

PETROLEUM AND GAS RESEACH BY REMOTE SENSING IN SOUTH CHINA SEA

Prof. Xu Ruisong

Guangzhou Institute of Geochemistry, Chinese Academy of Sciences
P.O.Box 1131, Guangzhou, China, 510640
E-mail: xurs@gig.ac.cn

KEYWORDS: South China Sea, Petroleum and Gas Anomaly, Remote Sensing Research, Correlation Analysis

ABSTRACT:

This study have been made SST processing by NOAA-11 CH4,5 band, false color image processing by NOAA-11 CH5,2,1 band, and more factor correlation analysis between gray value and thermal current value i.e. data in South China Sea, with computer image processing system, after weed cloud, atmospheric modified, and geometry rectification. The remote sensing data is from NOAA-11 in May 16-30, 1990, March 15-April 2, 1993 and April 12, 1994. The main study results as follow:

1. The temperature of sea surface is 1-3 °C higher than background value in petroleum and gas area of Yingo sea, Pearl river mouth, Taiwan strait, and Lilou beach in South China Sea.
2. The hydrocarbonphilous microorganism, algae, and plankton on Yingo sea, Pearl river mouth, Taiwan strait, Luzon sea, Lilou beach, and Honghe river mouth petroleum and gas area have been displayed special cherry red color on NOAA-11 CH5,2,1 band false color image different from background color.
3. The gray value with NOAA-11 CH1,4,5 band, temperature on South China Sea surface, gravity, magnetic anomaly and thermal current value have the best correlation. The gray value from NOAA-11 CH1 band has a positive correlation with temperature on South China Sea surface, gravity anomaly and thermal current value; has a negative correlation with magnetic anomaly. Gray value from NOAA-11 CH4,5 band has a positive correlation with magnetic anomaly; has a negative correlation with temperature on South China Sea surface, gravity anomaly and thermal current value.
4. According to research results, a few petroleum and gas prospect areas have been identified rapidly, economical and accurately in Luzon sea, Honghe river mouth, Pearl river mouth and Lilou beach i.e. areas on South China Sea.

1. INTRODUCTION

Since space age in 1960, remote sensing information have been serviced for ocean shipping, marine meteorology and marine engineering. World would going to marine remote sensing century after been launched the first ocean research satellite by U. S. A. in 1970. People study use marine remote sensing in areas of marine Physics, chemistry, meteorology, ecology, geology, environment, pollution and resources i.e.. In global change research, the remote sensing information that from different satellite

station and more band have been wide for study in global marine environment, primary products, resources, water color, carbon amount, carbon circle, water and steam change over world, quantitative, automation, and all weather i.e.(Xu Ruisong et al. 1990, 1992,1993,1997).

Land provide limited space for humanity life. So, must study more nature rule for need more space and resources from marine. But marine too large, change fast at short time, just remote sensing is the best way for marine resource and environment research

quickly, economy, quantitative, automation and all weather.

South China Sea located in S 3°-N 25°, E 98°-123°. It is the largest marginal sea in West Pacific and the biggest tropics sea basin in the world(Fig.1). The area is more than 360Km². Geomorphology consist with oceanic basin, trough, trench, continental slope, continental shelf, and Island. South China Sea basin is a rhombus one that long axle is direct to NE-SW. The water of basin is over 3600M deep. The marine trents are NE display, the deepest one is over 5559M. The continental shelf near by Chinese main land, India-China Peninsula, Indonesia archipelago is the smoothest continental in the world. The widest one is 285Km.The deepest one is 150m.The continental near by Philipines is narrow, high and precipitous. Water of continental slope is 150-3000m deep, the slope is 1-2 degree, the widest is 555Km. South China Sea is from tropics to subtropics, it has a striking tropical marine meteorology. There are rich regenerated and nonregenerated resources in South China Sea, include more than 500 Thousands Km² Petroleum and gas basin, the reserves is more than 150 billion barrels. Today, there are many petroleum companies to exploration and developed petroleum and gas in continental shelf around South China Sea. Because there are wide and far from main land in petroleum and gas basin of South China Sea, so take the greatest cost, get bear fruit from oceanic petroleum and gas exploration. This study stress the essentials problem, that are remote sensing theory, technology, and application model for oceanic petroleum and gas exploration. The aim is provide judging by oceanic petroleum and gas exploration through research and theory analysis.

