

Using the Information of Cosmic Rays to Predict Influenza Epidemic

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Abstract

Why does influenza become worldwide pandemic at times? This paper suggests some new observations. First, there is a remarkable relationship between influenza pandemics and cosmic ray environment. Second, there is an excellent correlation between influenza pandemics and bright novae and Nova 7 Car. In addition, we propose four indexes to predict future influenza pandemics. Using one of these indexes we successfully predicted the influenza epidemic in 1984.

A. Introduction

Influenza has caused the greatest visitation and the severest natural calamity in this century. Unimaginably about twenty million people died in the influenza pandemic of 1918-1919. Why does influenza become worldwide pandemic at times? For exploring its basic cause, in 1978 R.Ing suggested that except for the pandemic of 1889, the beginning dates of historical influenza pandemic in the 18th and 19th centuries, as well as pandemics and viral antigenic shifts in this century, appear to have occurred in years of high sunspot number.⁽¹⁾ We have different views on this. At the time of suggesting his viewpoint, R.Ing cited seven influenza pandemics in the 18th and 19th centuries, based on the researches by J.R.Mote. But from complete data published by J.R.Mote, there were fifteen main influenza epidemics in the 18th and 19th centuries.⁽²⁾ Although he employs different terms of "epidemic" and "pandemic", however, this distinction is purely for convenience as Mote indicated. Because different historical records had different criteria and different detailed extent, it is very difficult to compare epidemical scale one another exactly. The distribution of the beginning dates of fifteen main influenza epidemics in the sunspot cycle is shown in figure 1.

From figure 1 we can see that there are four times in years of high sunspot number(over 80) and five times in years of low sunspot number(below 25). In addition, from researches by W.I.B. Beveridge in 1977, there were seven considerable worldwide influenza pandemics in the 18th and 19th centuries.⁽³⁾ The beginning dates of these pandemics are also shown in figure 1. We note that there are one time in year of high sunspot number and four times in years of low sunspot number. Therefore, according to the studies by J.R.Mote and researches by W.I.B.Beveridge, we can conclude that in sunspot cycle the phase that correlated to a certain extent with epidemics and pandemics of influenza should be the years of low sunspot number, it was more than the occurred number in high sunspot year.

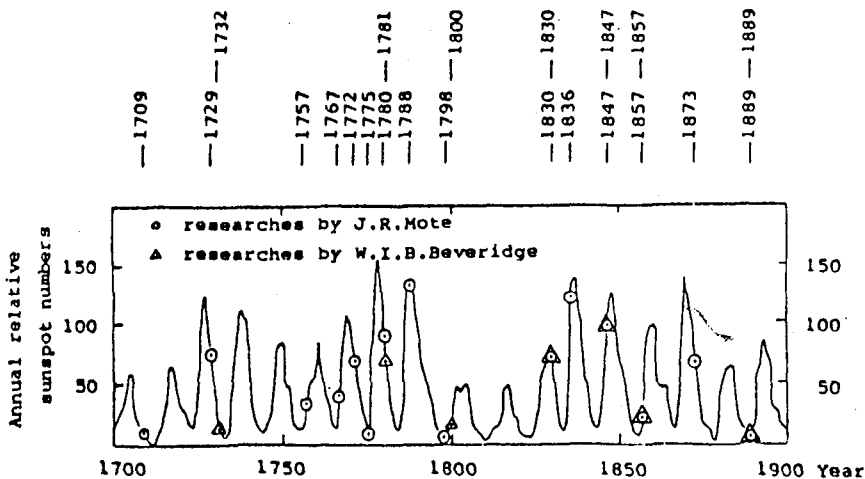


Fig.1 The distribution of the beginning dates of main influenza epidemics in the sunspot cycle in the 18th and 19th centuries

For explaining the mechanisms on how the high sunspot activity can affect influenza pandemics, Ing indicates that people conjecture that the amount of ultraviolet light (UV) incident on the surface of the earth is increased by enhanced solar activity, which might conceivably accelerate the mutation rate of the influenza virus. This speculation cannot, however, explain influenza pandemics occurred in years of low sunspot number. In this paper we try to offer an explanation for this based on cosmic ray researches.

But why have influenza pandemics occurred in some times and why have they not occurred in the others around the periods of low and high sunspot number? Actually, the periods of low and high sunspot number are merely a favorable conditions and a minor causing factor of influenza pandemic, and the dominant causing factor might be earth's cosmic ray environment.

