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Influence of Lunar Activities on the Twenty-four Solar Terms

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Abstract: Twenty four solar terms is a knowledge system formed by the ancients through long-term observation of the annual activities of the sun. Although it roughly reveals the changing rules of seasons, climate and phenology in a year, and reflects the influence of the sun on the earth's climate change on a large scale, because the ancients ignored the influence of the moon's activities on the earth's climate change on a small scale, the 24 solar terms they summarized often can not accurately predict the earth's climate change. In order to make the 24 solar terms reflect not only the influence of the sun on the earth's climate change on a large scale, but also the influence of the moon's activities on the earth's climate change on a small scale, we must refer to the key time nodes of the moon's activities to divide the 24 solar terms. That is to say, the first day (the seventh or twenty second day of the lunar calendar) after the "Greater Cold" of the old year should be set as the "Beginning of Spring" of the new year, and then the day after half a month should be the next solar term, which is the first day of the moon's next visit to the Antarctic or the Arctic, and so on. In this way, the 24 solar terms are consistent with the key nodes of lunar activities, and can accurately predict the changes of the earth's climate.

Key words: Twenty-four solar terms, lunar activity, polar vortex, global climate change.

1. Introduction

Twenty four solar terms reflects the change of natural rhythm to a certain extent and plays an extremely important role in people's production and life. It is not only a seasonal system to guide agricultural production, but also a folk system with rich folk matters. The 24 solar terms contain a long cultural connotation and historical accumulation, which is an important part of the long history and culture of the Chinese nation [1-2]. In the international meteorological circles, the 24 solar terms are known as "the fifth great invention of China". On November 30, 2016, the 24 solar terms were officially listed in the UNESCO representative list of human intangible cultural heritage.

Twenty four solar terms is a knowledge system formed by ancient Chinese through long-term observation of the annual activities of the sun [3-4]. It divides the year into four seasons, spring, summer, autumn and winter. Each season has three months and each month has two solar terms. Although it roughly reveals the changing rules of seasons, climate and phenology in a year, and reflects the influence of the sun on the earth's climate change on a large scale [5], because the ancients ignored the influence of the moon's activities on the earth's climate change on a small scale, the 24 solar terms they summarized often can not accurately predict the earth's climate change. Therefore, to accurately divide the solar terms of each year, we should determine them not only according to the activities of the sun, but also according to the activities of the moon.

2. The Activities of the Moon Cause Global Climate Change

Polar vortices are persistent, large-scale cyclones that originate in the Earth's polar regions, and are generally located in the middle and upper troposphere and can extend to the stratosphere. Usually they move around the North (or South) Pole, and can not easily go out of the

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polar basin [6], as is shown in Fig. 1 and Fig. 2.

Polar vortex usually strengthens in winter and decreases in summer. When the polar vortex is not destructed by the outside world, it can control the cold air of the polar circle well, as is shown in Fig. 3(a). But when the polar vortex break apart due to external destruction, cold air can be brought to the middle and low latitudes [7-8], as is shown in Fig. 3(b).

Since the Antarctic ice sheet is thick, the temperature is very low, and the Antarctic vortex is surrounded by highlands, less disturbed by external wind, Antarctic polar vortex is more stronger than Arctic polar vortices. But, due to the opening of the Arctic Channel and the exploration and exploitation of oil and as, Arctic sea ice has dwindled rapidly, Arctic ice cover and permanent permafrost has fallen obviously, the edge of polar basin has subsided gradually, and the sea-level and atmospheric equipotential surface in Arctic area have significantly decreased, causing the Arctic vortex to become thin and weak, unable to produce a strong wind, finally leading to global warming. If the Arctic ice cap can be kept from melting, the Arctic glaciers can be kept from dwindling, and the Arctic permafrost can be kept from dwindling, then arctic vortices can be strengthened to produce strong wind, leading to global cooling. Hence, the activity of polar vortex is an important factor affecting global climate change, and the poles are the air conditioners of the whole planet [9-10].

