

Ring Around the Rosies

Bill Howell, 04Oct06
Toastmasters – Hard Disk Café, Calgary

*Ring around the rosies
A pocketful of posies
Ashes, Ashes
We all fall down*

I heard this nursery rhyme for the first time in decades last week, shortly after arriving in Calgary. It is strange that after so many decades, the poem still sounded gay and pristine, and evoked happy and fun feelings. But it was also strange to hear a change in the third line of the poem, so I had confirm with my mother that she taught me "Husha, Husha", rather than "Ashes, Ashes". A historian has explained that the origin of the poem was a surviving generation's way of coping with the terrifying death and social upheaval of the Black Death – they made a child's poem and a game of it. So now the poem has taken on a far more powerful meaning to me, in some ways sad, but in other ways hauntingly beautiful, and a powerful tribute to human survival during a desperate time, and their grasp for normalcy thereafter.

And the poem also leads us into the underlying theme of my speech today: **Pandemics and solar activity**

A small number of scientists suspect that solar activity has had an important influence on the occurrence of pandemics throughout history.

The Plague in Kazakstan - 1955-1995

S. Davis, M. Begon, L. De Bruyn, V.S. Ageyev, N.L. Klassovsky, S.B. Pole, H. Viljugrein, N. Chr. Stenseth, H. Leirs "Predictive Thresholds for Plague in Kazakstan" Science, Volume 304, Issue 5671, 30 April 2004, Pages 736-738

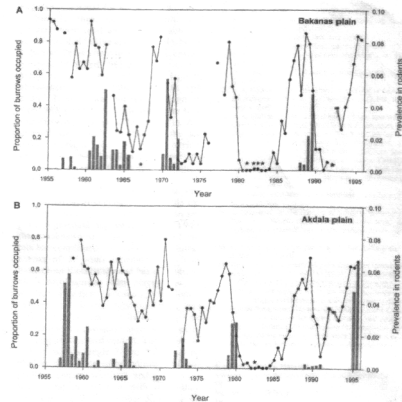


Fig. 1. (A and B) Spring and fall estimates of the proportion of burrows occupied (filled circles connected by solid lines) and prevalence of plague (vertical bars) in great gerbil populations from two sites in the Prebalkhash plague focus of Kazakhstan. In some seasons (marked by an asterisk), no great gerbils were tested for plague.

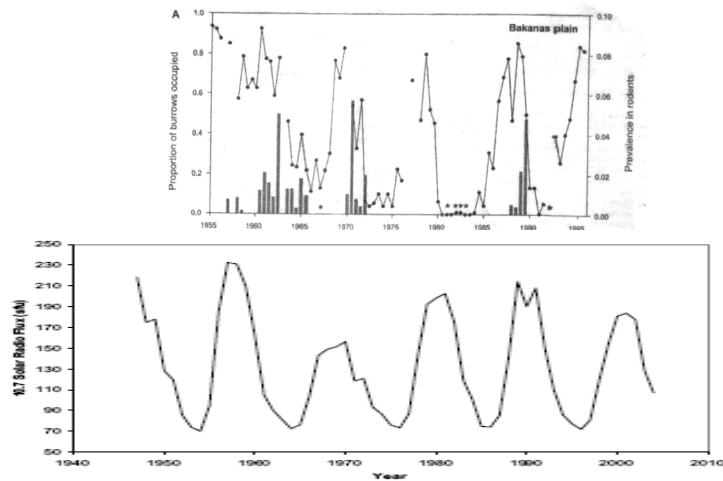
2. Modern bubonic plague

Lets start by taking a look at the bubonic plague today. Bubonic plague apparently kills 3,000 people a year on average, although the numbers probably fluctuate greatly from year to year, and Central Asia and possibly India are apparently where many cases occur.

[Show Figure 1] Let's take a look at recent data for 2 sites in Central Asia, where some effort and money was spent on tracking the plague in gerbil populations. This graph does NOT show human deaths, but instead shows the number of gerbil burrows occupied (solid line) as a proxy for gerbil population, and the fraction of gerbils with the plague. The theme of the '2002' paper that this was taken from is that the climate has a direct bearing on the plague incidence in "vectors" or carriers, and therefore the climate is a significant risk factor for potential human plagues.

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[Show Figure 2] However, let's look at one measure of solar activity and the gerbil data. Clearly there seems to be some correlation. This certainly isn't a proof that the variables are causally related, but it should pique your curiosity.

