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Research Report 1-2008 – The RC Theory

The existence of 'relational cycles' of solar activity on a multi-decadal to centennial scale, as significant models of climate change on Earth.

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[1] An independent analysis was conducted of sunspot records to 1610, solar activity proxy C14 isotope records for 1,200 years, temperature records for 2,000 years, using multiple sources, both chart extrapolated data and original data sets from other research sources. This research provides sufficient information to conclude that underlying and fundamental cycles of solar activity exist and are significant models of climate change on the Earth on multi-decadal and centennial scales. A theory has been formulated, "The Theory of Relational Cycles of Solar Activity, ' to describe these significant relationships between our Earth and these solar oscillations that result in the heating and cooling of the Earth. An important aspect of the theory is that it results in a set of tools for the predicting of global climate change decades in advance. As such, it offers the scientific community as well as the general public, a plausible means for understanding the natural and predictable shifts from global cooling to global warming and back to global cooling that have occurred for thousands of years in the past and will likely do so in the future. As a direct result of the theory, it is predicted that the Earth will experience a significant temperature decline beginning within 3-14 years and lasting two or three solar cycles resulting in global temperature reductions of at least 1.0-1.5 C, a level not seen for over 200 years. The depths and extent of the predicted cold period has the potential to result in world wide agricultural, social, and economic disruption.
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1. Introduction.

[2] During the 1970's, a major focus of world weather discussion was 'global cooling.' The cooling, as examined by the scientific community, was determined to be possible precursor signs of a coming new ice age. It was found consistent with the long term cycles of ice age arrivals which have been punctuated by intervening small periods of warm weather like the Holocene period we now live in. This view of the Earth's climate status was reversed during the 1980's and 1990's to 'global warming', except this time the role of the sun was muted. It has been widely reported that the primary driver for the current warm era is anthropogenic i.e. man-made, and caused by emission of excessive amounts of greenhouse gases from human industrial processes, primarily CO2. My research and the significant data base of similar and supporting research indicates a new cold period is now upon us, once again poised to reverse the discussion and review of global climate change processes. This paper details the process, findings and new theory that have arisen from my independent research and the wealth of corroborating research from many others.

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2. Sunspot Cycles.

[3] In order to assess the relationships between solar activity and effects on the Earth's climate, I undertook an independent study from available research data and associated graphical representations of such data. Initial examination of solar activity charts displaying one or two 11 year cycles, especially the current cycle 23 and predicted cycle 24, though revealing, were not clear in any cyclical pattern that would render them as a means of predicting future solar activity or climate impacts. Later, it was also observed that temperature variations on a wide scale took place within a single solar cycle and thus did not seem to present a tool for prediction of future solar activity much less temperature variations. Even more extended scales of all sunspot records from several sources were examined for any useable trends. For example, the chart in Figure 1 from NASA/MSFC shows sunspot numbers from 1610 to present day. While it begins to show cyclical patterns, they are too difficult to detect with clarity.