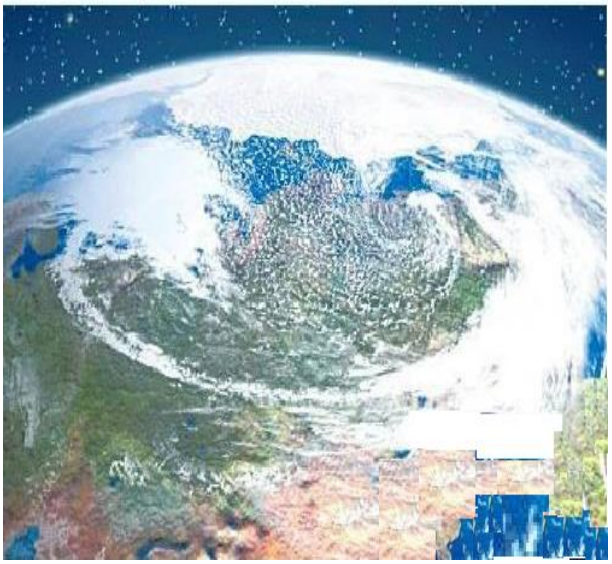

Fig. 1 North polar basin.

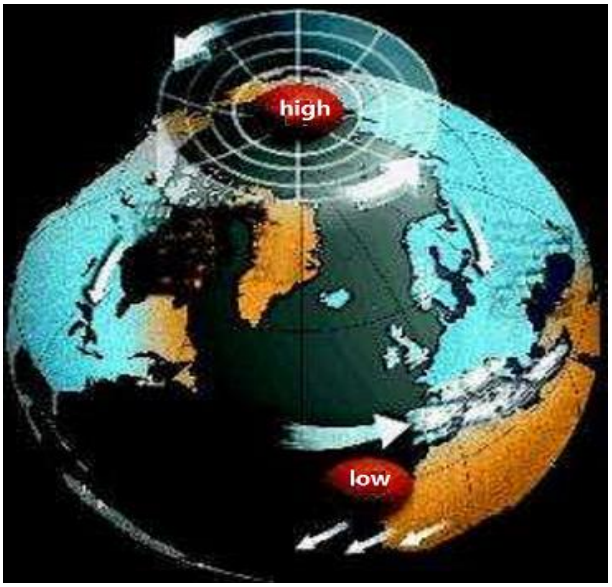

Fig. 2 North polar vortex.

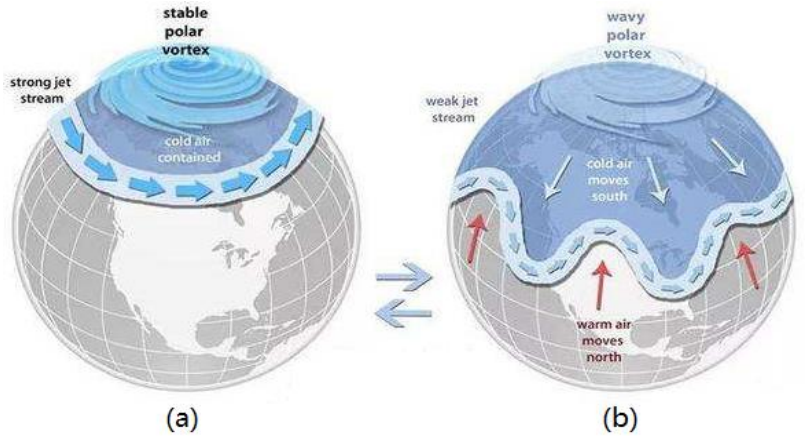

Fig. 3 The state change of polar vortex.