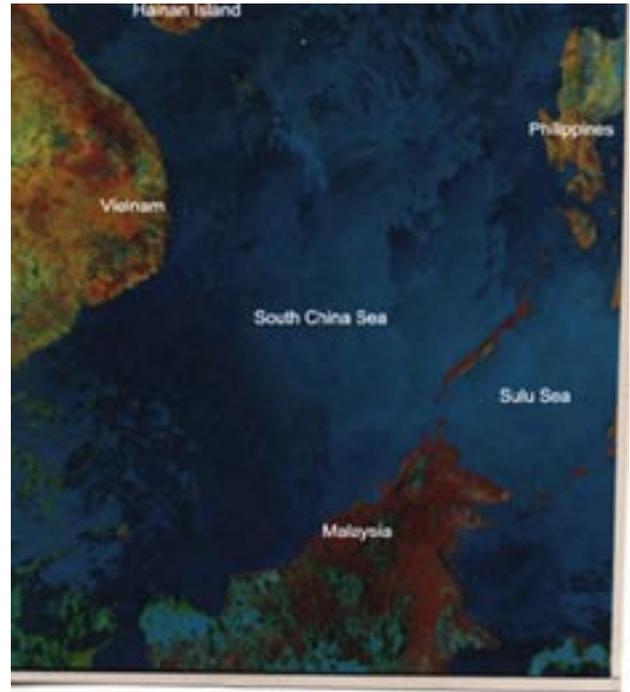


Fig. 1. NOAA-11 false color image and study area of South China Sea. Data is from NOAA-11 of 1993,3,15 to 1993,4,2. The false color image has been analysis with computer image processing system after weed cloud, atmospheric modified, and geometry rectification from NOAA-11 CH1, 2, 3, 4, 5. Red color is vegetation on land in image, yellow and green color is bear land, gray green color is cloud, light gray color is Pacific water in East South China Sea, blue gray color is India Oceanic water on West South China Sea, deep blue color is the stay long time water on middle South China Sea.

2. DATA RESEARCH AND ANALYSIS

2.1. Relationship Between Surfer Temperature and Marine Petroleum and Gas of South China Sea

This study had token NOAA-11 digit data from 1990,5,16 to 1993,3,15-4,2 on South China Sea for SST analysis with CH4, 5, after weed cloud, atmospheric modified, and geometry rectification by computer image processing system. Results display in Fig.2, 3, 4. SST model is:

$$T_s = C_1 + C_2 T_b + C_3 T_b^2$$

T_s -research temperature on sea surfer, T_b -gray value of NOAA-11 thermal band, C-correlation coefficient. Temperature error is 1 °C in low latitude area by SST model.

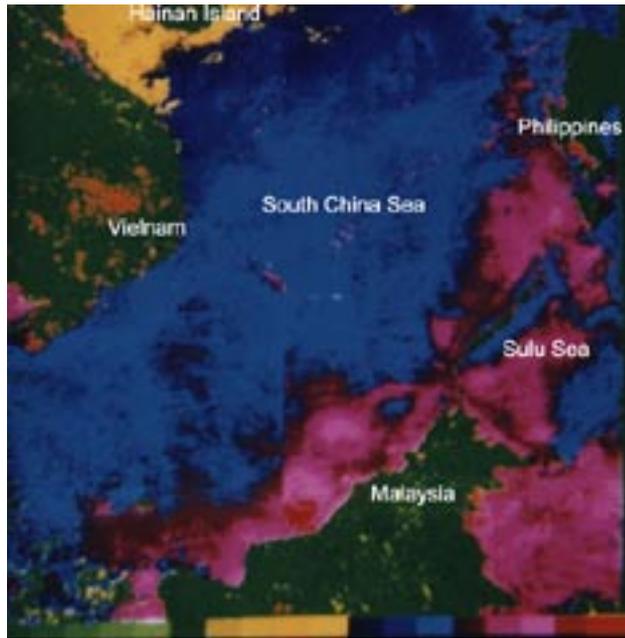


Fig.2. NOAA-11 false color image after SST analysis in South China Sea. Data is from NOAA-11 CH4,5 in 1993,3,15 to 4,2. Blue green color is 23°C. Red color is 33°C. It is 0.5°C every color hue.