Temperatures- the last 1,000 years

J. Veizer "Celestial climate driver: a perspective from four billion years of the carbon cycle" *Geoscience Canada*, vol 32, no 1, pp13-27, 2005. CAVEAT: gas diffusion effects in glaciers
 (a) solar cycle length (b) cosmic ray flux (c) solar irradiance (e) atmospheric [CO₂]

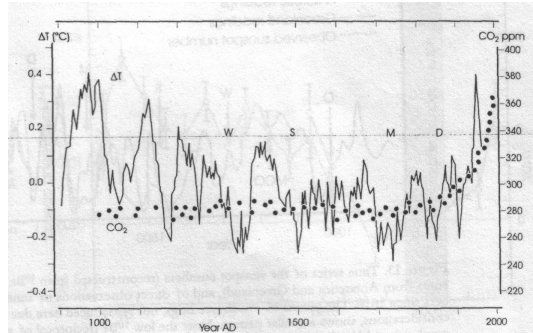
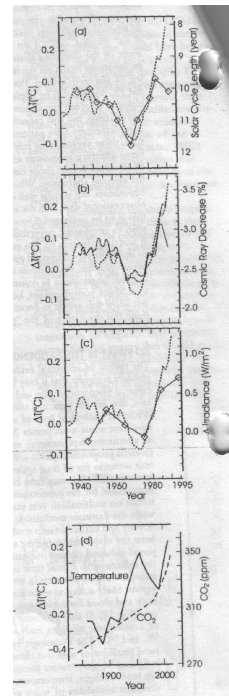


Figure 12. The temperature change (ΔT) and CO₂ records of the last millennium from a Greenland ice core (GISP2). Temperature was calculated from the 50 year smoothed record as $T(^{\circ}\text{C}) = 0.6906 \delta^{18}\text{O} - 13.68$. The $\delta^{18}\text{O}$ database is available at <http://ftp.ngdc.noaa.gov/paleo/icecore/greenland/summit/gisp2/isotopes/d18o1yr.txt>. The detailed structure showing the coincidence of cold intervals with sun activity minima (W to D; Wolf, Spörer, Maunder, Dalton) may or may not be statistically valid because of the noisy nature of the proxy signals, but the overall trend is confirmed also by the borehole temperature profiles (Dahl-Jensen et al., 1998). Adapted from Berner and Streif (2000).



3. The sun as a major climate driver

[Show Figure 3] The next illustration shows the coherence between solar activity and the average global temperature. In spite of a phase shifting, there is clearly strong coherence between solar activity and climate. There is a wide range of other types of solid correlations between astronomical drivers and the climate, but I'll leave it for some future presentation.

Not stated during the presentation:

· A modest number of scientists, often severely under attack from other "scientists" (not to mention environmentalists etc) believe that astronomy is the primary driver of climate:

- galactic rays - the sun's magnetic field shield's us from them to some extent – a bit like "shields up" on Star Trek). These are thought to be a major determinant of cloud cover variability on timescales exceeding months or years or something like that. In fact during the presentation, a major experimental result was released by Danish scientists showing how UV radiation promotes "cloud nucleation" (in the lab)!!
- solar irradiance & magnetic fields
- Earth orbitals, axis precession & inclination (these being the basis of Milankovich cycles most easily seen by the most recent 4 glaciation events)
- Earth's geomagnetic field

A very small number of scientists (me included!) believe that CO₂ is simply a function of temperature, and that its return influence is either minimum, too small to detect amid the noise of the major drivers, or insignificant. (water vapour is by far the most important greenhouse gas!!!).

Temperature – [CO2] Coherence

Cynthia Kuo, Craig Lindberg, David J. Thomson "Coherence established between atmospheric carbon dioxide and global temperature"
Nature, vol343, 22Feb1990, p709-714

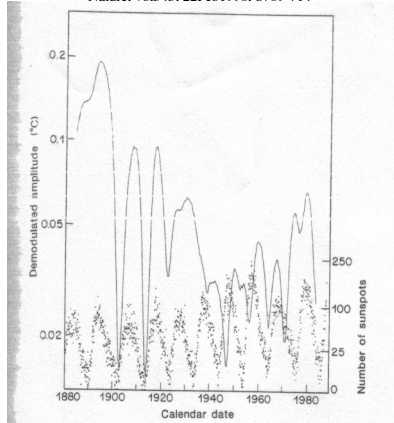


Fig. 4 The solid curve shows the amplitude of the complex demodulate of the Northern Hemisphere temperature record between 0.9 and 1.1 cycle yr^{-1} . A plot of the sunspot numbers is shown below. Detailed examination of the coherence between the demodulate and the solar cycle shows that these two have about a $1/(30 \text{ yr})$ difference in frequency (corresponding to the longer lower sideband mentioned in Fig. 2b).