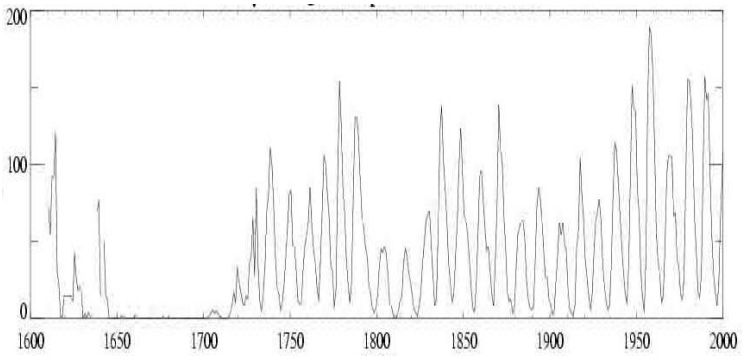

Figure 1. Yearly averaged sunspot numbers 1610-2000. Source: NASA/MSFC

3. Centennial Cycle.

[4] Though no trends were immediately evident from charts of sunspot histories in unevaluated form similar to Figure 1, the graph of sunspot counts in Figure 2 also depicting numbers back to 1610, immediately showed a recurring cycle. An oscillation between 90-100 years was directly measured from a highly expanded and more detailed version of the chart. The low points of solar activity are evaluated at the years 1700, 1810, and 1910. One can extrapolate the next low point in the average sunspot line to be within the range of year 2000 to 2010. The graph is a high fidelity reproduction of the raw data and as a result, through graphical measurement, has yielded accurate first order calculations of what I have termed the 'Centennial Cycle' in the range of 90-100 years. It is important to note that it is the smoothed average line of the solar activity maximum and minimum points which produced the measurement points and the clearest image of the cyclical nature of the Centennial Cycle. Again, attempts to discern a long term cycle or trend from an individual solar cycle or small groups of solar cycles had not been able to show meaningful relationships. This finding was also observed in the analysis of Figure 3 showing both beryllium 10 and sunspot numbers extending back 600 years. This graph was used to provide comparative data and validation of the use of the sunspot numbers as a reliable solar proxy. Note the strong correlation of Be 10 low concentrations coincident with the sunspot lows for the years 1700, 1810 and 1910 as well as the small low at what measures at 1967. This graph was also effective for analysis because of the compressed time scale in seeing the more pronounced average sunspot line and more distinct amplitudes at maxima and minima. Additionally, solar activity lows from the sunspot number portion of this chart were measured at years 1700, 1810, 1888 to 1916, and 1967.

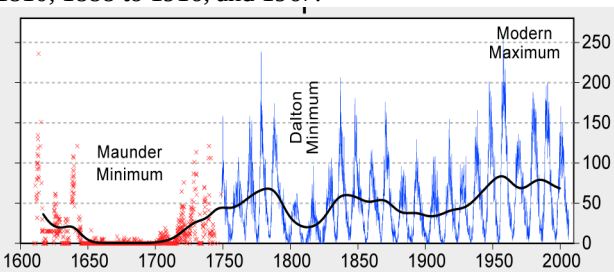

Figure 2. 400 years of sunspot observations depicting the Maunder and Dalton Minimums and the Modern Maximum. Source: Graphics; R. A. Rhode, Global Warming Art, from data sets by Hoyt and Schatten (1998a, 1998b).

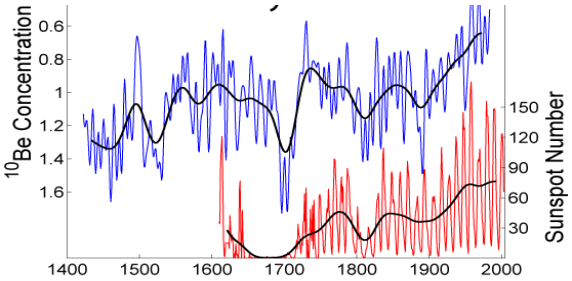

Figure 3. Solar activity proxies over the period 1400 to 2000. Displayed are beryllium 10 concentrations in the blue portion of the graph from annually layered ice cores from the Dye-3 site, Greenland (Beer et al. 1994). The lower red series showing sunspot numbers is reconstructed from historical observations by Hoyt and Schatten (1998a, 1998b). Solid black lines are smoothed 30 year averages. Source: Graph; R.A. Rhode, Global Warming Art.

4. Bi-Centennial Cycle.

[5] Finding the Centennial Cycle led to a further expansion of the range of consideration to see whether there were larger cyclical processes at work. This was found in fact, upon the examination of the graph produced from the crucial work done on radiocarbon dating by Reimer et al.(INTCAL04), and faithfully reproduced in Figure 4. This graph and data taken from this graph resulted in the determination of the 'Bi-Centennial Cycle'. From this all important graph and the extensive data set from the study by Reimer et. al., I was first able to recognize the obvious periodicity of the 'Bi-Centennial Cycle'. Using chart measured and extrapolated data of the carbon 14 curve, from 900 AD to present I directly computed a cycle of 207 years ± 24.4 years. Use of the Reimer data set per se, yielded a more exact Bi-Centennial calculation of 206.25 years with a variance of ± 23.75. Data elements extracted from the extensive INTCAL04 data set were used to calculate the more accurate Bi-Centennial Cycle as 206.25 years by calculating cycles between major peaks of C14 over the 1,100 year period. I have termed the low between the years 880 to 940AD as the "Mayan Minimum" as it preceded the collapse of the Mayan civilization.

[6] With the Bi-Centennial Cycle derived, it was then used to estimate current 206 year cycle characteristics. Chart determined data showed the range of time between cycle peaks and the following minima was within a range of 30 to 92 years with a mean of 61 years. From both of these sets of data as well as Figure 5, the following was derived as a result of the influence of the Bi-Centennial Cycle:

Predicted peak of current 206 year cycle:	1986-1987
Predicted peak range: ±23.75 yrs:	1962-2010
Actual solar activity peak (from sunspots):	1960
Approximate symmetrical peak of current 206 year cycle:	1970