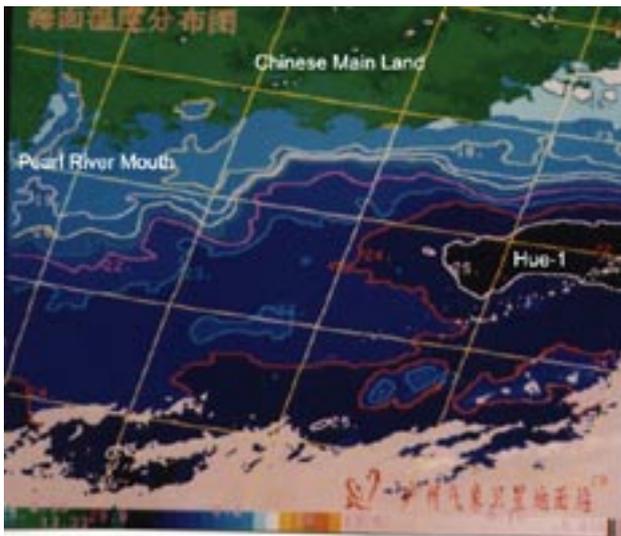


Fig.4. NOAA-11 SST analysis image in Pearl river mouth to Taiwan strait of South China Sea. Data is from NOAA-11 CH4,5 in 1990,5,30. More than 25 is Huezhou-1 petroleum and gas deposit in image. More than 24 is petroleum and gas prospect area.

2.2. Hydrocarbonphilous marine biology data research and analysis

According to trace percolation principle, there are rich hydrocarbonphilous microorganism, algae and plankton on sea water that is rich hydrocarbon. This

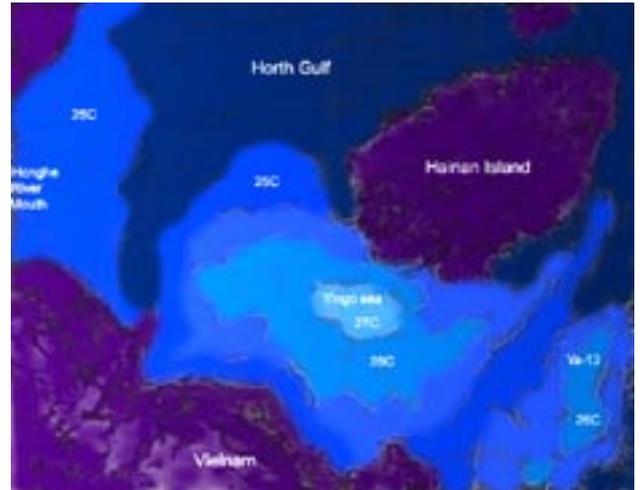


Fig.3. NOAA-11 SST analysis image in North gulf of South China Sea. Data is from NOAA-11 CH4,5 in 1990,5,16 to 5,30. More than 27°C is Yingo sea petroleum and gas deposit in image. More than 26°C is Ya-13 petroleum and gas deposit prospect area.

study made out false color image with a line stretch from NOAA-11 CH5,2,1 in 1994,4,12. Hydrocarbonphilous marine biology display special cherry red color on NOAA-11 false image different from background sea water(Fig.5,6).

