The Correlation Between Epidemics and Sunspot Peaks: A Literature Review

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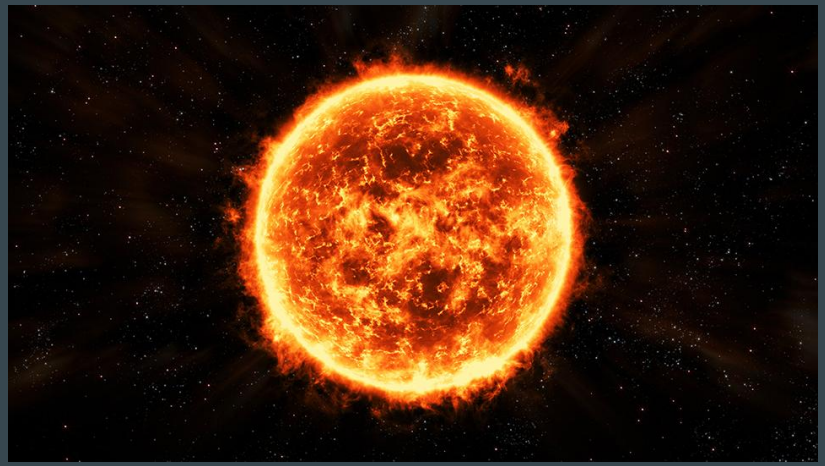
Purpose

If the start of epidemics are initiated by the results of the solar cycle, then it would provide scientists with necessary information to do things like narrow down the consequences of epidemics. The purpose of this review is to focus on studies to identify if epidemics are affected by the periodic solar cycle.

Background Research: Solar Cycles



Solar Cycles:

- Periods of time that occur every eleven years and influence behavior on the Sun's surface, such as creating sunspots
- Consist of a solar maximum with higher amounts of sunspots and a solar minimum with smaller quantities of sunspots

Sunspots:

- Darker regions on the surface of the Sun with temperatures of 2,000 K less than normal areas
- As the quantity of sunspots changes, magnetic fields on the northern and Southern Hemisphere switch
- When one cycle ends, sunspots form at higher latitudes, while when the next cycle ends, sunspots form closer to the Sun's equator.

Solar Cycles: The Maunder Minimum

In 1894, English astronomer Edward Walter Maunder observed a series of very few sunspots between certain years. He named this period known as the Maunder Minimum, a period of time consisting of extremely rare sunspots occurring from 1645 to 1715. Rather than the usual 40-50 thousand sunspots, there were only about fifty sunspots during this time. As a result, temperatures decreased, resulting in shorter seasons and increased food shortages. The Maunder Minimum also existed along with the Little Ice Age which can be explained by less sunspots so decreased temperatures.

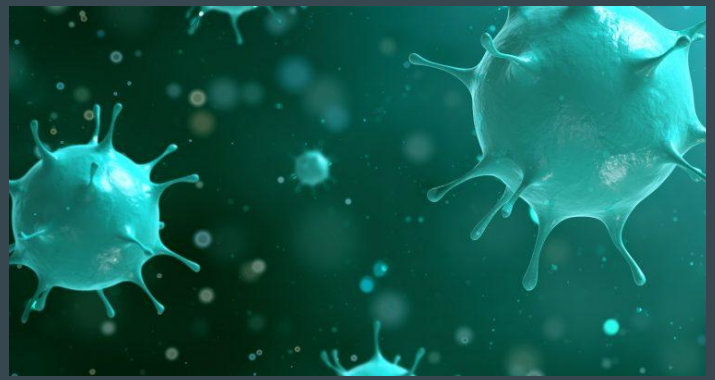
Solar Cycles

Types of Cycles:

- Schwabe Cycle
  - Traditional cycle lasting 11 years
- Gleissberg Cycle
  - First identified in 1862
  - Lasts about 88 years
- Seuss-Devries Cycle
  - Lasts about 200 years
- Hallstatt Cycle
  - Lasts 2,400 years

Currently, we are living during Solar cycle 25 (Scientists began recording solar cycles in 1755). The solar minimum began in December of 2019 while the maximum is expected to occur in July of 2025.

Background Research: Epidemics



Epidemics:

- Wide spread diseases that can occur in certain locations but on a global scale where it is known was a pandemic
- Caused by spread of small microscopic, abiotic agents.
- Agents can potentially be zoonotic where they are transferred through animals to humans through petting, biting, etc.
    - For example, if pigs, chickens, birds, and other animals were all confined in a specific area, their exposure is increased if one of the chickens is butchered. This is because the other animals are exposed to the chicken's organs and blood. This causes the other animals viruses to mix with those from the chickens. The viruses are altered and increases the risk that the virus will be able to infect humans.