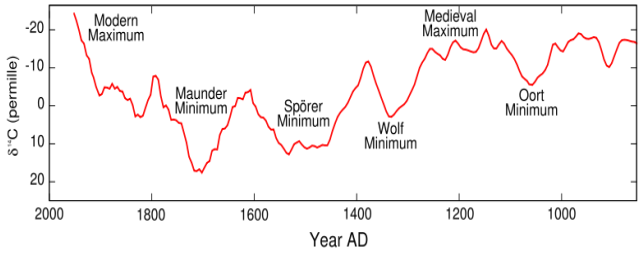

Figure 4. Solar activity events in carbon 14 are depicted from the year 900 to approximately 1950. The Modern and Medieval Maximums are shown along with the Maunder, Sporer, Wolf and Oort Minimums. The year 880-940AD minimum is referred to herein as the "Mayan Minimum". Not labeled is the Dalton Minimum which was roughly during the time 1793-1830. Source: Graph; L. McInnes, GNU Free Doc. License, Data: Reimer et al 2004.

5. Temperature Correlation.

[7] Once the Centennial and Bi-Centennial Cycles were defined, their impact on the Earth's climate by way of temperatures was evaluated from a variety of sources. A series of charts of US and global temperatures were used to correlate solar activity lows from sunspot and carbon 14 numbers and actual instrumented temperature measurements from 1850 to 2006 from NOAA and Hadley Center records. Derived temperatures were also used from multiple temperature proxies from research by Bao Yang et. al., going back to 0 AD. This provided a complete 2,000 year temperature profile.

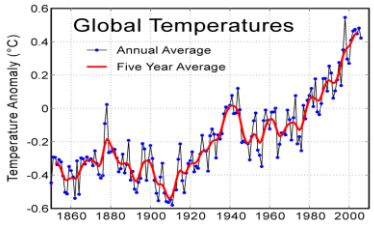

Figure 5. Global temperatures from the period 1860 to 2000. Sources: Graph; R. A. Rhode GWA, Free Doc License, data set from HADCRUT3, Climate Research Unit of the University of East Anglia, Hadley Centre.

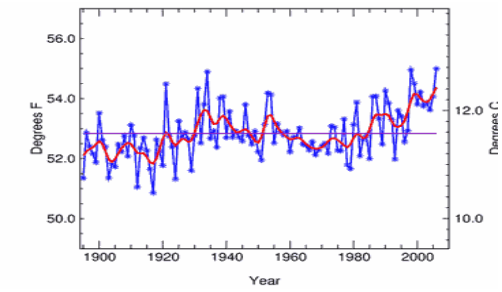

Figure 6. National (US) temperatures from 1895 to 2006. Blue line shows yearly values, red line filtered values, and burgundy mid chart line, the long term mean. Source: NOAA, National Climate Data Center.

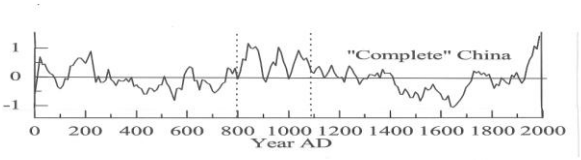

Figure 7. Temperatures in China for the period 0-2000 AD. This "Complete China" plot was extracted from the set of temperature curves from the researchers' original figure and used as the best representation for this study. Nine temperature proxies were combined to create the plot. The left scale is in temperature deviations in sigma units. Source: Bao Yang, et.al., Geophysical Research Letters (2002).

[8] As a result of chart derived temperatures, a table of comparative data was constructed providing a rough correlation between solar activity previously determined and temperature lows covering the last 1,100 years. The result is an impressive, nearly identical overlap of solar minimums and temperature lows. An evaluation of the degree of correlation can be established from Table 2 and based upon a relationship where N is the number of solar activity minima, and the number R is the minima which are (approx.) coincident with temperature minima. When R/N~ 1 or similarly, N-R/N ~ 0, a near perfect correlation exists. With R/N evaluated at .93 and N-R/N at .07, a remarkably strong relationship is established between solar activity and Earth effects in terms of temperature lows. Temperature highs were not examined in this study but the implication is that there exists a similar correlation between solar activity highs and global temperature highs. Further study is required.

#	Solar Activity Low	Nearest Major Temp. Low
	(Figure 2 Lows)	(Figure 5,6 Lows)
1.	**1965**	**1967**
2.	**1905**	**1905**
3.	**1888**	**1887**
4A.	**1809**	**1810**
	(Figure 3 Lows)	(Figure 7 Lows)
4B.	**1815**	**1810**
5. (Maunder)	**1660-1740**	**1660-1680**
6. (Sporer Low)	**1530**	**1520**
7. (Sporer Start)	**1450**	**1440**
8. (Wolf Min.)	**1300-1350**	**1280-1320**
9.	**1225**	**1230**
10.	**1140**	**1140**
11. (Oort Min.)	**1060**	**1090**
12.	**1000**	**1000**
13. (Mayan Min.)	**910**	**900**

Table 2. Corroborating solar activity lows (from Figures 2, 3) and temperature lows (from Figures 5,6,7) and showing an impressive degree of coincidence. For the year 1810, two temperature charts had the period displayed and thus both are shown as indicated. The wide base of the bottom of the Sporer Minimum low temperature period made two temperature correlations possible.

