



Schumann Resonance and Sunspot Relations to Human Health Effects in Thailand

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Abstract. There is sensible scientific evidence to establish a trail of connection from the sun activity to human biological and health effects. This explains why sunspot numbers and indices of Geomagnetic Activity are correlated with serious human health effects in a large body of published studies. The key element is the role of the Schumann Resonance signal that is detected by human brains and is used to synchronize diurnal and ELF brain rhythms. The Schumann Resonance signal intensity is modulated and highly correlated with solar activity and the electron concentrations in the lowest layers of the ionosphere. The enhanced or weakened solar activity moves the level of the SR signal outside the normal homeostatic range and, through the Melatonin mechanism, causes health problems and enhanced death rates in large human populations. A five-year monthly database is used to confirm the correlation between the climatic factors of Sunspot Number, Southern Oscillation Index and Global mean temperature anomalies with the SR signal strength. The Sunspot Number emerges as the strongest factor. A 19 year data-set of annual mortality rates in SE Asia is used to seek evidence of correlations between human mortality rates and the sunspot number in order to support and confirm the SR hypothesis. A wide range of mortalities that are associated with Melatonin reduction, are found to be significantly correlated with sunspot number, including cancer, cardiac and neurological mortality.

1. Introduction

The hypothesis and model of the Schumann Resonance (SR) signal being the biophysical mechanism for the biological and human health effects of Solar/Geomagnetic Activity (S-GMA) is strongly supported, Cherry (2002). Resonant absorption of the SR signal in human brains is classically sensible because of the matching of oscillating frequency ranges of the SR spectrum and EEG rhythms. Multiple studies show the S/GMA activity alters Melatonin levels in humans. Cherry (2002) shows that there is multiple, independent evidence of a homeostatic relation to cancer, cardiac, reproductive and neurological effects from altered S/GMA indices that are highly correlated with the SR signal intensity. A vital role of the SR signal is synchronizing the circadian and ELF brain rhythms, a Zeitgeber. In well developed urban areas 50/60 Hz fields in homes and many radiofrequency/microwave sources expose all people to electromagnetic signals many magnitudes over a million times higher than the SR signal strength, masking the modulation of the human health effects associated with S/GMA.

In SE Asia Thailand has a published annual health effects data-set 1974–1992 almost covering two solar cycles. Thailand has a good health data collection system and the majority of its population is not exposed to the high RF/MW signals that are found in most developed countries. Cherry (2002) found significant relationships between sunspot number and male suicide, female breast cancer and male cerebrovascular mortality. It is not the spots on the sun that cause these health effects. The solar activity modulates the earth's Geomagnetic parameters, the ions in the ionosphere and this modulates the intensity and frequency of the Schumann Resonance signal.

With 5 years of SR data the correlations between SR intensity, Sunspot Numbers, global temperatures and Southern Oscillation Index (El Nino/La Nina) are presented to confirm the SR Hypothesis and Model though establishing correlation between SR Intensity and the Sunspot Number. The second stage investigates a wide range of health effects, consistent with the Melatonin hypothesis. They are found to be highly correlated with Solar Activity as shown by sunspot numbers. Together this provides strongly probable support for the Schumann Resonance hypothesis and model. Significant correlations between the annual sunspot number and the annual mortality rates would add considerable strength to the hypothesis and model, and confirm that extreme Solar-Geomagnetic Activity is a natural hazard for human health.

2. Relationships between Climate Factors and SR Intensity

The Schumann Resonance signal is a global radiating electromagnetic signal sourced from lightning primarily generated by tropical thunderstorms. It forms a standing resonance spectrum in the cavity formed between the earth's surface and the lowest layers of the ionosphere. The daily modulation of the ionospheric D-region electron and ionization density modulates the height of the cavity. Solar activity generated D-region ionization during the day, produces a narrower cavity depth. At night the loss of sunlight and the recombination of the electrons and ions remove the D-region, increasing the depth of the cavity. This produces higher intensity and frequencies in the daytime hemisphere and lower intensities and frequencies in the nocturnal hemisphere. With increased solar activity and following solar storms (flares), the ionosphere is chronically enhanced for about a week, altering the SR signal in parallel, Cherry (2002).

