

Analysis of the Liaohe Estuary Coastline changes in the past thirty years



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ABSTRACT

Located in the south of Panjin city, Liaoning Province, the Liaohe Estuary has a famous oil and salt production base, and economy there is developing rapidly. Shuangtaizi Estuary National Nature Reserve is located here, and the contradiction between economic development and ecological protection is relatively prominent in the region. In this paper, Landsat TM/ETM data of Liaohe Estuary in 1987, 1997, 2007 and 2017 were used. The location, length and type information of Liaohe Estuary coastline were extracted with methods of visual interpretation and automatic interpretation. The model linking the coastline changes with natural, economic and social factors was established to explore the drivers of coastline change. The results showed that the coastline of Liaohe Estuary has undergone complicated changes in the past thirty years. The length of coastline in the 1980s decreased, the speed of coastline reduction have slowed by the 21st century, and the coastline has not changed significantly in recent years. Changes in the coastline have also resulted in land area changes, with a total increase of 593.61km². It is mainly the transition from natural coastline to artificial coastline, among them the muddy coastline has the largest change. The coastline changes of Liaohe Estuary were influenced by both natural and human factors. Natural factors included Liaohe Estuary evolution, storm surges. Human factors included the development of salt fields, aquaculture, port construction and urbanization construction.

INTRODUCTION

Due to changes in natural conditions such as estuary siltation, sea level rise caused by climate warming, and the impact of human activities such as reclamation, land reclamation and Marine engineering, the coastline is constantly changing. Traditional field investigation methods cost more manpower, less efficiency, longer working cycle, and the data obtained are not easy to be counted. The characteristics of large area, synchronous and high precision of satellite observation can accurately record coastline conditions and relevant ground information, and effectively overcome various limitations that may be encountered in ground survey. Its unique timeliness enables it to conduct repeated detection of the same area in a short time and realize dynamic monitoring of the coastline. The comprehensiveness and comparability of its data allow people to extract the information they need from it selectively. Accurate coastline extraction can correctly grasp the actual situation of Liaohe estuary line changes, which is of great significance for coastal zone management and development, as well as providing scientific, timely and effective information for decision-making departments.

METHODS

In order to improve the accuracy of coastline extraction and eliminate the errors caused by manual interpretation, the paper will first establish a coastline classification system and extract Liaohe Estuary coastline based on this system.

METHODS

Combined with the method of automatic interpretation complementary extraction. Liaohe Estuary coastline types are divided into two categories: artificial coastline and natural coastline.