6. Comparative Research.

[9] A comparative review of available literature after completion of research, was done to determine the accuracy of the study findings and the associated theory, as well as its value as a model for prediction of future solar activity and concurrent climatic effects. In summary, the results of the comparative study found that there are numerous highly professional and experienced scientists whose research provides substantial corroboration for one or more elements of the Theory. This includes the important substantiation that the well known Gleissberg and deVries/Suess cycles have essentially the same periods as the Centennial and Bi-Centennial cycles, respectively. References attached hereto have been used for this study validation and represent only a fraction of the total of sources used in the comparison phase of the research. The only

references used during my research and theory development, are specifically noted within the text of this report.

7. Conclusions.

[10] As a result of research conducted, a theory has been formulated to account for the observations and findings. The "Theory of Relational Cycles of Solar Activity" or simply the "RC Theory" has seven main elements: (1) There exists a family of solar activity cycles that has a profound and direct influence on the Earth's climate, and (2) These cycles are 'relational cycles' since their effects can be experienced or 'related' to during one or two human lifetimes, and (3) There is a "Centennial Cycle" of 90-100 years duration, which manifests itself with solar activity minimums and associated low temperatures with episodes lasting a few years to 1-2 decades, and (4) There is a "Bi-Centennial Cycle" of about 206 years, that is the most powerful of the relational cycles and has significant effects on the climate of the Earth lasting many decades resulting in the most extreme variations in solar activity and in the Earth's temperatures, and (5) These cycles are correlated strongly to all past major temperature lows, and (6) There is remarkable regularity and hence predictability of these oscillations, such that the theory may be a powerful tool in forecasting of major temperature and climatic cycles on Earth, many decades in advance, and (7) There may be other relational cycles of shorter duration accounting for lesser solar and climatic events which may be revealed in subsequent research.

[11] Therefore, the comprehensive nature of the findings and strongly supported conclusions of the study, when coupled with other research on this subject, are such, that in aggregate they provide a plausible explanation for the periodic reversals of climate change displayed by multi-decadal shifts from 'global cooling' to 'global warming' and back to 'global cooling', etc.. This yields a fundamental new basis for the general public, government leadership, educators and students, to understand the repetitive and variable nature of solar activity and the effects they have on the Earth's climate.

[12] As a result of the theory, it can be predicted that the next solar minimum may start within the next 3-14 years, and last 2-3 solar cycles or approximately 22-33 years. Beginning with cycle 24 but no later than cycle 25, sunspot numbers may approach a Wolf number of 50 for each of two consecutive solar cycles. It is estimated that there will be a global temperature drop on average between 1.0 and 1.5 degrees C, if not lower, at least on the scale of the Dalton Minimum. Should the minimum begin with solar cycle 24 as forecast, the bottom of the temperature curve for this predicted minimum is forecast for the year 2031 with widespread record cold for years on either side of 2031. A start at solar cycle 25 would extend the range of the next bottom of the solar minimum to the 2031- 2044 period or more.

[13] As a result of the predictability and accuracy afforded by the RC Theory, and in the interests of the welfare of the world's citizens, the following special note is added: This forecast next solar minimum will likely be accompanied by the coldest period globally for the past 200 years and as such, has the potential to result in world wide, agricultural, social, and economic disruption.

[14] **Acknowledgements.**
Dr. Boris Komitov, Bulgarian Academy of Sciences, and Dr. Ernest Njau, University of Dar es Salaam, Tanzania, for their conduct of the peer review of this paper/research report. The Global Warming Art project and the GNU Free Document Licensing program in total, for their open availability of high fidelity graphical representation of important research data, especially by R.A Rhode and L. McInnes. The Wikipedia organization for in depth information from numerous articles used in background research during the study. The impressive and extensive work of Dr. P. J. Reimer et al for their C14 calibration work over the years. Both NOAA and NASA, in particular the Solar Physics Group at Marshall Space Flight Center (MSFC), and the Hadley Center for a substantial amount of raw data, historical, and current solar physics and climate research information. In addition the outstanding analysis of Chinese temperatures by Bao Yang et.al. was a valued component of the research for this paper.

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