The strong diurnal variation of the SR signal intensity is closely associated with the ionosphere and the cavity characteristics, and hence it is expected that the S/GMA will be the strongest factor of the SR intensity, with global temperature and the Southern Oscillation Index being secondary factors through their modulation of the number and strength of the thunderstorms. During the Northern middle to later summer, the enhanced incidence of local thunderstorms is likely to be the source of locally enhanced SR intensity from the California site. During 2001 the later sum-

Table I. Correlation coefficient between the Schumann Resonance Intensity and the Sunspot Number, Southern Oscillation Index and Global Temperature Anomalies. Global refers to the global mean and north to the northern hemisphere and south to southern hemisphere mean. The data period is 1997–2001, 60 months with 4 Outlier months.

Climatic variable Raw	Correlation coefficient		
	SP adj.	Outliers adj.	
Sunspot number	0.6267 ⁺⁺	0.657 ⁺⁺	
Temperature (global)	0.0953	0.3723 ^{**}	0.4280 ^{***}
Temperature (north)	0.1531	0.3123 [*]	0.3217 [*]
Temperature (south)	−0.0117	0.3275 [*]	0.4230 ^{***}
Southern Oscillation Index	0.0304	−0.2852 [*]	−0.1870

Significance: * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$; + $p < 0.0001$ and ++ $p < 0.00001$.

mer months had many missing data days. When considering global relationships, such local extremes could be treated as outliers if they are consistently extremes.

Balling and Hildebrandt (2000) found significant correlations between the Schumann Resonance peak frequency collected from Rhode Island, with temperatures from subtropical and tropical latitudes but they did not seek relationships to sunspot numbers which are correlated with the depth of the cavity between the earth surface and the D-Region of the Ionosphere.

The relationship between the SR intensity and climatic factors produces a complex situation with considerable scatter. Progressive trend removal is used to reduce this effect. The strongest correlated variable is removed to allow a “cleaner” data set to be used for the subsequent correlations.

With 5 years of SR data available (1997–2001) a monthly data-set of 60 month mean parameters was formed involving sunspot number, GMA-Cp index, SOI, Global Mean Temperature Anomaly, South and North Hemisphere Temperatures anomalies, Schumann Resonance Mean Intensity and Frequency. All the data was obtained from Websites. Trend lines are expressed as the Least Squares Fit linear line $Y = mX + c$, where m is the gradient and c is the intercept. With the correlation factor r , t -test t and probability value p .

Table I summarizes the initial (Raw) data analysis of the correlations between the climate variables and the SR Intensity. Clearly the Sunspot Number has the strongest correlation ($r = 0.6267$) with the second factor being the Northern Hemisphere Temperature ($r = 0.1531$). After the sunspot relationship is removed, the correlations with the temperatures and SOI all increased significantly. The SOI shows a negative correlation showing that the world is warmer with more thunderstorms during the El Nino (negative SOI) and lower activity during a La Nina (positive SOI).

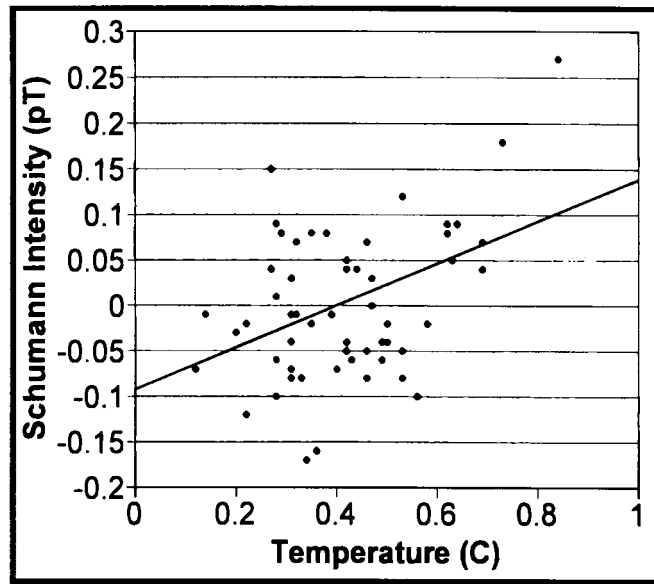


Figure 1. The global mean monthly anomaly temperatures and their relationship with the Schumann Resonance Intensity. Trend, $m = 0.234$, $c = -0.0974$, $r = 0.4280$, $p = 0.001$.