Just as the Moon can cause ocean tides, the Moon also has a gravitational effect on the polar vortices. When the Moon approaches a polar vortex, the Moon can tilt or break the polar vortex, pour out some cold air and inner sub-cyclones. With the rotation of the Earth and the revolution of the Moon, the cold air flow from the polar vortex pours down around the planet, as is shown in Fig. 3(b). Some of these cold air and sub-cyclones fall in the polar basin, while some of the cold air and sub-cyclones, accompanied by the stratospheric flow, pour in the direction of the Moon's gravity. Hence, these cold air and sub-cyclones can flow with a speed greater than 50 m/s, which can reach the latitude of the Moon in a few days. Where the cold air goes, the wind blows widely, floating clouds turn into rain, temperature drops sharply, even causing seasonal changes. Specially, some drifting sub-cyclones can absorb the warm and moist airflow evaporated from deep valleys to intensify into a strong atmospheric vortex, which then falls into a nearby forest to become a fire tornado, setting off a big wildfire to destroy a large area of forest or grassland. While some of the sub-cyclones, when encountering the high temperature airflow from the ocean surface, immediately intensify into typhoons or hurricanes [11-12].

When the moon moves northward from low latitude from the first day of the lunar calendar to the seventh day of the lunar calendar, or when the moon moves southward from the top of the Arctic from the eighth day to the fifteenth day of the lunar calendar, as shown in Fig. 4, it can tilt the Arctic vortex and pour out part of the cold air of the polar vortex. Some of the cold air flows along the direction of the gravity of the moon along the stratosphere, and when encountering the water vapor evaporated by the sun, it will be transformed into rain and land on the ground. If it is the seventh or eighth day of the lunar calendar, the moon is closer to the Arctic vortex, the moon has a greater attraction to the polar vortex, and it pours out more cold air. Where the air flow goes, there will be strong winds, floating clouds will be transformed into rain, and the temperature will drop sharply, which is easy to cause seasonal changes. Therefore, the seventh and eighth day of the lunar calendar are the main time nodes of lunar activities.

When the moon moves southward from low latitude from the 16th to 22nd lunar calendar, or when the moon moves northward from the top of the Antarctic from the 23rd to 30th lunar calendar, as shown in Fig. 4, it can tilt the Antarctic vortex and pour out part of the cold air of the polar vortex. Some of the cold air flows along the direction of the gravity of the moon along the stratosphere, and when encountering the water vapor evaporated by the sun, it will be transformed into rain and land on the ground. If it is the 22nd or 23rd day of the lunar calendar, the moon is closer to the Antarctic vortex, the moon has a greater attraction to the polar vortex, and it pours out more cold air. Where the air flow goes, there will be strong winds, floating clouds will be transformed into rain, and the temperature will drop sharply, which is easy to cause seasonal changes. Therefore, the 22nd and 23rd day of the lunar calendar are also the main time nodes of lunar activities.

3. The Influence of Lunar Activity on the Change of Solar Terms

Twenty four solar terms had been established in ancient times. The ancients divided a solar activity year into 24 segments on average according to the climate

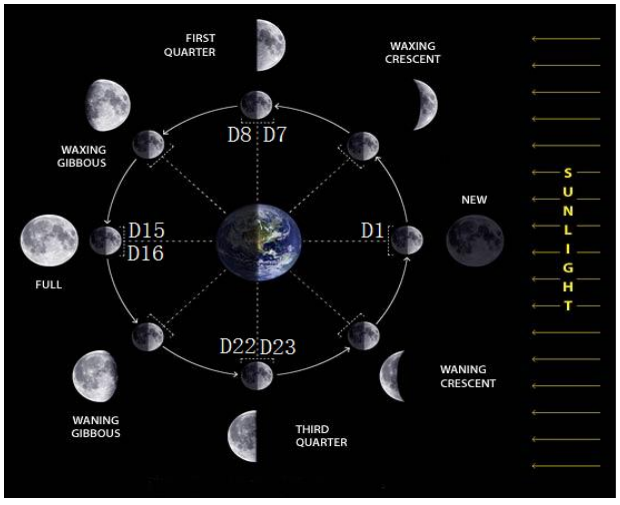

Fig. 4 Phases of the moon.

change of different positions of the sun directly on the earth and combined with the agricultural cycle, each segment represents a solar term. Therefore, there are 24 solar terms in a year and two solar terms in a month. Each solar term lasts about 15 days, as shown in Fig. 4. However, this division ignores the impact of lunar activities on the earth's climate on a small scale, so it can not accurately predict the change of the earth's climate.

