MONITORING OF ENTEROMORPHA PROLIFERA IN QINGDAO MARINE BY EXPLOITING THE SYNERGY OF ACTIVE AND PASSIVE REMOTE SENSING DATA

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Abstract: In recent years, Enteromorpha prolifera often appear along China coastline mostly in the Yellow Sea and the East China Sea. Enteromorpha prolifera are marine edible macroalgae which belong to chlorophyta ulvales ulvaceae enteromorpha. Although Enteromorpha prolifera are non-toxic, they would seriously consume the oxygen in the sea when they die. It is considered to be "green tide" when this kind of macroalgae breed largely and rapidly in international in recent years.

In late June 2008, Enteromorpha prolifera bloomed in Qingdao marine, covering the Qingdao Olympic Sailing Center. The large scale and the fast extending speed of the Enteromorpha prolifera bloom were rare in history. The Enteromorpha prolifera bloomed just before Beijing 2008 Olympics, so it attracted most attention around the world. Monitoring Enteromorpha prolifera using remote sensing data has the advantages of rapidness, wide coverage, low cost. But commonly used optical remote sensing is easily affected by cloud, which limits the monitoring timelines. In this paper, the theory of Enteromorpha prolifera monitoring from optical remote sensing and SAR remote sensing were analyzed. Then, the technical routes of Enteromorpha prolifera monitoring by exploiting the synergy of active and passive remote sensing data were presented. Because the SAR images are not affected by cloud, the timelines can be increased exploiting the by synergy of active and passive remote sensing data. MODIS and RADARSAT were used to monitor Enteromorpha prolifera. The monitoring results were used to analyze the beginning and spread of Enteromorpha prolifera. Furthermore, the monitoring results from MODIS and RADARSAT were compared.

The main results of this paper are as follows. From the overall, remote sensing technology is effectively applied to monitor the information about the emergence, the distribution and development of Enteromorpha prolifera. It is an effective method to monitor such a large rang Enteromorpha prolifera bloom in the ocean. It also provides the scientific basis for cleaning up the Enteromorpha prolifera for water environment treatment. At the same time, the result is helpful to profoundly understand the law of development about the Enteromorpha prolifera and investigate the reasons why the Enteromorpha prolifera bloom breaks out so strongly in Qingdao marine. Secondly, MODIS plays an important role in detecting the large scale Enteromorpha prolifera bloom due to its short revisit period, high SNR and free of charge. Considering the monitoring method, the results show that the spectral index of MODIS is a useful way to monitor the Enteromorpha prolifera. Thirdly, SAR remote sensing plays an important role in the Enteromorpha prolifera emergency monitoring. Active remote sensing can avoid being influenced by cloud while optical remote sensing could not. Compared with the results monitoring by SAR and optical remote sensing on the same day, it can be seen that although the area was slightly different, the spatial distribution information is quite similar. Finally, it can be seen from the monitoring results, the Enteromorpha prolifera bloom broke out extremely severely in 2008, the results show that Enteromorpha prolifera began at May 14th, at the south of the Qingdao marine, the juncture in the sea areas 174km away from Qinghuangdao and 102km way from Yancheng. The central coordinate is 34°31′N，121°23′E. From then on, the biomass increased rapidly. Until late June, Enteromorpha prolifera bloomed in the most sever cases. Enteromorpha prolifera bloom was under control until July 25th. In the whole process, Enteromorpha prolifera drifted to west and north with wind and ocean current.

Keywords: Optical Remote Sensing; SAR Remote Sensing; MODIS; RADARSAT; Enteromorpha prolifera; Synergy

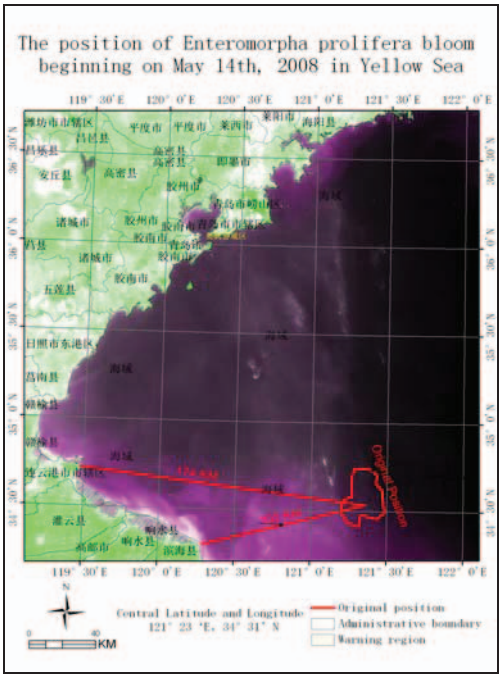

Figure 1. The original position of E.P on May 14th, 2008 in Yellow Sea

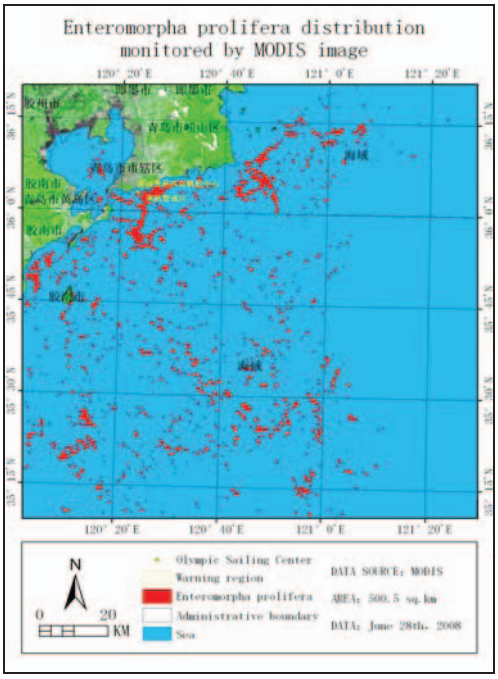

Figure 2. E.P. distribution on June 28th, 2008 monitored by MODIS image

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