When the graphs showing sunspot adjusted (SP Adj) SR Intensity, and climate parameters were considered, there were four consistent extreme outliers. All were from the northern summer and three from the three months in 2001 with much missing data. Hence the four extreme outliers were removed and the correlations further improved for the temperatures.

The strongest correlation temperature was the Global Mean Temperature. The sunspot and 4 outliers adjusted data for the Global Mean Temperature Anomaly and the Southern Oscillation Index are presented in Figures 1 and 2.

When the sunspot effect is removed then there is a highly significant relationship between the SR Intensity and the Global Mean Temperature. The impact of the El Nino/La Nina events (SOI variations), when the sunspot variation is removed is non-significant, Figure 2.

The direct correlation with the monthly Sunspot Number is $r = 0.6267$, $m = 0.164/100$ sunspots, $c = 0.6222$, $t = 5.7949$, and $p < 0.0001$. When the Global Temperature Anomaly and SOI factors are removed from the SR Intensity then the Sunspot relationship is extremely significantly correlated, $p < 0.000002$, Figure 3.

Table I and Figure 3 show that the solar activity is the strongest influence on the intensity of the Schumann Resonance Signal, with the Global Temperature and the Southern Oscillation Index having much smaller but correlated modulation effects. The improvement of the raw relationship between the Sunspot Number and SR Intensity had $r = 0.6192$ while the Temperature and SOI adjusted relationship, has $r = 0.7476$. This is significantly increased. This shows that the Global Mean

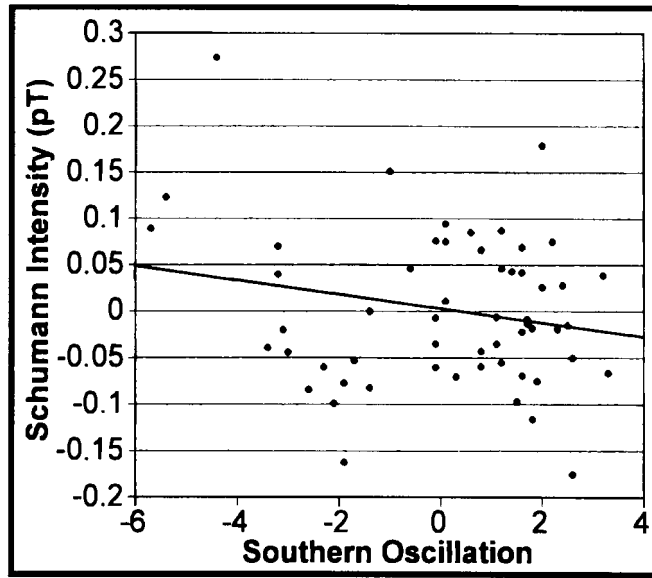


Figure 2. The sunspot adjusted and the monthly mean Schumann Resonance Intensity correlated with the Southern Oscillation Index, $m = -0.00727$, $c = 0.0005$, $r = -0.1870$, $t = 1.399$, $p = 0.17$.