B. Influenza and the cosmic ray environment

Since the start of systematic and continuous observations of cosmic ray in 1936, the number of ground level enhancement event had been rare in more than forty years. Among them large enhancement events happened only five times.⁽⁴⁾ These large Ground Level Solar Cosmic Ray Events (GLEs) occurred on Feb. 28, 1942; Mar. 7, 1942; July 25, 1946; Nov. 19, 1949 and Feb. 23, 1956. According to the researches by V.M. Zhdanov et al.⁽⁵⁾ there were five influenza pandemics in the first half of this century. Among them the beginning dates of two pandemics were in 1943 and in 1947. They occurred just after the first three large GLEs respectively. After the large GLE on Nov. 19, 1949, in 1950-1951 there also occurred a severe influenza epidemic spreading to Europe, Africa, North America, Japan and other places. In Liverpool, the death rate even surpassed that of the pandemic of 1918.⁽⁵⁾ So V.M. Zhdanov et al. held that the epidemic time of the fifth influenza pandemic in this century was 1947-Feb. 1952. Even more, in 1957, the next year of large GLE on Feb. 23, 1956, there occurred a worldwide influenza pandemic too. Among seven influenza pandemics occurred hitherto in this century, it was the second severest pandemic. We note that after five large GLEs occurred in the past forty years or so influenza pandemic invariably broke out in each case. Therefore, very remarkable is the corresponding relationship between influenza pandemic and the large variation in the cosmic ray environment.

These extraordinary events of cosmic ray environment all occurred before influenza pandemics one year or so. To start a new influenza pandemic this interval is reasonable, since it takes time for influenza viruses to mutate or to recombine genes and then for selection of human immunity to form new pandemic strains.

Among three pandemics the severest one was that of 1957. And the GLE on Feb. 23, 1956 was the largest GLE among all recorded GLEs. It seems as if the scale and harmfulness of influenza epidemic were related to the enhanced amplitude of ground level cosmic rays. But this relationship might not be simply understood as a direct proportion relationship.

The mechanisms on how the cosmic ray environment can affect influenza pandemics cannot be discussed here in detail. We presume it has these main aspects. First, the sudden enhancement of cosmic ray environment could deplete the atmospheric ozone layer and therefore bring the increase of the amount of ultraviolet light incident upon the surface of the earth. Second, the abrupt enhancement of ground level cosmic rays seems to give living things an X-ray. The ionizing radiation resulted from cosmic rays in human and animal body and the enhanced ultraviolet rays could lead to mutation of influenza viruses or gene recombination among different human and animal influenza viruses and therefore bring viral antigenic shifts and form new subtypes of influenza virus. Third, the large variation of cosmic ray environment could lead to corresponding variation of other natural environment elements and therefore bring a more favourable ecological environment for infection and transmission of new subtype of influenza virus.

From these mechanisms, we can understand the reasons that influenza pandemics sometimes occurred in the years of low sunspot number. Because the years of low sunspot number were just the years of high cosmic ray intensity on the earth⁽⁶⁾, so the years of low sunspot number were just the years of high ultraviolet intensity incident on the surface of the earth.

C. Influenza and novae

The researches on the relationship between cosmic ray environment and influenza pandemic provide a new way for exploring causes of other influenza pandemics. We might envisage that influenza pandemic can also be aroused by other astronomical phenomena not just the sun, if these phenomena can cause large enhanced effect of cosmic ray environment of life on the earth.

Here we want to raise a new issue i.e. the relationship between the novae and influenza pandemics. From table 1 we notice that there is a very good corresponding relationship between bright novae and the front four influenza pandemics occurred in this century. In this century there have hitherto occurred only eight novae with maximum apparent magnitude (MAM) brighter

than 2.2. And table 1 listed as many as five bright novae. The three others are GK Per with MAM 0.2 in Feb.1901, V476 Cyg with MAM 2.0 in Aug.1920, and V1500 Cyg with MAM 2.2 in Aug.1975. After the occurrence of Nova V1500 Cyg, we have noted that swine influenza virus(H_{sw} IN1) reappeared in 1976 and the H1N1 subtype resurfaced in 1977 and spread to wide regions of the world. After the occurrence of Nova V476 Cyg, we have also noted that influenza epidemic occurred in many countries, such as UK, Ireland, Belgium, Norway etc., the influenza mortality reached a peak in 1922.⁽⁵⁾ As regards the Nova GK Per, we have not had detailed epidemiological data of influenza in 1902, so we donot know whether an influenza epidemic occurred or not in that year. We note that after seven bright novae out of those eight all occurred epidemics or pandemics of influenza. Therefore, the corresponding relation between bright novae and influenza pandemics is also very remarkable.