Types of Epidemics

- The Flu
  - Type of infection that is transferred through airborne interactions such as sneezing, talking, etc
  - In the past year in the United States, there has been 24,000 to 62,000 deaths due to the flu with 200,000 hospitalized.
- SARS (Severe acute respiratory syndrome)
  - Rapidly spreading disease that out-broke in 2002 in the Guangdong province in Southern China
    - Area where it had begun is still known as a potential re-emergence region of SARS-CoV. The virus actually has reappeared four times where three were laboratory incidents.
  - Minor symptoms identified as myalgia, shivering, malaise, etc
- Spanish Flu/Flu Epidemic of 1918
  - Caused about 50 million deaths worldwide with 675,000 being in the United States and about ⅓ of the global population contracted the virus
  - After contracting symptoms, victims sometimes died within days or even hours.
  - As a result of this pandemic, the average life expectancy decreased by over twelve years in the US.

Types of Epidemics Continued

- COVID-19
  - Respiratory illness currently wiping the planet with about 122 million cases globally and rising
  - Began in Wuhan, China in December of 2019 where epidemiologists believe the virus arose from an animal.
  - Before this pandemic, COVID-19 has never been identified in humans, however, it is very closely related to other coronaviruses like SARS
    - Coronaviruses have been seen in cattle, cats, bats, etc
  - Symptoms such as fever, cough, sore throat, shortness of breath, inability to stay awake, loss of taste, etc.

Research:

Hoyle and Wickramasinghe (1990):

- Two astronomers that postulated space objects are able to store infections that consistently travel to Earth
- Described that the electric fields that are linked with sunspot winds have the ability to transport small virus particles to the Earth's surface
- Believed extraterrestrial materials could reach distant places at the same time
    - Shown by the Spanish Flu of 1918 where the virus had broken out in Bombay and in Boston on the same day.

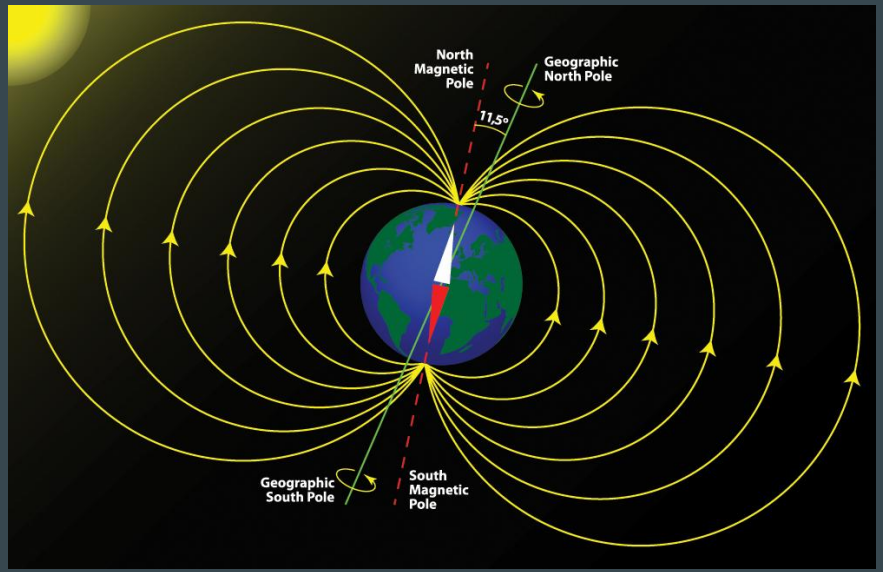
Influenza Pandemics and Sunspots- Easing the Controversy
Ertel, S (1994)
Did flu epidemics 'fly in' from space?
Thorson, B (200)

Limitations of Hoyle and Wickramasinghe

Hoyle and Wickramasinghe's note was never peer-reviewed and they never expanded on their research. However, many scientists acknowledged and fixed the mistakes of the two astronomers. Hope-Simpson, one of these scientists, read through this note and argued that if influenzas are initiated by solar behaviors, then the causes of the influenzas must be extraterrestrial. He researches this later on..