For example, according to the existing division of 24 solar terms, the first solar term "spring" in 2020 is set on February 4, 2020 (lunar 11), which does not accurately reflect the law of lunar activities. Because the last solar term of the previous year, "great cold" was caused by a large number of cold air currents poured out of the Antarctic polar vortex when the moon came down from the top of the Antarctic and the cold and wet ocean air currents blown by the strong Antarctic air currents, resulting in a great cold weather in the northern hemisphere for nearly half a month. Therefore, only when the moon moves close to the Arctic vortex and pours out the Arctic vortex can the residual cold and wet air in the "great cold" solar term be removed in reverse and a new spring in the northern hemisphere be opened. Therefore, we should scientifically set January 31 (the seventh day of the lunar calendar) as the "beginning of spring" solar term. The fact also shows that the temperature was gradually rising after January 31, and daytime temperature didn't fall below 10℃ in the following months.

For another example, according to the existing 24 Solar Terms, February 19, 2020 (lunar calendar 26) is Rain Water, but in fact, on that day and the day after that, Nanchang is cloudy and sunny, and there is no return to winter with rain and snow. If January 31 (the seventh day of the lunar calendar) is set as Beginning of Spring, February 15, 2020 (the twenty second day of the lunar calendar) should be set as Rain Water. This is consistent with the actual weather in Nanchang on that day, because it rained in the daytime and snowed in the evening, which is the scene of increasing rainfall. In addition, the lunar calendar 22 is just when the moon approaches the Antarctic head space. The moon is closer to the Antarctic vortex, and has a greater attraction to the polar vortex. More cold air is poured out, which makes many parts of the world windy, cloudy and rainy. It is very natural to have sleet weather. Therefore, setting February 15, 2020 (lunar calendar 22) as Rain Water is also consistent with the time node of lunar activity.

For another example, according to the existing 24 solar terms, August 7, 2020 (lunar calendar 18) is Beginning of Autumn. Under normal circumstances, there should be precipitation to cool down. However, from August 7 to 8, 2020, the weather in Nanchang turned cloudy without any rainfall. According to the new solar term division method advocated by the author, August 11, 2020 (lunar calendar 22) is the beginning of autumn. In fact, the weather in Nanchang on that day was light rain in the daytime and thunderstorm at night, which just reflected the climatic characteristics of Beginning of Autumn. In addition, the setting of August 11, 2020 (lunar calendar 22) as the "Beginning of Autumn" coincides with the time node of lunar activities.

However, the current method of solar term division is basically consistent with the new one advocated by the author in setting the following solar terms in 2020:

Cold Dew (October 8, lunar calendar 22), **First Frost** (October 23, lunar seventh day), **Beginning of Winter** (November 7, lunar calendar 22), **Light Snow** (November 22, lunar calendar, eighth lunar calendar), **Winter Solstice** (December 21, lunar seventh day), **Lesser Cold** (January 5, 2021, lunar calendar 22), **Greater Cold** (January 20, 2021, 8th lunar calendar).

The time setting of these solar terms is consistent with the key nodes of lunar activity, which can better predict the natural phenomena of these solar terms.

4. Conclusion

To some extent, the 24 solar terms reflect the changes of natural rhythm, but because people ignore

the impact of the moon's activities on the earth's climate change, the 24 solar terms they summarize often can not accurately predict the earth's climate change. To make the 24 solar terms reflect not only the influence of the sun on the earth's climate change on a large scale, but also the influence of the moon's activities on the earth's climate change on a small scale, we must refer to the key time nodes of the moon's activities to divide the 24 solar terms. That is to say, the first day (the seventh or twenty second day of the lunar calendar) after the cold solar term of the old year will be set as the "beginning of spring" solar term of the new year, and then the day after half a month should be the next solar term, which is the first day of the moon's next visit to the Antarctic or the Arctic, and so on. In this way, the 24 solar terms are consistent with the key nodes of lunar activities, and can accurately predict the changes of the earth's climate.

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