Another illustration of the temperature-solar link, but I didn't spend time on this as it's a bit tricky.

Influenza pandemics and solar activity

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

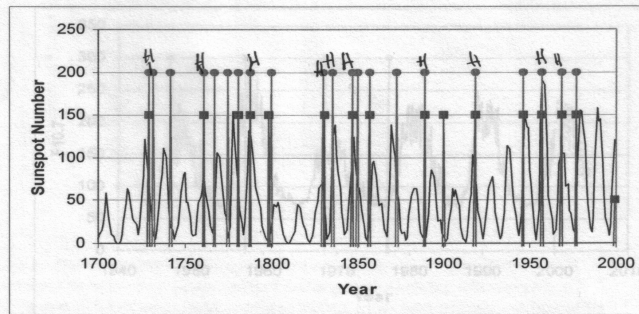


Figure 1: A plot of start years of pandemics (shown as spikes) and sunspot number. Pandemics listed by Garrett (1994) are shown as spikes to 200, topped with diamonds, and those listed by Potter (1998) as spikes to 150, topped with squares. The square at the 50 level, in 1999, represents the flu epidemic of 1999-.

4. Influenza pandemics

[Show Figure 3] Here is another illustration of the sun-pandemic link based on influenza pandemics since 1700. In this graph you can see a statistically significant relationship, representing a two-fold increase in pandemic risk during a certain phase of solar activity. Remember that influenza is a big killer. For example, the Spanish flu pandemic of ~1917/1918 killed perhaps 50 million people which is greater than the 20 million people estimated to have been killed during the Black Death plagues of 1347-1410, but the Black Death killed a far higher portion of the population.

However, the Spanish flu did NOT occur during the peak risk phase, and this is an important illustration that solar activity is only ONE of the risk factors for a pandemic, and it is not the most important. Civil engineering is the most important (clean water, remove sewage and waste), followed by standard of living (ie good and adequate food, shelter) and then the medical system.

Recent Influenza Pandemics

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

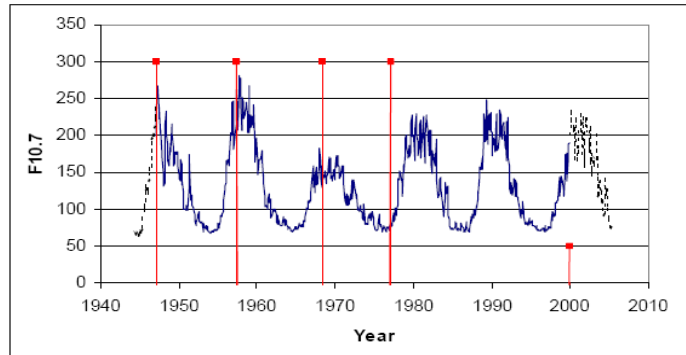


Figure 2: The 1946, 1957, 1968 and 1977 pandemics (shown as spikes) on a plot of the 10.7cm Solar Flux index. The flux values prior to 1947 (shown dotted) are estimated from sunspot data, and those beyond 2000 (also dotted) are estimated from a previous activity cycle. The small spike in 1999 represents the influenza epidemic in progress at that time.

The most recent four cycles really emphasize the timing point.

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

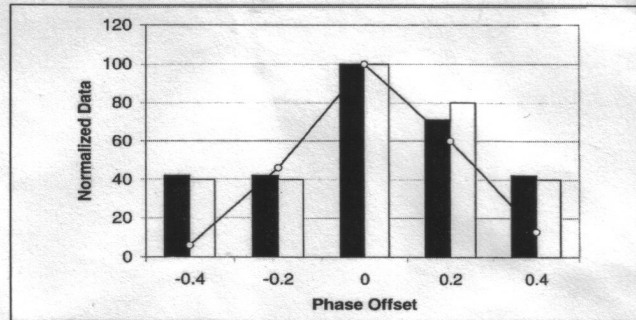


Figure 1) *The two distributions of pandemic count versus phase offset scaled to a peak value of 100. Pandemics listed by Garrett (4) and Potter (5) are shown, respectively, in solid black and white. The circles connected by solid lines show an average solar activity cycle, also scaled to have a peak value of 100*

As previously mentioned, a recent analysis put the risk of a pandemic during a certain phase of the solar cycle as twice the level of most of the cycle. More recent analysis (still in work) indicate that an even more specific phase analysis reveals a four-fold increase in risk of influenza pandemics.