Electromagnetic Fields

- Fluctuating levels of radiation due to sunspots causes alteration of magnetic fields
- Human bodies are composed of many bioelectrical processes, such as breathing, cell division, organ motion, your heart beat, etc. There are also many electromagnetic fields in our natural environment.
    - Our planet is mostly in contact with atmospheric electricity which is strengthened as a result of interactions between sunspots and the geomagnetic field.
- Exposure to electromagnetic field can disrupt bodily processes and cause severe changes in gene expression.
    - Explains the theory that sunspots cause virus DNA mutations



Mechanisms of Geomagnetic Field Influence on Gene Expression..
Zaporozhan, V and Ponomarenko, A (2010)

Coronavirus could turn to global...
Rao, N (2020)

Electromagnetic Fields:

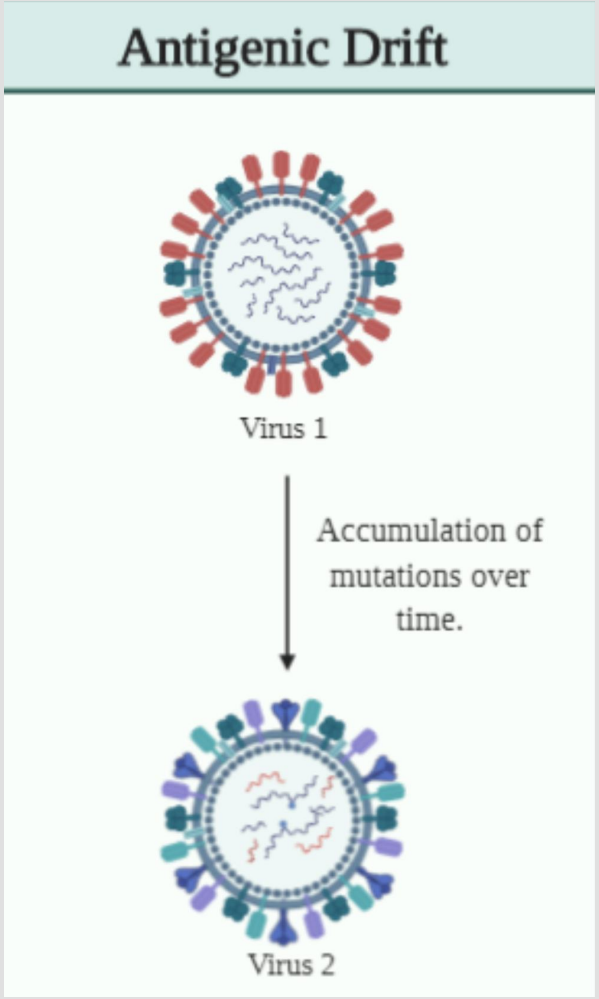
During the solar minimum, the electromagnetic field of our planet weakens, causing another way of virus transmission.

- This is shown by the Zika outbreak in 2015. We know that the virus was transmitted through mosquitoes, however, based on research, magnetic fields were significantly weaker towards the beginning of the outbreak. A mutation in the mosquito‘s DNA sequence could explain this idea.

Microorganisms help with this weakening, helping new pathogens reach the surface.

Coronavirus could turn to global pandemic as freak solar minimum menas outbreak imminent
Rao, N (2020)

- Most scientists believe that pandemics are caused by antigenic drifts, genetic alterations caused by mutations.
    - Mutations arise due to the excess radiation from the sunspots that makes it to our atmosphere
- When antigenic drifts are more severe, our bodies don't have enough of the necessary antibodies to fight of a virus.



Survival of the Sickest
Moalem, S (2008)

Researchers say sunspots may spread flu germs (1990)

Virus Particle Viability

In contrast to the last slide, some say viruses are unlikely to remain viable when traveling through the atmosphere due to their unstable fatty coverings. However, the fluctuating amounts of radiation from the sunspots causes magnetic field changes, as explained earlier, allowing an easier method of transportation for unstable virus particles.

Many scientists have connected the dates between sunspot maximums and pandemic dates.

- For example, a sunspot maximum in 1979 coincided with the initiation of the Red Flu. A solar maximum in 1761 occured along with a pandemic from 1761 to 1762.

Hope-Simpson, another scientist, claimed that antigenic shifts of multiple influenzas such as H1N1, H2N2, and H3N2 have all coincided with a solar maximum in 1947, 1957, and 1968, as shown in the graph to the right.

- Overall, Hope-Simpson declared most epidemics occurring in the 20th century have taken place near sunspot peaks.

