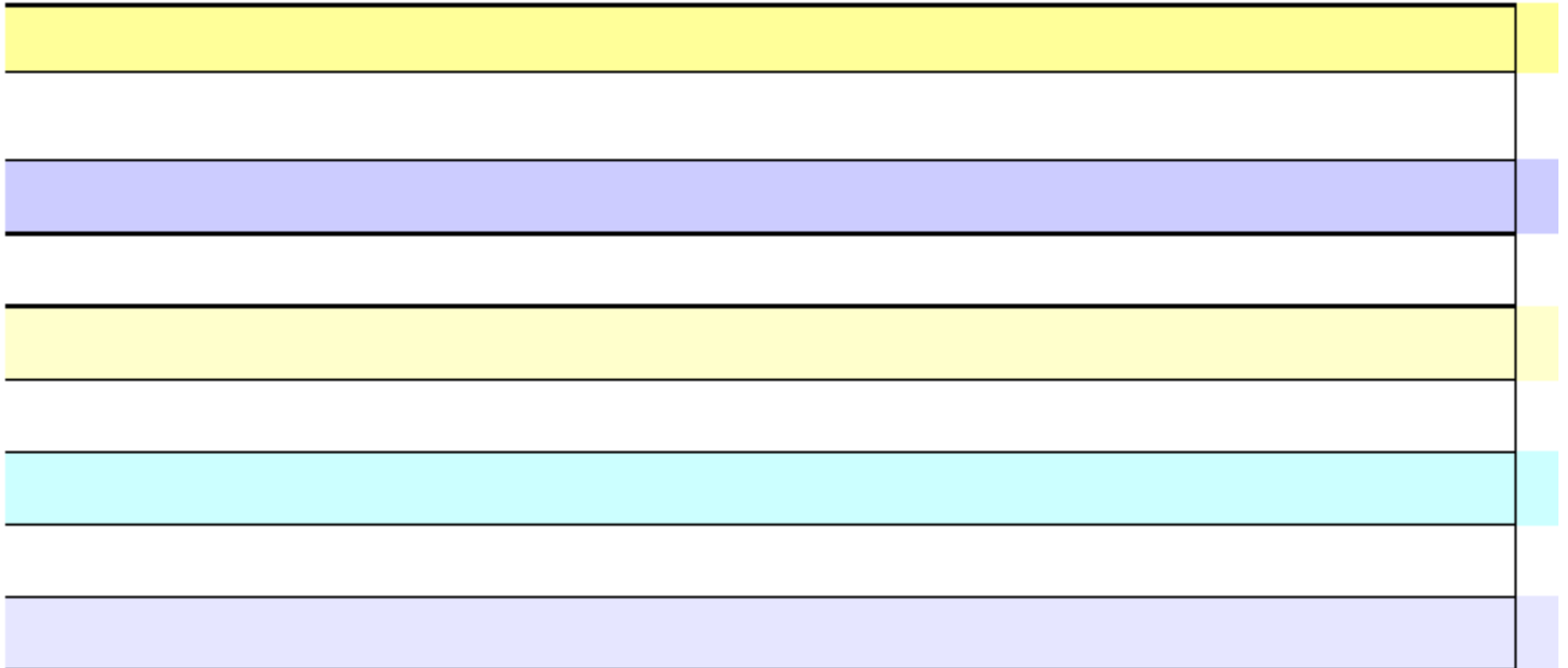


experienced by civilisations.









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