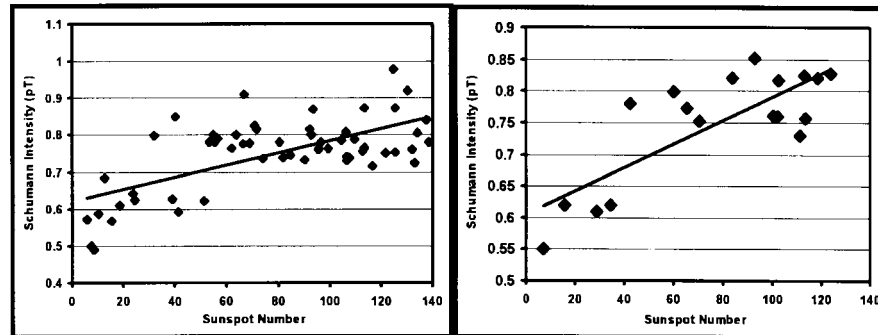


Figure 3. (a) Monthly SR Intensity adjusted Global Temperature Anomaly, and Southern Oscillation Index, relationship with the Sunspot Number. Trend: $m = 0.186/100$ sunspots, $c = 0.62Pt$, $r = 0.657$, $t = 6.396$, $p < 0.000002$. (b) Seasonal SR adjusted as for (a) relationship with the Sunspot Number. Trend: $m = 0.186/100$ sunspots, $c = 0.61pT$, $r = 0.791$, $t = 5.176$, $p < 0.00001$.

Temperature and the SOI together have a smaller but significant effect on the SR Intensity. The measure of solar activity, the Sunspot Number, is by far the strongest relationship to the SR Intensity.

3. Biophysical Mechanisms

Melatonin is the primary circadian rhythm neurohormone, along with the neurotransmitter serotonin. Several studies have significantly correlated reduced Melatonin with increased GMA, Bardasano *et al.* (1989), Burch *et al.* (1997), Rapoport *et al.* (1997, 1998, 2001), Weydahl *et al.* (2001). Burch *et al.* (1997) shows a significant dose-response reduction of Melatonin with increasing GMA index. The Schumann Resonance signal synchronizes the ELF brain patterns in a homeostatic manner and contributes to the daily circadian rhythm synchronization. S-GMA induced changes in the SR signal intensity alters the Melatonin levels, Cherry (2002). Because of Melatonin's vital role in the daily rhythm, all major organs have Melatonin receptors.

Therefore a factor that alters human Melatonin secretion can influence almost every vital organ, especially the brain, heart, central nervous system and reproductive system. Melatonin is also the body's most potent antioxidant. Hence reduced Melatonin leads to more oxidative free radical cellular damage, leading to cancer and premature aging through enhanced apoptosis (programmed cell death). In neurological activity, altered Melatonin is related to depression and suicide, "neurological disease" and increased circulatory stress leading to strokes (cerebrovascular mortality).

Since SR intensity is extremely closely correlated with Sunspot Number, diseases and mortality correlated with Sunspot Number are very plausibly associated with altered SR signal intensity, causing reduced Melatonin a leading to significant enhancement in the death rates in human populations. The Thailand annual health mortality rate data is investigated for possible correlations with the sunspot cycle to show that the health effects are correlated to the Schumann Resonance signal strength.

4. Long-Term Health Effects Related to the Sunspot Cycle

The annual mortality data from Thailand, SEAMIC (1997), had a linear time trend removed by a Least Squared Fit (LSF) and then it was smoothed by a 3-y running mean to slightly reduce the inter-annual variation of other effects such as SOI and thermal variations.

5. Crude Death Rate

The overall crude death rate is the first example of the relationship between sunspot activity and mortality rates in Thailand. The data has had the time trend removed and has been smoothed by the 3-y running mean, reducing the data points to 17 and the degrees of freedom (df) to 15.