About the great pandemic of 1918-1919 we think that its beginning was caused by other factor but the Nova V603 Aql took a decisive role for that why the second wave of this pandemic became very different than the first wave in harmfulness and turned to the most spectacular outbreak of any disease for hundreds of years.

Table 1. The contrast between bright novae and the first four influenza pandemics in the 20th century

The beginning dates of influenza pandemics ⁽⁵⁾	Bright novae ⁽⁷⁾
1918	Nova V603 Aql, maximum apparent magnitude -1.1 on June 10, 1918
1926	Nova RR Pic, maximum apparent magnitude 1.2 on June 8, 1925
1936	Nova DQ Her, maximum apparent magnitude 1.4 on Dec.22, 1934 Nova CP Lac, maximum apparent magnitude 2.1 on June 20, 1936
1943	Nova CP Pup, maximum apparent magnitude 0.2 on Nov.11, 1942

Table 2. The contrast between the years of maximum of brightness of Nova η Car and the years of influenza pandemics in the 18th and 19th centuries

The years of epidemics and pandemics of influenza by J.R.Mote ⁽²⁾	All the years of maximum of brightness of Nova η Car ⁽⁷⁾	The years of influenza pandemics by W.I.B.Beveridge ⁽³⁾
1709-1712		
1729-1733	1729	1732-1733
1757-1762	1752	
1767		
1772		
1775-1776		
1780-1782		1781-1782
1788-1790		
1798-1803	1801	1800-1802
1830-1833	1827	1830-1833
1836-1837		
1847-1850	1843	1847-1848
1857-1858	1856	1857-1858
1873-1875	1871	
1889	1889	1889-1890

As regards the influenza pandemics of 18th and 19th centuries, we found that there existed an interesting relationship between them and Nova γ Car. The brightness of γ Car was variable. It was sometimes bright and sometimes dark. According to the researches by C. Payne-Gaposchkin,⁽⁷⁾ in 18th and 19th centuries its maximum occurred only eight times. Table 2 shows that after every maximum of brightness of Nova γ Car there was almost always the influenza pandemic. Especially in the 19th century, their relation was bordering on one to one corresponding relation. It is hardly conceivable for such good correlation. Is it possible that the Nova γ Car could bring a very large amount of UV, X- and γ -rays incident on the earth when it turned up outburst?

Nova is a violent phenomenon of star explosion. People believe it is one of the sources of cosmic rays. If the nova can really bring the influenza pandemic, then the transmitter of nova information should be its high energy X-, γ -rays (nova's X-, γ -rays \rightarrow the depletion of the atmospheric ozone layer \rightarrow the strong increase in the solar UV incident on the surface of the earth \rightarrow influenza pandemic). Nevertheless, bright nova is a rare astronomical phenomenon. In the past forty years or so there occurred only one bright nova with MAM 2.2. The modern data of cosmic ray intensity variation effect of nova are very few, so it is difficult now to make sound comments on affection extent of bright nova on earth's cosmic ray environment. However, the excellent correlation between influenza pandemics and novae implies strongly that the cosmic ray environment variation of earth should be seriously investigated after the occurrence of nova. Therefore, we suggest that the intensity variation of X-, γ -rays and UV will have to be investigated by various observation means from ground level to satellite altitude when turning up outburst for γ Car or when occurring of bright nova in the future.

D. To predict influenza epidemic

According to the excellent correlation in the past, we propose four indexes to predict future influenza pandemics: first, the occurring of the large GLE; second, the occurring of the bright nova; third, the turning up outburst again for γ Car; fourth, the large enhancement of life's cosmic ray environment caused by other astronomical phenomena.⁽⁸⁾⁽⁹⁾⁽¹⁰⁾ When one of these indexes takes place, it would not at all be surprising if a new influenza pandemic should emerge soon after.

We are glad to report that according to the first index we successfully predicted the influenza epidemic in 1984. On Dec. 8, 1982 there occurred a middle GLE.⁽¹¹⁾ So the author wrote a report to the China Influenza Centre to predict that influenza epidemic would soon emerge in the world in 1984. As expected, the influenza epidemic has emerged. In the USSR in two months from the second half of January to the first half of March the number of cases of influenza illness reached several millions, about 3-5% of the population were affected during the week of highest activity,⁽¹²⁾ in big cities and in the capitals of fifteen Soviet Socialist Republics the incidence reached about 10% of the population. In the same time, widespread influenza illness has been reported also in the USA, many European countries, Japan, Pakistan, Algeria, Morocco, Tonga etc..⁽¹³⁾ Therefore, one of the viewpoints of this paper has got a successful verification.

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