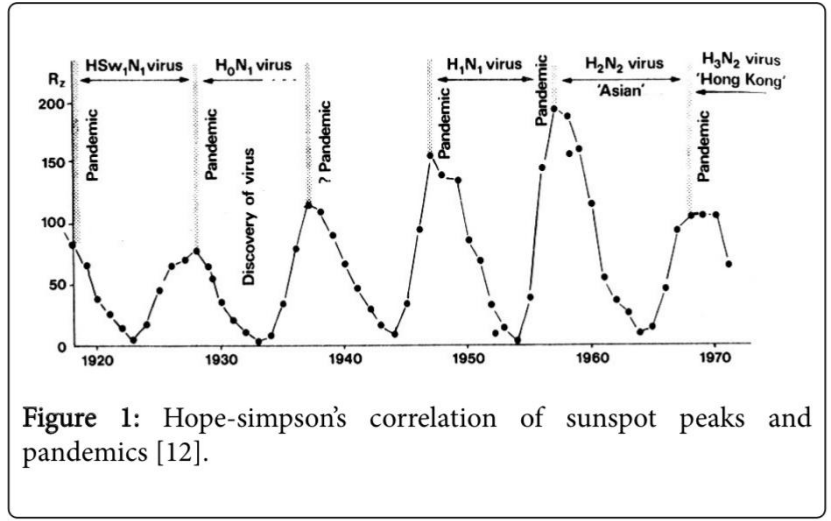


Figure 1: Hope-simpson's correlation of sunspot peaks and pandemics [12].

Is sunspot activity a factor in influenza pandemics?
Qu, J (2016)

Nature Correspondence
Hope-Simpson (1978)

Connection of Dates

Another scientist, Jiangwen Qu used descriptive epidemiology to show this connection. He later concluded that influenza pandemics as well as potential pandemics have occurred during or near times of sunspot extremes. The shortest amount of time between a sunspot maximum and pandemic is 35 days while the longest amount of time calculated was 67 days. His research had a confidence interval of 95%, showing high reliability. According to his research, Qu also determined that epidemics can be initiated due to external viral materials, via comets, meteoroids, asteroids, etc.

Connection of Dates

In 1994, Ertel, a parapsychologist, analyzed epidemics that took place near the times of the solar cycle. He approached his research by measuring the distance of an influenza pandemic from its closest solar maximum and then compares it with the same value that is expected. To do this, Ertel created the metric equation Q=1-2D/Dmax, where D is the years of a pandemic from the sunspot maximum. If the value of Q was high, it would indicate that the pandemic occured closer to the time of the maximum. Ertel concluded that the distances calculated versus expected were reliable in that they had a plus or minus 1 range. However, although his dates were correct, Cambridge University responded to Ertel‘s research by saying he did not acknowledge whether the epidemic had occurred during a solar maximum or a solar minimum. Cambridge corrected this research after examining his references.

Connection of Dates

John Yeung, a professor at the Chinese University of Hong Kong, outlined reviews of pandemics and possible influenza pandemics as well as analyzed global sunspot numbers acquired from the World Data Center for Sunspot Index, Belgium. Yeung used the sensitivity of using sunspot number more than 50 (SSN > 50) to observe an increase in pandemics with an increase of sunspots. As a result of his research, he found that two epidemics may have taken place from 1729-1733 and 1781-1782. Yeung also detected the presence of two epidemics that may have taken place from 1830-1833 and 1889-1892. The sensitivity of using SSN is greater than 50 to detect influenza pandemics was 85.7% with a confidence interval of 95%.

Garret and Potter, two other scientists also connected dates of pandemics, from 1700 to 1997, with sunspots according to their magnitude and phase.

In their research, there appears to be no real connection between magnitude and phase where phase is phase offset. Phase offset can be calculated by subtracting the year of solar maximum from year of pandemic and dividing that by year of cycle end minus year of cycle start.

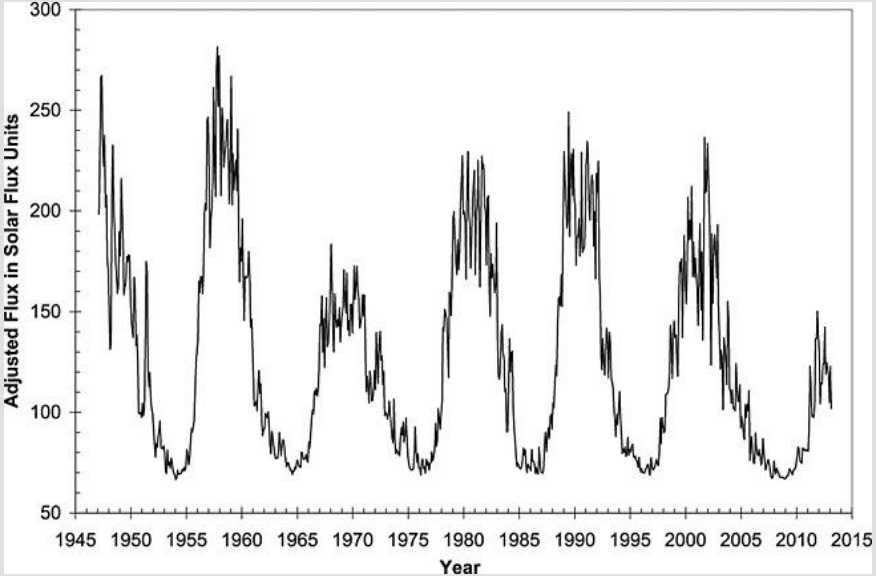
If the phase offset is calculated as 0, a pandemic occurs with the solar maximum. This was seen in a pandemic from 1761-1762 and a pandemic in 1957.