This analysis demonstrates that the overall crude death rate is modulated by the sunspot cycle. This supports and confirms the role of the Schumann Resonance signal in interacting with human brains, reducing the Melatonin, enhancing the cell

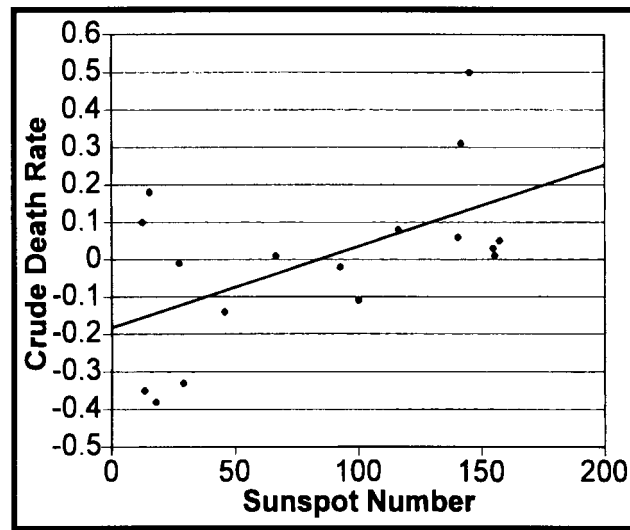


Figure 4. Time trend adjusted annual crude death rate, per 100,000 people, for Thailand as a function of the Sunspot Number. Trend: $m = 0.0021$, $c = -0.177$, $r = 0.5419$, $t = 2.497$, $p = 0.025$.

damage, enhancing cancer, heart disease and neurological disease, and increasing the total death rate.

6. Neurological Mortality

The brain is a very sensitive electromagnetic organ with strong dependency on the protective and cellular repair support of Melatonin. Since S-GMA reduces Melatonin it is predicted that sunspot cycles will be correlated with Suicide, Accidental death and cerebrovascular (stroke) mortality. All of these show significant correlations with sunspot number, summarized in Table II.

7. Cancer Relationships

Because of Melatonin's powerful antioxidant action, SR and S-GMA activity are predicted to be strongly correlated with a range of cancers in a quiet electromagnetic environment such as Thailand. The cancer/sunspot relationships are summarized in Table III.

The all cancer mortality in Thailand has dose-response relationships with Solar Activity shown by Sunspot Number are presented in Figure 7 for males and females. Male leukaemia and female breast cancer are shown in Figure 8.

Table II. Correlation parameters of neurological mortality in Thailand and Sunspot Number, The gradient is the number of cases per 100,000 people/100 sunspots.

Disease	Correlation coefficient	<i>t</i> -value	<i>p</i> -value	Gradient
Suicide (male)	0.6860	3.6518	0.0022	0.809
Stroke (male)	0.6847	3.6381	0.00223	1.947
Stroke (female)	0.5566	2.5951	0.0195	0.834
Accidental vehicle death (male)	0.7141	3.9504	0.00115	4.788
Accidental vehicle death (female)	0.7572	4.4895	0.00043	1.274
Accidental death (male)	0.6007	2.9101	0.0109	12.279
Accidental death (female)	0.6079	2.9652	0.0096	3.225

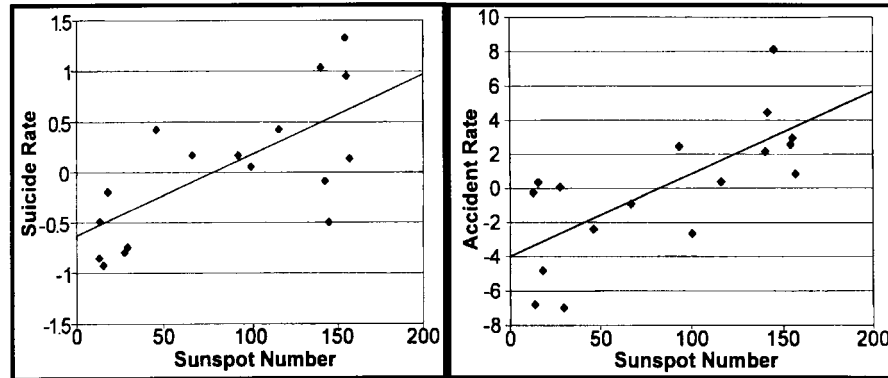


Figure 5. The suicide (left) and accidental death (right) dose-response relationships in Thailand with the Sunspot Number.