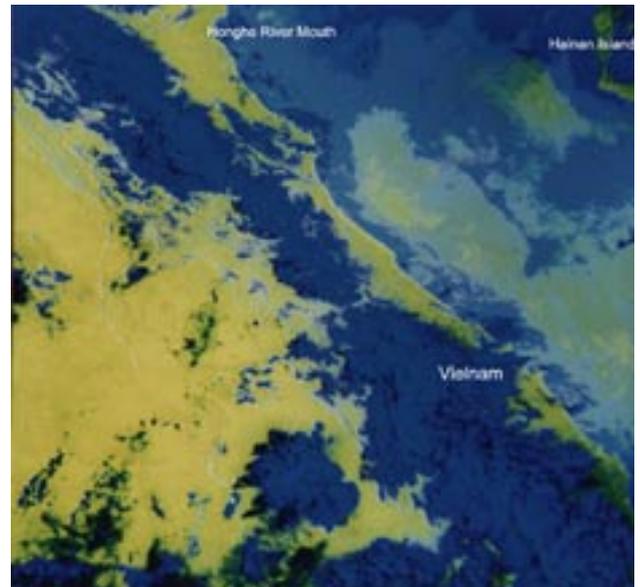


Fig.5. NOAA-11 CH5,2,1 false color image in North gulf of South China Sea from 1994,4,12. Petroleum and gas basin of Yingo sea and Honghe river mouth is displayed deep yellow color in image. Hydrocarbonphilous marine biology is displayed special cherry red color line and block.

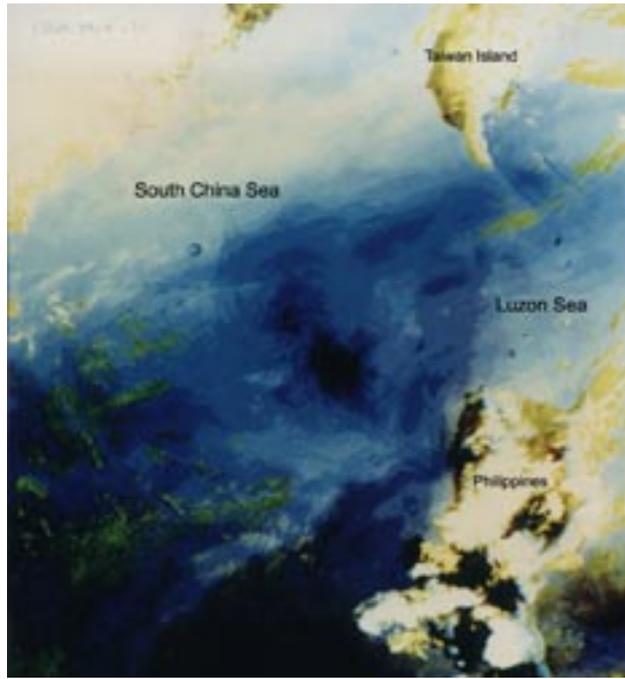


Fig.6. NOAA-11 CH5,2,1 false color image in Luzon sea from 1994,4,12. Hydrocarbonphilous marine biology is displayed special cherry red color in image.

2.3. More Factor Correlation Analysis Between Petroleum and Gas Research and NOAA-11 digit Data in Nansha sea area of South China Sea

This study select NOAA-11 CH1,4,5 gray value data, petroleum and gas research data at 17 same sample points from Nansha sea area of South China Sea in 1993,3,15-4,2 with more factor correlation analysis(Table 1). The study results at Table 2.

Table 1. Data of NOAA-11 and petroleum and gas exploration from Nansha sea area of South China Sea.

No	Longitude	Latitude	T	CH1	CH4	CH5	Gr	Ma	Th.
1.	112°20'	10°40'	26.30	6	23	21	-10	25	120
2.	113°30'	10°00'	26.50	5	23	22	30	-60	60
3.	115°30'	9°13'	26.70	4	24	24	10	-30	60
4.	112°50'	7°00'	26.90	6	22	20	30	20	60
5.	109°40'	7°30'	26.80	10	22	23	60	0	60
6.	109°40'	6°35'	26.90	9	19	18	0	-30	120
7.	110°30'	5°45'	26.20	8	20	18	30	20	90
8.	110°40'	5°35'	27.40	6	20	18	40	20	90
9.	111°25'	4°50'	27.30	7	21	19	38	-20	90
10.	109°45'	4°30'	27.20	8	23	21	30	10	120
11.	108°40'	5°40'	26.50	7	23	22	28	0	60

