

Shoreline Evolution in Northern Coast of Viet Nam - A Case of Inconsistency between Sustainability of Nature and Human Beings-

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1. Introduction:

The Red River starts from Yunnan mountains in China and ends up to the sea through 11 estuaries in the northeastern side of Viet Nam. The Red River Delta, which occupies about 15,000km², has been rapidly formed by sediment transported by the Red River system. However, since the beginning of 20th century, coastal area of Hai Hau district, located in the southwestern coast of the delta, has been experienced serious erosion. This study's objective is to highlight the main reasons for this case of erosion and consider it from standpoints of both nature and human beings.

2. Long-term evolution of the Red River Delta:

Looking back to past centuries, from the 10th century the Red River Delta has continuously spread toward southeast with the average rate of about 25-30m/year (Fig.1). Although this progress is considered to be a natural phenomenon, in parallel with this shoreline advance, people also constructed levees to keep the land and protect inland areas. Haruyama (2001) showed out that sea levee had been constructed already in early 15th century, and, since then, this levee system has been moved toward the sea gradually for 500 years (Fig.2).

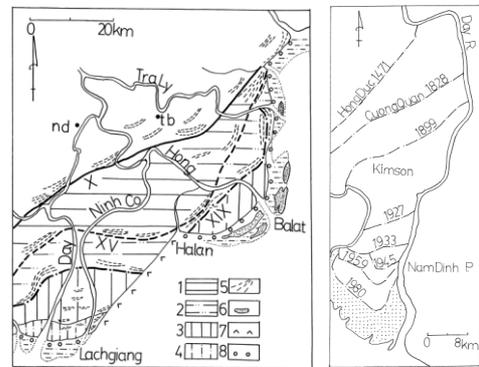


Figure-1 Longterm evolution of the Red River Delta¹⁾ Figure-2 Previous record of sea levee¹⁾

3. Modern evolution:

3.1 Satellite images analysis:

Satellite images (16 scences), taken at Hai Hau coast from 1989 to 2008, and record of observed tide data were used to investigate the modern situation of coastal evolution here. That results show the general trend of erosion (Fig 3and 4).

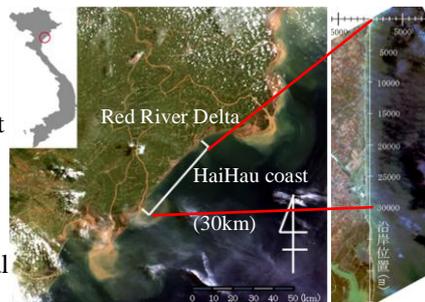


Figure-3 Study area and longshore axis

3.2 Numerical analysis :

Thus far, due to lack of observed wave data, it was difficult to understand the shoreline change. To overcome this problem, hindcast using numerical models was attempted. In this study, incident waves to the Hai Hau coast were calculated based on 20 years wave data (1989-2008) at an offshore grid point given by the European Center Medium-Range Weather Forecast. The hindcast model consists of wave model and 1-line shoreline change model. The wave model used is to calculate the plane wave field

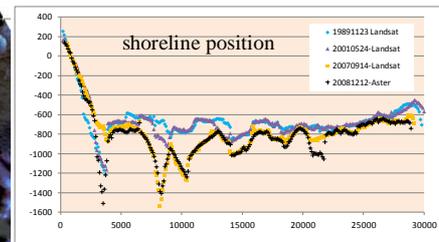


Figure-4 Shoreline change from 1989 to 2008

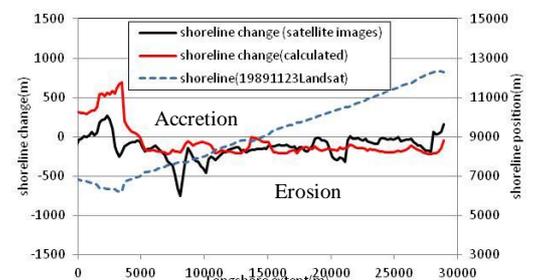


Figure-5 Reproducing calculation result of shoreline change from 1989 to 2008

Keywords: erosion, shoreline, The Red River Delta, nature, sustainability

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analysis model using energy balance equation. In the present study, we did not consider any artificial factors so that calculated results show only the natural trend of shoreline evolution at Hai Hau district for 20 years. The calculated shoreline change was compared with that from a satellite images analysis, indicating that this calculated result almost showed the similar trend of the observed one by satellite (Fig.5).

4. Impacts on local area:

In order to understand impacts of coastal erosion on local area, an interview survey to 17 residents and local government officers was conducted on September 22nd 2011, as a part of field survey in Hai Hau district. With the knowledge we obtained from study or researches, we only know the fact that erosion has been occurring at that area on some special conditions, but when we walked our footsteps to the real place and directly listened to the local residents' voice about more than all the things we studied, we could feel it not only by our brain but also by our heart. For a long time, this area had to face very high risk on water disasters and shoreline retreat. Every year, when the typhoon season comes, they have to live in the readiness to evacuate. Due to that instability of life, residents living in coastal area of Hai Hau district could not have a happy life. Coastal area of Hai Hau district is the one of the areas with lowest human develop index in Nam Dinh province. The main reasons are supposed to be the instability of life and under-developing economy. Traditional economy depends mainly on fishery, agriculture and mostly salt-field. In other words, local residents's life deeply relied on the sea. They used the sea for their livelihood but the sea has been always containing the biggest risk for their life.

4. Discussions:

Previous researches have tried to highlight the main causes of erosion at this coastal area and also showed out some hypotheses. Certainly, people's economic activities which resulted in river cut-off, deforestation and dams construction, contributed to a higher erosion rate, but are not main causes because erosion already started several decades earlier. In the other words, the natural mechanism is supposed to be the biggest reason for this case of erosion, although it is accelerated by human activities. Both simulated result of this study and the previous study of Haglund & Svensson (2002) pointed out that constant northward and southward longshore currents during several consecutive months transport beach material away from the eroded area and result in a great loss of sediment. And, they originated in the natural properties of this coastal area (for example low-lying coastal land area and constant wind directions).

5. Conclusions:

According to the previous record, the current area of Hai Hau coast had been a part of the sea. In the period from 1430 to 1440, predecessors had constructed a new levee in the sea so that this area was formed gradually by accretion. Hence, the name Hai Hau, which means 'behind the sea', was given to this new land. It is supposed to be natural that a place originally belonged to the sea is now being taken back. However, since people has been living there for 500 years and unconsciously considered it their land, they think it is an 'abnormal' phenomenon. This case of coastal erosion must be a part of sustainable nature, but now turned out to prevent the so-called 'sustainability of human beings'. We can't negotiate with nature and we also do not have the right to ask local residents to give up their life there. Certainly, hard strategies, such as sea levee, wave-dissipating blocks, jetties,.. should be reinforced and constructed to slow down the progress of erosion. Besides, improving residents's understanding of natural phenomenon, history of their land, along with flexibility of coastal zone planning and management should be considered.

Acknowledgements

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