RESEARCH OF AIR POLLUTION IMPACT OF STRAW BURNING BASED ON MODIS

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Straw burning is becoming one of the serious problems to affect environmental quality in China. Every year about 0.65 billion tons of crop straws are produced in China, 20 percent of them are not effectively used and are burned directly [1-2]. For straw burning is distributing in the rural area, it's not easy to be verified and supervised. Satellite remote sensing technology with its characters of high time effectiveness and objectivity can be used to accurately monitor straw burning distribution in large areas. There are a lot of research and applications in this field [2-8]. However, those researches lack of combination with air quality. MODIS is a key instrument aboard the Terra (EOS AM) and Aqua (EOS PM) satellites. It can view one place about two times a day. Now MODIS data has been widely used for biomass burning monitoring. This paper takes use of MODIS data to research on the air pollution impact of straw burning. Firstly, this paper introduces the detection method of the fire points of straw burning based on MODIS data. Then combining with GIS buffer tool and statistic method, it analyzes the relationship between the fire points of straw burning within butter area and the air quality. Finally, it studies the air pollution impact from the straw burning integrating with atmospheric data in the research area of North China.

The algorithm for selection of fire points from MODIS is "contextual fire detection algorithm" [8]. Its main principle is to calculate the statistical character of the bright temperature between the central pixel and its surrounding pixels and setting some judgments and threshold values of bright temperature of band in 4um, band in 11um and the bright temperature difference between the band in 4um and 11um to detect the anomaly fire points. Afterwards also includes eliminating the false fire points caused by sun. As to the extraction of the straw burning fire points, it was based on land use data and GIS tool. At the same time, the stable fires will be removed. To the air pollution analysis, Beijing was taken as study case. With the support of GIS tool, buffer areas of 600km, 700km, 800km

are made around the center of Beijing, and the work concerning the effect of straw burning extent on air quality is analyzed.

Through the above method, taking use of MODIS data, the straw burning situation in June, 2007 in China was studied. The main study area is North China. The distribution map and statistic result of fire points of straw burning in China are shown in Figure 1 and Figure 2.

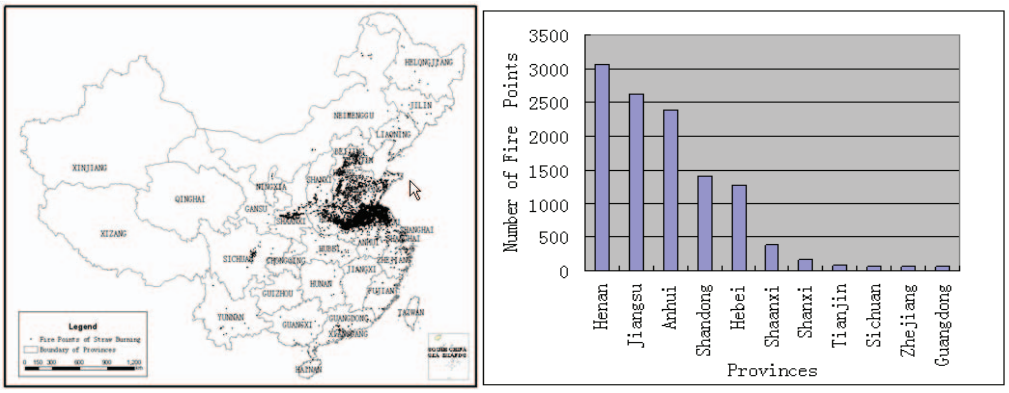

Fig.1 Distribution (left)and statistic(right) map of fire points of straw burning in June 2007 in China

The air quality data for study is from the City Air Quality Daily data [10]. Air pollution index data was used in this research. Other data include Chinese Administrative Map, Land use and meteorology data. From the results, it's can be seen that straw burning in June mainly distributed in Henan, Jiangsu, Anhui, Shandong, Hebei, Shanxi provinces (As shown in Figure1),which consisted of 91.6% fire points of the whole country. As to Contrasting analysis on straw burning distribution and air quality, Beijing city was selected as a studying object, a time-series analysis is made between air quality data and the number of the fire points. (As shown in Figure 3 to 4).