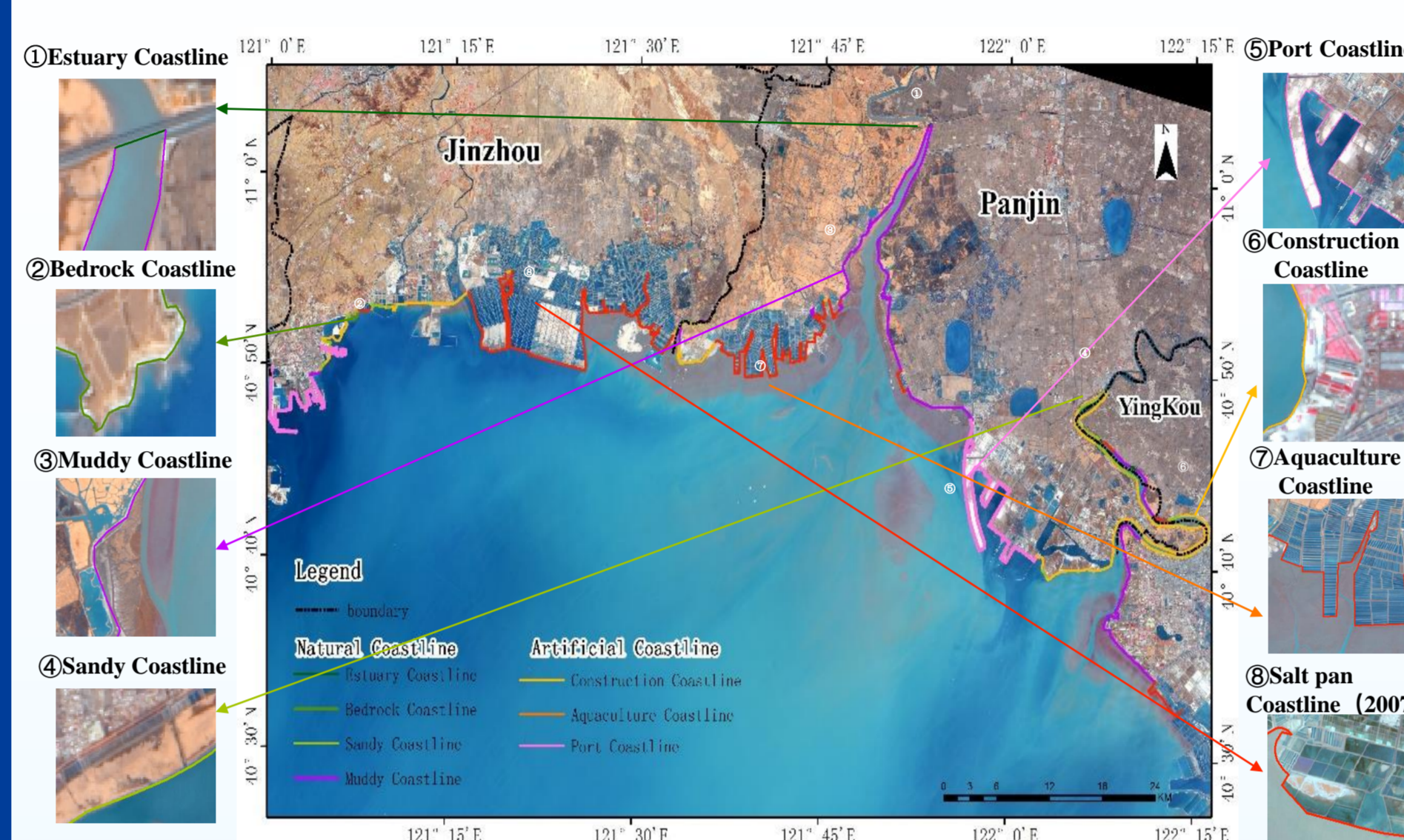


Figure 1. Classification system of Liaohe Estuary coastline

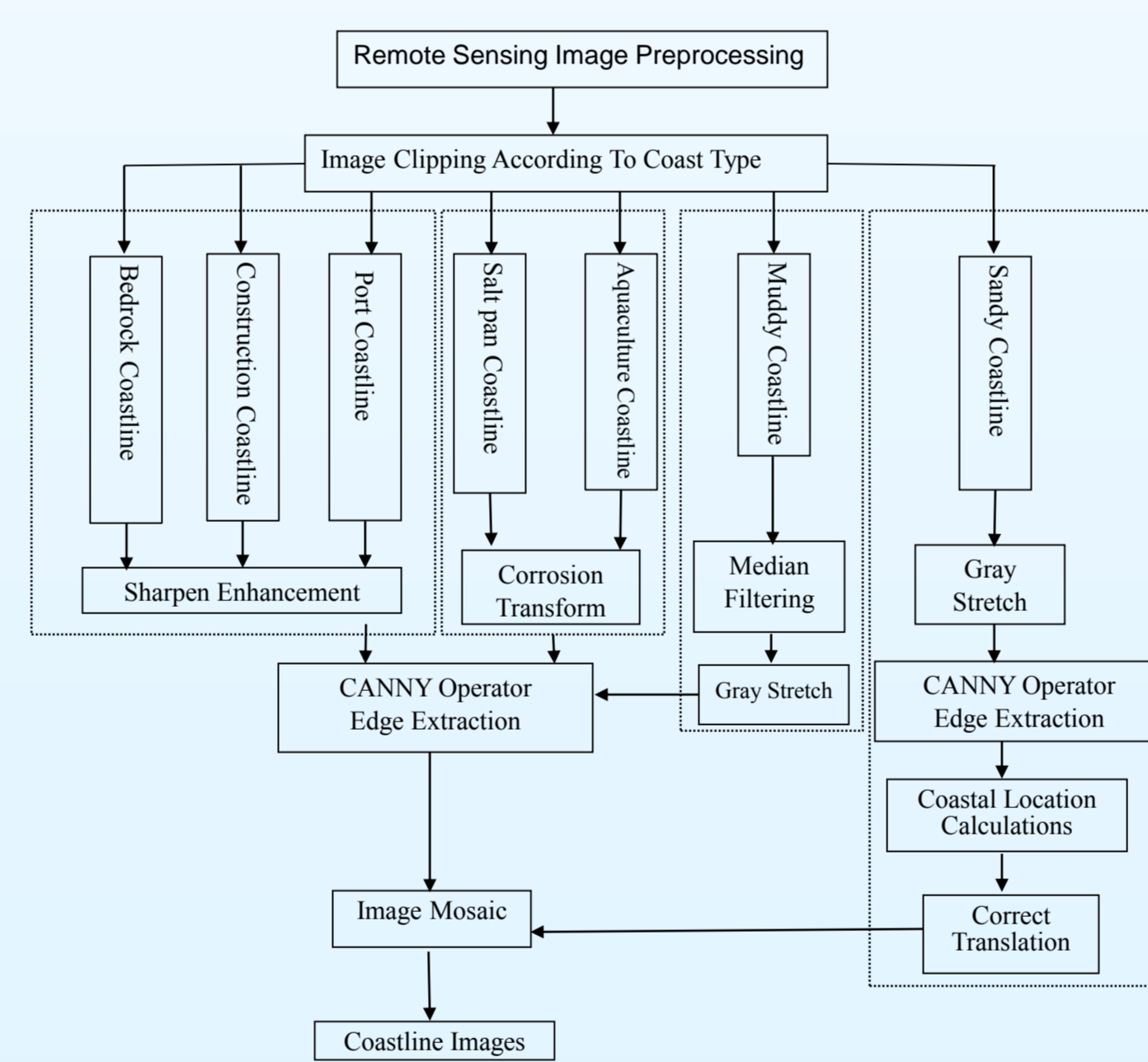


Figure 2. Automatic extraction of coastline flow chart

RESULT

It can be seen from the four phase satellite remote sensing images and the extracted results of coastlines (FIG. 2) that the coastal changes of Liaohe estuary were severe from 1987 to 2017.

