DISPERSAL OF SUSPENDED SEDIMENT IN THE SOUTHWEST INSHORE OFF THE MODERN HUANGHE (YELLOW) RIVER ESTUARY

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1. INTRODUCTION

Rapid sediment accumulation has happened in Laizhou Bay for the southward dispersal and deposition of sediments off the mouth of Huanghe (Yellow River) since its mainstream was artificially diverted to Qingshuigou distributary in May 1976. Especially in the southwest nearshore area of Laizhou Bay, the seabed becomes shallow and the tidal flats become extensive, accompanying with drastic changes of seabed scour and silting. In consideration of the significant impacts of Yellow River delta evolution to the local area's agriculture and industry, studies on suspended sediment and its accumulation in the coastal sea of Laizhou Bay, especially in the southwest nearshore area are very important.

2. DATA AND METHOD

Remote sensing technique was used to estimate suspended sediment concentration (SSC) and to examine transportation and deposition in southwest nearshore area of Qingshuigou channel period of the Yellow River. Spectral radiance and reflectance above the sea surface were measured with a spectronradiometer of FieldSpec Dual made by ASD company in USA, which equipped with standard white plate of diffuse reflectance of 25%~30% and spectral ranges of 350~1050nm, from 19th to 27th June 2004 in north nearshore area of Yellow River mouth(Fig.1.a).[1] An empirical relationship between turbid waters reflectance in Landsat TM/ETM band and SSC is established through the simulation of Landsat spectral bands (visible to near infrared). General form of this model is: R=0.0082ln(S)+0.0002, where R is spectral reflectance in % extracted from band 3, and S is SSC in mg/l, correlation coefficients is 0.93.[2] 11 Landsat images of different acquisition dates were used to detect range of suspended sediment dispersed and deposited influenced by many factors in different periods at southwest nearshore area of Yellow River estuary (Tab.1). On the other hand, In-situ water samples and sea bottom sediments were obtained from north of Zimaigou River to south of Xiaoqinghe River from 20th to 30th January 2007(Fig.1.a). SSC, its grain size and bottom sediment types were analyzed respectively to understand the characteristic of sediment diffused and deposited.

Table 1 Distribution of SSC retrieved from Landsat images from different Landsat images and environment factors during the image acquired

NO.	Satellite image		Tide condition	Wind speed (m/s)	Wind direction	Sediment load (t/m^3)	River Discharge ($\times10^8 m^3$)	Orientation of deposit**	Distance (km)
	Time*	sensor							
1	1986-08-08	TM	Ebb	5	SSE	8.16	741	SSW	18.2
2	1989-11-20	TM	Ebb	4	SSE	4.48	838	SSW	21.1
3	1990-11-23	TM	Ebb	3.7	WNW	16.78	894	SW	23.5
4	1992-08-24	TM	Ebb	4.3	SSE	88.61	2020	SW	17.3
5	1994-02-19	TM	Ebb	4.2	SSE	5.2	454	SSE	32.6
6	1994-09-15	TM	Ebb	4.8	NNE	32.46	1140	SSE	18.4
7	1997-02-11	TM	Ebb	9.1	NW	0	0	SSW	8.2
8	1999-08-28	TM	Flood	5.5	SSE	5.67	156	SSW	13.6

9	2001-04-03	TM	Flood	5.3	N	0.122	63.6	SSE	35.6
10	2003-05-27	ETM	Flood	7	SE	0.027	44.3	SW	15.9
11	2004-09-10	TM	Ebb	3.2	NE	5.85	680	SSE	20.1

*June to September is high river discharge, and other is low river discharge

**starting point of direction is Zimaigou River mouth

3. RESULTS AND CONCLUSIONS

From the retrieval figures it is inferred that the zone of sharp falling of highly turbid water that is more than 3000mg/l of SSC is located about a 10~20km distance from Tianshuigou River mouth southward during high discharge period, and a 20~35km distance during low discharge period(Fig.1.b). Comparison of the variation of submarine topography from 1992 to 2000, a 15km range region of strip shape southward the Tianshuigou River mouth appeared to be eroded area, and sedimentation took place mainly from about 25km southward the Tianshuigou River mouth to near the Zimaigou River mouth(Fig.2). These zones of sedimentation and erosion corresponds roughly to the zones of sharp falling of highly turbid water (more than 3000mg/l of SSC) in the same period. Otherwise, the diffusing direction of suspended sediment gradually turned to SSE direction when it was transported along the coast, and an approximately 20 degree-angle has been formed between the coastline and a longshore drift (Fig.1.b). According to analysis in situ observation between north of Zimaigou River and Xiaoqinghe River, the distribution of near-surface SSC , the bottom sediment types and the stability of the heavy mineral all reveal that a longshore drift southward commonly exists southwest nearshore area of Laizhou Bay. Contrastive analysis on retrieval of SSC and in situ observation indicates that empirical relationship between spectral reflectance in Landsat TM/ETM band and SSC is effective for detection of transportation and deposition in southwest nearshore area of Qingshuigou channel period of the Yellow River.

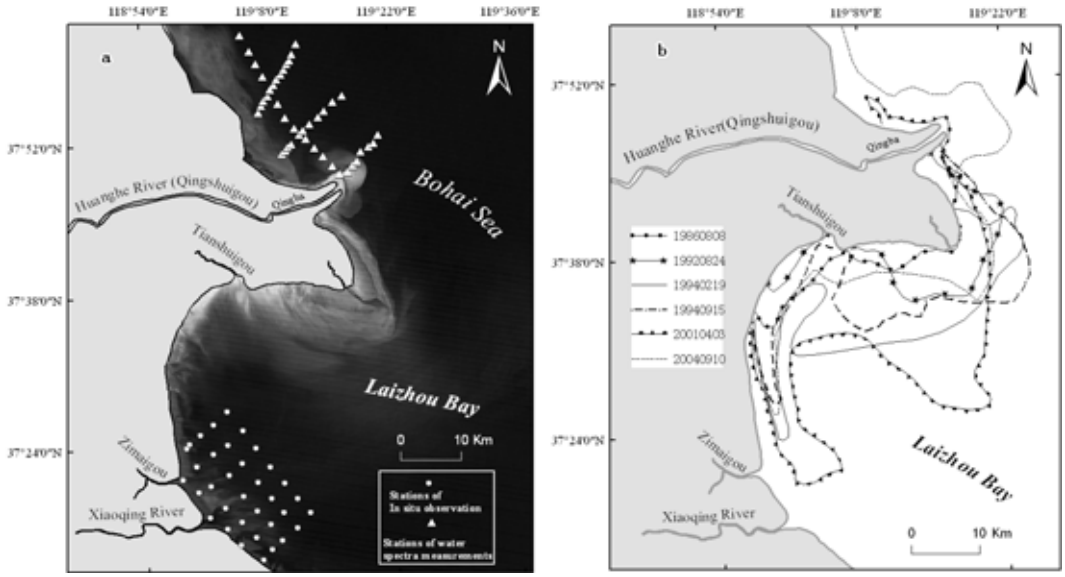

Fig.1. a) Location of observation stations in the Huanghe River Estuary and adjacent coastal waters; b) Planar distribution of SSC retrieved from LandsatTM/ETM images in southwest nearshore area of Yellow River mouth

4. REFERENCES

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