Pandemics Listed by Garrett			Pandemics Listed by Potter		
Years	**Magnitude**	**Phase***	**Years**	**Magnitude**	**Phase***
1729-30	High	+0.20	1729-33	High	+0.20
1732-33	High	+0.50	-	-	-
1742-43	Moderate	+0.36	-	-	-
1761-62	High	+0.00	1761-62	Low	+0.00
1767	Moderate	-0.22	-	-	-
1775-76	Moderate	-0.33	-	-	-
1781-82	High	+0.33	1781-82	High	+0.33
1788-89	Low	+0.07	1788-90	Low	+0.07
1800-02	Moderate	-0.33	1799-1802	Moderate?	+0.42
1830-33	High	+0.00	1830-33	High	+0.10
1837-37	High	-0.10	-	-	-
1847-48	High	-0.08	1847-48	Moderate	-0.07
1850-51	Moderate	+0.15	-	-	-
1857-58	Mild	-0.27	1857-58	Low	-0.27
1873-75	Mild	+0.27	-	-	-
1889-90	High	-0.33	1889-90	High	-0.33
-	-	-	1900	Low?	-0.50
1918-19	High	+0.10	1918-20	High	+0.10
1946	?	+0.20	1946-48	Low	+0.20
1957	High	+0.00	1957-58	High	+0.00
1968-70	High	+0.00	1968-70	High	+0.00
1977	?	-0.20	1977-78	High	-0.20

* This quantity, phase offset from activity maximum, is described later in the text.

Pandemics and Solar Activity
Tapping et. al. (2000)

To make sure their research was reliable, Garret and Potter created a simulation to test if their information was simply a coincidence. The simulation concluded that the probability that the research was indeed random was less than 2%. The researchers also used the 10.7 cm Solar Flux, a collection of data that indicates solar activity, to verify their research.

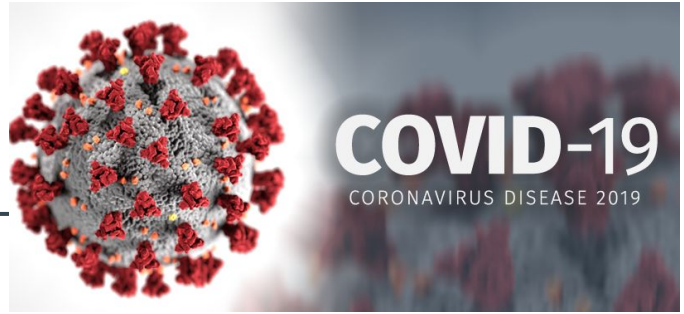


Conclusion

- Viruses, complex cells, bacteria, fertilized ova, among other things have travelled into our atmosphere from space, causing evolution and increased genetic diversity.
- During solar minimums, magnetic fields are weakened, allowing an easier method of travel for viruses.
- Excess radiation from sunspots during the solar maximum is transported by the help of solar winds and electric fields, causing mutations in virus DNA, known as an antigenic drift, a key concept in epidemic initiation.

Conclusion: Applications

- Epidemics and the Solar Cycle have the ability to disrupt our existence, so this research as well as future research can help scientists narrow down effects of both events
    - For example, the consequences of COVID-19 have been detrimental to our global population. If our society had a way to predict epidemics before they even happen, these consequences could be reduced significantly.



Conclusion: Limitations

- The topic cannot be tested in an experiment so scientists don't know if this theory is completely valid.
  - If the topic was tested through an experiment, it is considered unethical since you would potentially kill or harm living things. You would also need consent from the entire global population which is unrealistic and basically impossible.

Conclusion: Future Studies

- Scientists believe that solar behavior can cause other effects and are evident in nature
  - Cardiac issues, breast cancer
  - Tree rings and ocean sediments

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