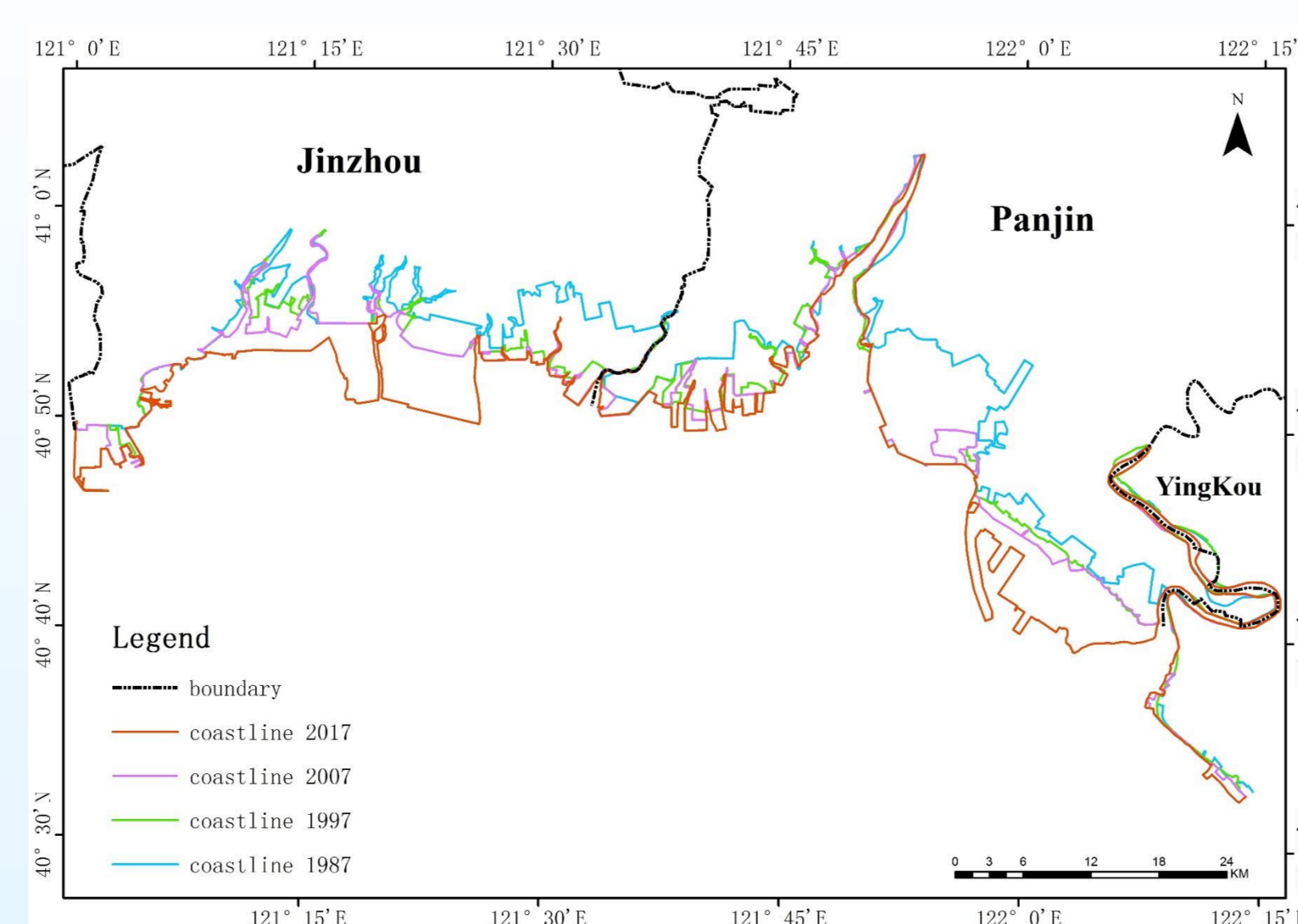


Figure 3. Coastline changes at Liaohe estuary from 1987 to 2017

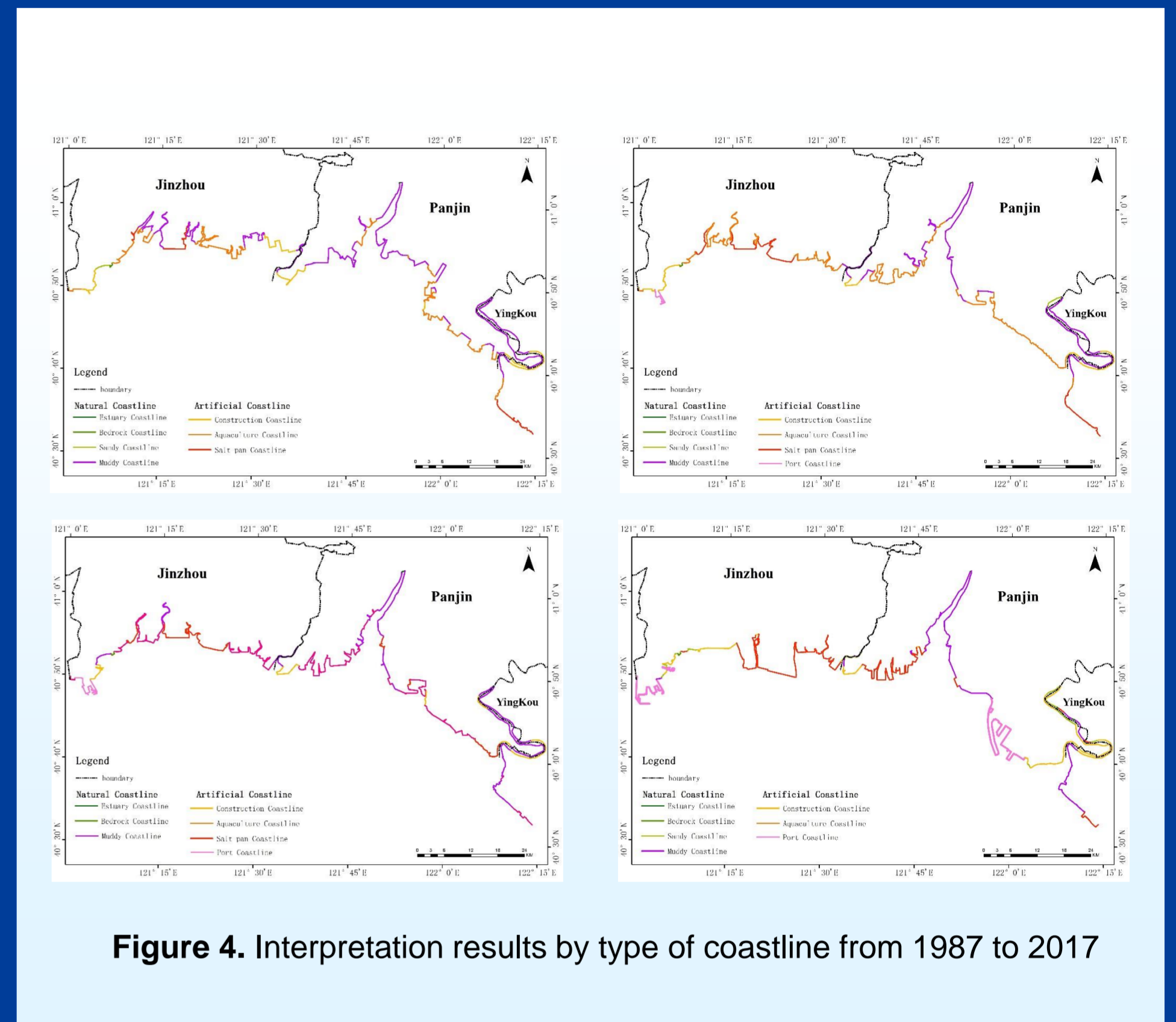


Figure 4. Interpretation results by type of coastline from 1987 to 2017

CONCLUSIONS

Table 1. Variation in length of each type of coastline(unit: km)

	Natural coastline				Artificial coastline			Total length of coastline	
	Bedrock Coastline	Estuary Coastline	Muddy Coastline	Sandy Coastline	Aquaculture Coastline	Construction Coastline	Port Coastline		Salt pan Coastline
1987a	1.66	1.03	236.83	3.26	136.37	57.72	0	32.04	468.91
1997a	1.66	1.04	155.36	3.8	179.14	36.91	9.78	53.17	440.86
2007a	1.66	1.08	154.14	0	167.73	41.9	19.14	56.89	442.54
2017a	1.66	0.69	98.43	27.33	151.23	90.97	89.88	0	460.19

Table 2. Variation of area between coastlines in different periods (unit: km²)

	Increase Area	Decrease Area	Total area change
1987a-1997a	290.41	2.77	287.64
1997a-2007a	69.83	3.12	66.71
2007a-2017a	234.46	1.06	233.4
1987a-2017a	594.7	1.09	593.61

1) During 1987a-2017a, the Liaohe Estuary coastline underwent complex changes. In the 1980s the length of the coastline declined. By the 21st century, coastline shortening will slow down, and the change in shoreline is not obvious in recent years. The change of coastline also resulted in the change of land area, and the total land area increased by 571.56km².

2) The transformation of coastline types is mainly from natural coastline to artificial coastline, of which the variation of silty coastline is the biggest. In the new century, due to the construction of Panjin port, the salt pan coastline was transformed into the port coastline. From 1987 to 1997, the silty coastline in Yingkou area was transformed into the aquaculture coastline. From 1997 to 2007, due to the vigorous development of the salt field industry, the aquaculture coastline in this area was transformed into the salt pan coastline.

3) The analysis results of the estuary and river width of Liaohe Estuary show that the estuary and river channel of Liaohe river have also changed a lot. The estuary of Shuangtaizi river has narrowed due to the large-scale cultivation and development and the construction of salt field around the sea. Shuangtaizi river channel and Daliaohe channel are mainly caused by silt siltation and aquaculture reclamation, which also leads to the partial narrowing of the river channel.

MAJOR REFERENCES

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