[didn't say this during the presentation...]

The sun behaves in a non-linear, non-stationary manner, and there is evidence for distinctly different states or phases of solar behaviour (although not necessarily discrete states!). Between one state and the next, basic relationships may change. For example, the irradiance of many stars decreases during periods of inactivity (appearance of sunspots), while others, including the current state of the sun, have higher irradiance. But the sun straddles the boundary between positive a positive irradiance-sunspot relationship, and a negative relationship. Historical accounts may indicate a negative relation between sunspots and irradiance at a time in the past.

Other Pandemics

(no charts – but some are being put together)

5. Other pandemics

While I do not have charts and statistics, discussions with epidemiologists and others have come up with the measles, smallpox, and cholera, and malaria has been the subject of several studies that claim to have established a climate-pandemic link. These are "vector-borne" diseases. Furthermore, solar UV variability has been linked to non-melanoma skin cancers in Australia.

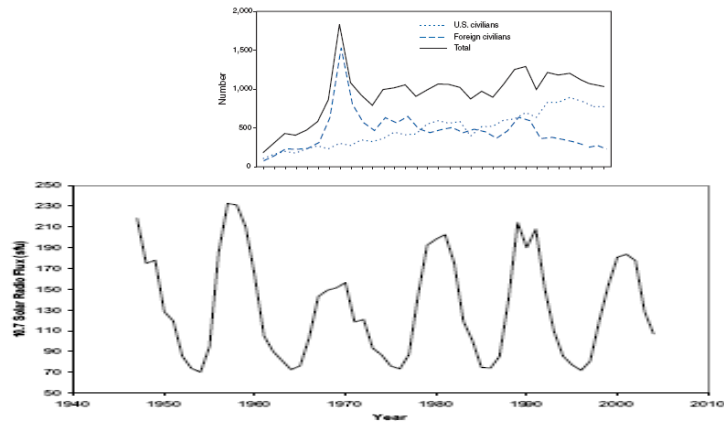
Climate-disease linkages are receiving a great deal of funding as part of the worldwide effort to study climate change and the Kyoto premise of global warming. It appears to me that this will provide the heavy datasets necessary to better establish climate-disease relationships, and this in turn will be relatively easy to link to astronomical activity as an important driver of pandemics – but certainly not the only nor the most important driver!

Malaria – USA

(not shown during Toastmaster presentation)

<http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5504a2.htm>

FIGURE 1. Number of malaria cases among U.S. and foreign civilians, by year — United States,* 1973–2004†



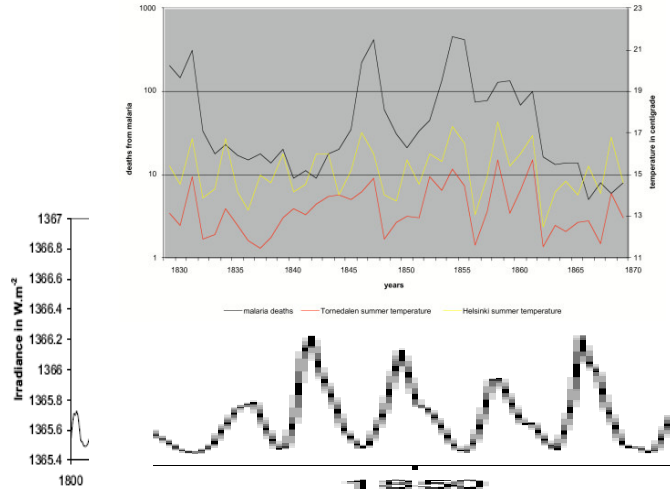
As an advanced nation with high standards of living and medical treatment, one might expect the USA to be little-influenced by the sun or the weather with regards to malaria cases. The number of cases is very low, and is apparently mainly due to immigrants or citizens travelling overseas.