12.	116°30'	12°00'	26.70	6	23	21	90	-50	60
13.	116°30'	10°30'	26.60	4	24	23	-10	100	60
14.	111°10'	8°45'	27.00	6	21	19	0	-70	60
15.	111°30'	4°30'	27.30	6	20	18	30	-30	100
16.	108°35'	8°00'	27.00	7	20	17	30	-50	80
17.	112°35'	7°20'	26.00	6	22	20	20	-50	60

Note: T-temperature(°C). CH1,CH4,CH5-NOAA-11 CH1,4,5 gray value. Gr-gravity anomaly(mgal). Ma-magnetic anomaly(nT). Th-thermal current value(mw/m²).

Table 2. The results of more factor correlation analysis

Y	X1	X2	X3	X4	X5	X6	
T	CH1	CH4	CH5	Gr	Ma	Th	
°C	0-255	0-255	0-255	mgal	nT	mn/m ²	
MV	26.78	6.53	21.76	20.24	26.24	-17.35	81.76
EM	1.61	0.634	6.25	8.43	9.963	1.895	9.485
Y	1						
X1	.133	1					
X2	-.384	-.502	1				
C X3	.355	-.301	.910	1			
X4	.202	.300	-.040	-.020	1		
X5	.040	-.103	.131	.122	-.253	1	
X6	.245	.422	-.359	-.390	-.243	.085	1

Note: MV-mean square value. EM-error of mean square. C-correlation coefficient. T,CH1,4,5,Gr,Ma,and Th-same as Table 1.

3.RESULTS AND DISCUSSION

3.1.Relation between sea surface Temperature and Petroleum and Gas Basin of South China Sea

On the basis of this study, sea surface temperature is different from South to North and East to West in South China Sea. The feature is South area higher than North, East area higher than West. The sea surface temperature different value is high to 10°C from South to North and East to West of South China Sea. Study results show, sea surface temperature can direct sea petroleum and gas exploration. For example, sea surface temperature of Yingo sea petroleum and gas basin is 1-2°C higher than background (Fig.3), Pearl river mouth and Taiwan strait is 2-3°C higher than background, (Fig.4), Lilou beach of Nansha sea, South China Sea is 2°C higher than background (Fig.2).

3.2. Remote sensing study of Hydrocarbonphilous marine biology

NOAA-11 CH 2.1 false color show, there are rich hydrocarbonphilous marine biology in North gulf and Luzon sea Petroleum and gas basins, south China Sea, and special cherry red color in petroleum and gas basins different from background (Fig.5.6).

3.3. More Factor Correlation Study

Modal of more factor correlation analysis is:

$$Y=47.65+0.23X_1-0.0918X_2-0.0181X_3-0.0435X_4-0.35X_5-0.464X_6$$

The mean of Y, X_{1-6} is same as Table 2. F is 0.5911. According to study results, sea surface temperature and NOAA-11 CH 1.4.5 gray value is the best correlation with gravity, magnetic anomaly and thermal current value. The gray value of NOAA-11 CH1 is positive correlation with temperature on South China Sea surface, gravity anomaly and thermal current value; have a negative correlation with magnetic anomaly.

The gray value of NOAA-11 CH 4.5 is positive correlation with magnetic anomaly; have a negative correlation with temperature on South China Sea surface, gravity anomaly and thermal current value (Table 2).

3.4. On the basis of research results, a few petroleum and gas prospect areas have been identified rapidly, economical and accurately in Luzon sea, Honghe river mouth, Pearl river mouth, and Lilou beach i.e. areas on south China Sea.

3.5. This study results need more marine petroleum and gas exploration data to test.

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ACKNOWLEDGEMENTS:

I thank Chinese Academy of sciences, south China sea institute of Chinese Academy of and Chinese Meteorological Bureau who give me good service for my project.