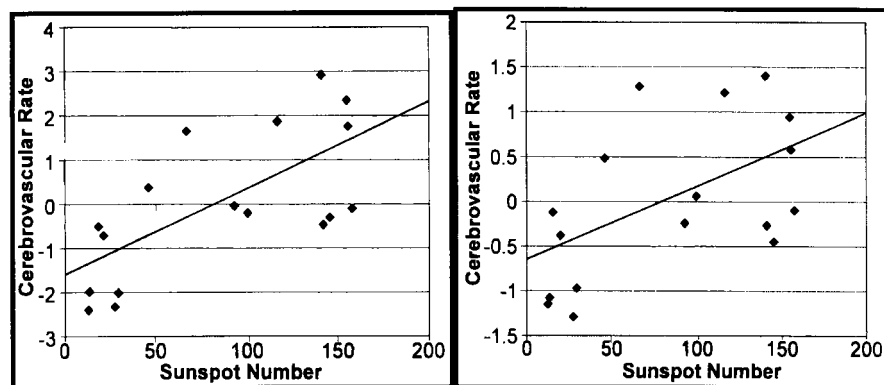


Figure 6. The cerebrovascular (fatal stroke) rate trend correlated with Sunspot Number for males (left) and females (right).

Table III. Correlation parameters of carcinogenic mortality in Thailand and Sunspot Number, The gradient is the number of cases per 100,000 people/100 sunspots.

Disease	Correlation coefficient	<i>t</i> -value	<i>p</i> -value	Gradient
Colon cancer (male)	0.4555	1.9829	0.0647	0.1327
Colon cancer (female)	0.3143	1.2823	0.23	0.0528
Leukaemia (male)	0.5658	2.6574	0.0172	0.1100
Leukaemia (female)	0.4656	2.0377	0.0583	0.0559
Breast cancer (female)	0.7665	4.6227	0.00029	0.1722
All cancer (male)	0.6373	3.2027	0.00556	2.4737
All cancer (female)	0.7000	3.7975	0.00158	1.4371

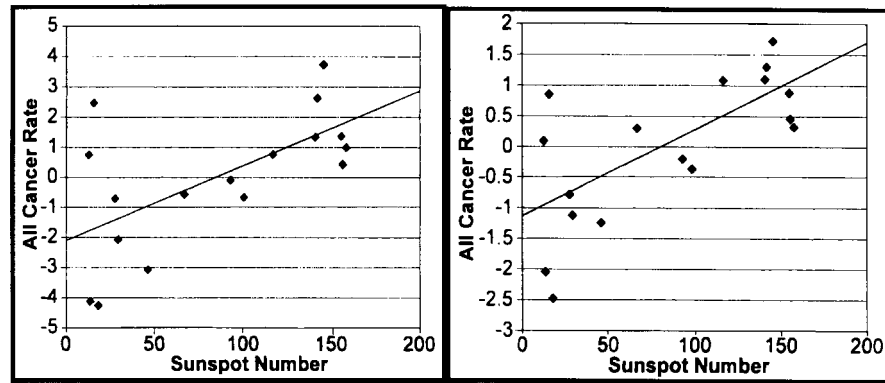


Figure 7. The sunspot related all cancer mortality for males (left) and females (right).

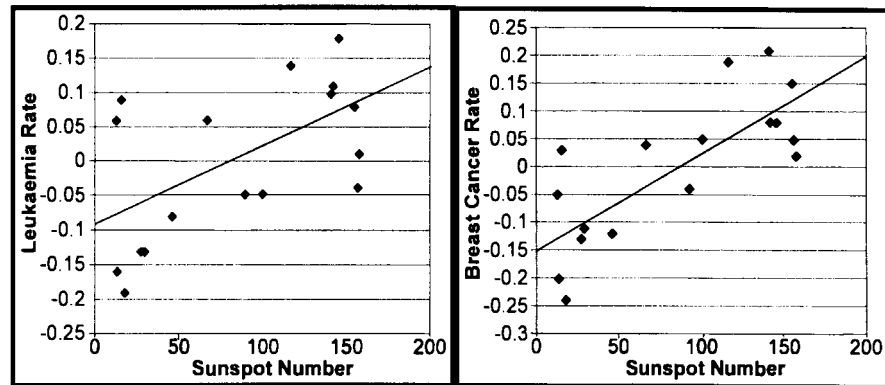


Figure 8. Significant correlations between sunspot number and male leukaemia (left) and female breast cancer (right) mortality in Thailand.