Malaria – Finland 1800's

(not shown during Toastmaster presentation)

Malaria deaths in southern Finland and mean temperatures of the preceding summer in Helsinki and Tornedalen 1830–1870.

Finland - <http://bmc.ub.uni-potsdam.de/1475-2875-4-19/>



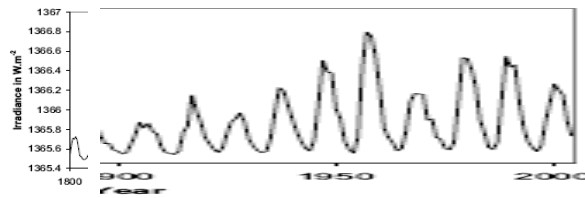
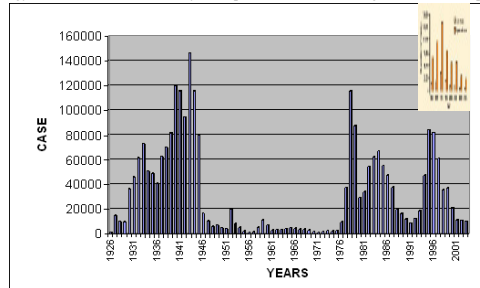
As recently as the mid-1800's in Finland and Canada, malaria was an important disease in spite of the relatively very cold temperatures then at the the end of the "Mini-Ice Age". Apparently most of the deaths among Irish workers who built the Rideau canal from Kingston to Ottawa died of malaria at about the same era.

Unfortunately, without the original data series, copy & paste graphics are of low quality

Malaria – Turkey, Eritrea

(not shown during Toastmaster presentation)

<http://www.saglik.gov.tr/eng/malaria/malaria.htm>
http://www.rti.org/pubs/rti_Eritrea_malaria_brochure.pdf#search=%22malaria%20cases%20historic%22
Ken Tapping "Modeling solar irradiance: values and uncertainties" - presentation to the Engineering Institute of Canada's Climate Change Technology Conference, Ottawa, 12May06 <http://www.ccc2006.ca/eng/index.html> (not published yet as of May06)



Is there a ghost of a correlation between solar activity and malaria in modern developing/ mostly developed nations? This isn't terribly convincing, but perhaps a knowledge of the system's dynamics might help establish a link? (guesswork at present)

Conclusion

6. Conclusion

So keep in mind that one of the great historical pandemics could well strike at some time, or perhaps a brand new type of pandemic will evolve. And some surviving generation, having lived through the horror and despair of watching loved ones die horribly, and their bodies being burned or piled into mass graves, may deal with it by reviving the ancient poem:

Ring around the rosies..

And they may blame it on the sun...

Influenza and Immunization in Ontario

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)

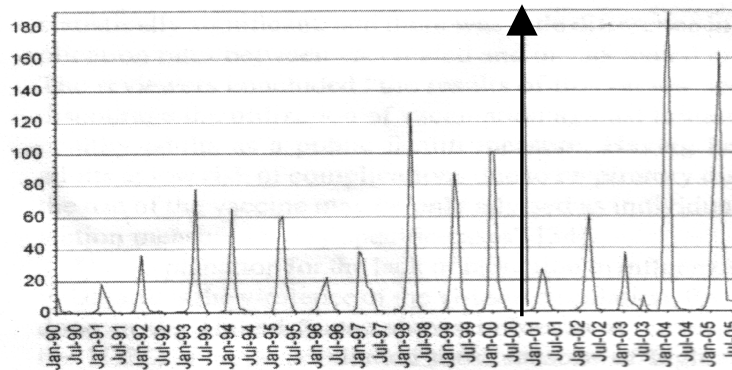


Fig. 1. Mean monthly influenza cases per 100,000 population in Ontario from 01/1990 to 08/2005. Vertical line shows introduction of the UIIC.

This was not discussed during the presentation.

Ontario introduced free flu vaccines at the point in time indicated by the arrow. Initially this seemed to be a successful policy, but later it seems to have "lost effectiveness", largely because the vaccine did not correspond to the form of prevalent flu.

However, it is interesting to see that the flu incidence in one of the world's most advanced economies, with a high standard of living, and in the midst of a massive new campaign, still seems to respond to the sun (via climate, radiation-driven mutation or whatever mechanism might prove out).