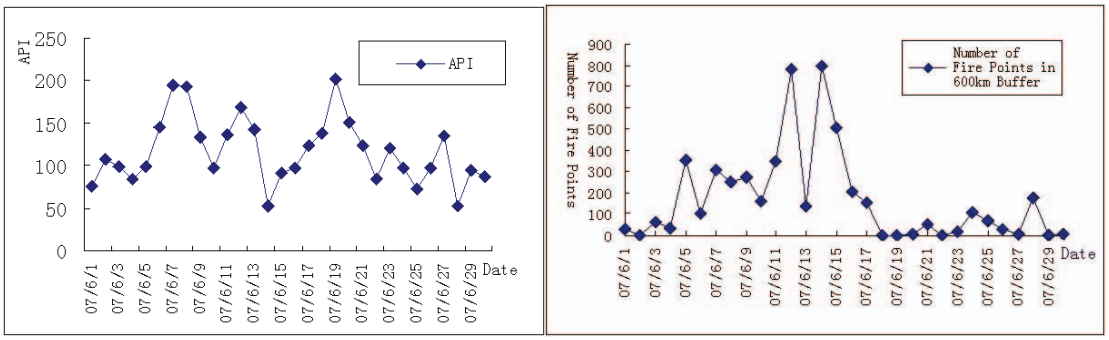

Fig.3 Air pollution index trend map of Beijing(left)and Statistic map of the fire points in the 600km buffer area of Beijing

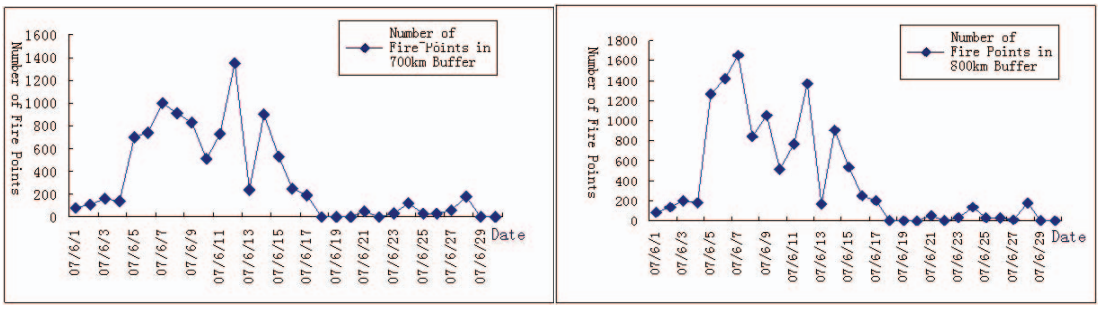

Fig.4 Statistic map of fire points in 700km(left) and 800km(right) buffer area of Beijing

Through correlation analysis, the correlation coefficients between the number of straw burning fire points within three buffer areas and API values can be got that are correspondingly 0.04, 0.54, 0.54.It showed that fire points within 700 and 800 km buffer areas has better accordance with API values. Shown from the API values in Beijing in June (As shown in Figure 3), air pollution condition was especially serious. In the whole month, there were over 50 percent of days that API values were higher than 100, which demonstrated the grading of air quality was under the second-level. The days having more serious air pollution were mainly distributed from 6th to 13th and from 17th to 23rd in June. , fire points had been increasing from 5th to 15th. In this period, there are more fire points on 7th and 12th. Fire points decreased on 13th. At the peak of air pollution from 17th to 21st, due to cloud covering, fire points monitored are too few to be compared with air quality data. From the meteorological data in Miyun and nearby ground stations [11], it showed the meteorological situations are: the mean ground temperature of air was 27℃, average relative humidity was54%, no rainfall and a less than 2 m/s mean wind speed. It showed that meteorological condition was not helpful for pollutants diffuse.

All in all, the research shows that it is an effective complement way to monitor fire points of straw burning by satellite remote sensing. MODIS data can be better to be used to monitor and supervise the present and the trends of the fire points of straw burning. It also represents that when the weather is clear, on the basis of satellite products, GIS and statistic analyzing tools, it is better to analyze the air pollution problem arises from the fire points of straw burning, and combining with meteorological factor, a comprehensive result concerning to air pollution can be achieved.

Key Words: MODIS; Satellite Remote Sensing; Straw Burning; Fire Points Distribution; Air Quality

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