Table IV. Correlation parameters of cardiac mortality in Thailand and Sunspot Number, The gradient is the number of cases per 100,000 people/100 sunspots.

Disease	Correlation coefficient	t -value	p -value	Gradient
Hypertension (male)	0.8497	6.2422	0.000012	0.7438
Hypertension (female)	0.6653	3.4516	0.00329	0.5718

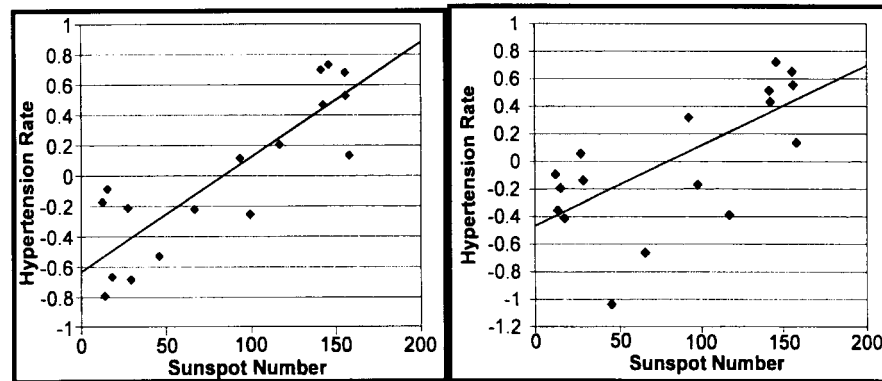


Figure 9. Hypertension mortality for males (left) and females (right) in Thailand, showing significant correlations with solar activity and hence the Schumann Resonance Intensity.

8. Cardiac Mortality

Reduced melatonin enhances cell death. In the heart this leads to heart attacks. Geomagnetic Activity is also correlated with blood pressure changes in at least two independent studies. Hence a correlation with hypertension mortality was investigated and found, Table IV.

These correlations with Hypertension show some of the highest t -values and significance, confirming the sensitivity of the heart to altered electrical activity, the Schumann Resonance signal and reduced Melatonin.

9. Summary and Conclusions

The Schumann Resonance Intensity is extremely significantly correlated with sunspot number and associated with increasing global mean temperatures and modulated by the El Nino/ La Nina events of the Southern Oscillation. Because of the high significance and clear relationship between Sunspot Number and the SR Intensity, the Sunspot Number was used to seek correlations with annual mortality data from a quiet electromagnetic environment provided by Thailand.

There are strong correlations between all death, cancer, cardiac and neurological mortality and the Sunspot Number. The plausible mechanism requires a strong and rational scientific relationship with an agent that links the sunspot activity to human reactions. The Schumann Resonance signal is the only identified mechanism that meets all of the requirements in Cherry (2002). This study confirms the relationship between SR Intensity, sunspot activity and human health effects. It also confirms the melatonin mechanism since all of the correlated mortality conditions are related to melatonin reduction. Multiple, independent studies have associated melatonin reduction with S-GMA, including a significant dose-response relationship. This study confirms that S-GMA, through the Schumann Resonance interaction with human brains that alters the melatonin homeostasis, is a natural hazard for human health. All is not negative about the role of the Schumann Resonance signal. It provides the homeostatic synchronization of the brain for the seasonal and daily rhythms in conjunction with the sun. Beyond this it provides essential ELF synchronization of the brain wave patterns. This is likely to have provided the brain with sufficient stability and coherence to have developed in a soft, flexible, adaptive electromagnetic biological organ, called the brain, by synchronizing and stabilizing the brain's electromagnetically activity, has allowed intelligence to be developed in a quickly reactive organ.

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