

Flood in the Mekong Delta

Flood and saline intrusion



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1. Saline intrusion

The water related natural disasters in the Mekong Delta can be divided into "flood (or submergence)" and "saline intrusion" roughly. The word, "flood" means a phenomenon that excess river waters originated from upper stream submerge the area of inner dike in general. However under the condition of the strong tidal influence toward inland rivers and canals like the Mekong Delta, the flood tide also could cause a flood. Therefore both of flood waters from fresh water basin and saline intrusion make the same output of "flood" to the society, whereas the mechanism of each natural phenomenon are completely different. As an essential major premise, the saline intrusion is very characteristic and important

phenomenon to understand the natural status in the Mekong Delta. The following figure from a material¹⁾ shows the range of saline intrusion. The coastal sea of the Mekong Delta, the South China Sea, is well known with its large tidal difference in seawater level, and the differential exceeds 4.0m in maximum. Under the condition that the most area of the Mekong Delta has only several meter in the height above the sea level, this large tidal movement has great influence to inland area, especially in the rainy season when the river waters from upper stream also increase. While the change of water level due to tidal movement extend to Kompong Cham in Cambodia which is located at the upper 410km point from the sea along the main rivers, the intrusion of seawater itself can reach about 60km far from the sea²⁾. In the meantime, Thailand Bay that face to the west coast of the Mekong Delta has only less than 2.0m in its tidal differential, therefore, the waters from the South

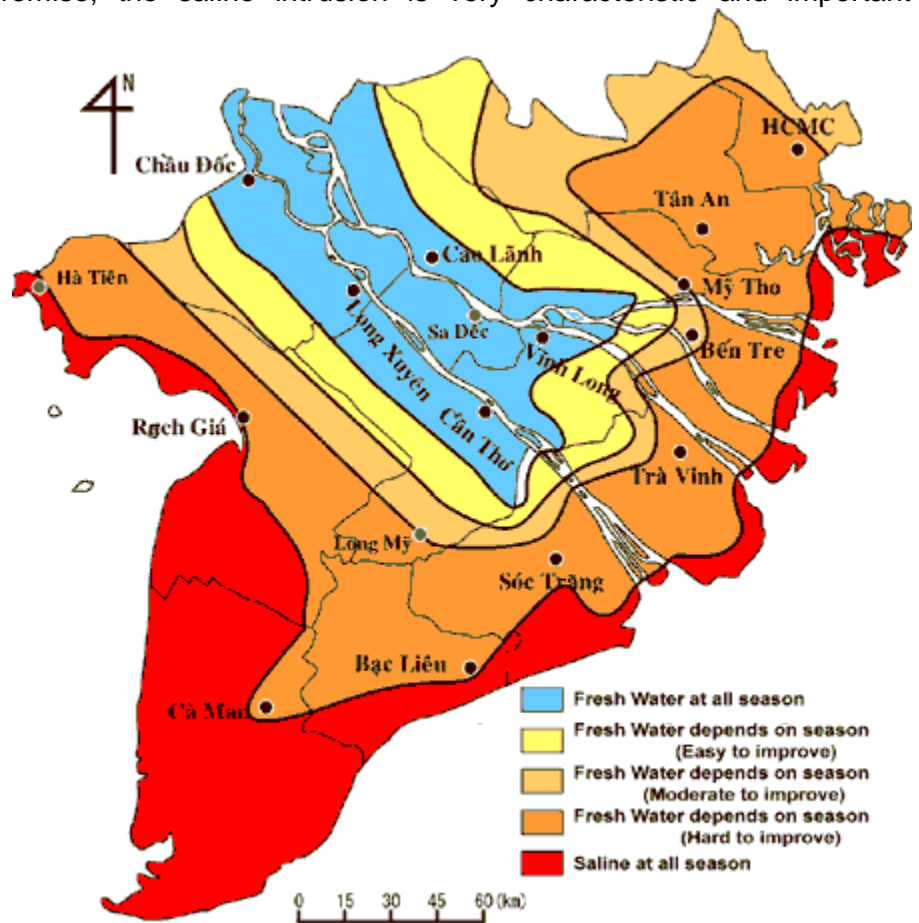


Fig. Status of saline intrusion in Mekong Delta

China Sea through the rivers and inland canals easily flow into Thailand Bay (from a specialist in irrigation teaching at a collage in Can Tho City). Moreover, by the results from a tidal table of this area in 1986³⁾, Phu An in Ho Chi Minh City which faces to the South China Sea recorded 3.7m in maximum differential in a year (maximum sealevel of 4.8m, minimum of 1.1m), while Ha Tien observatory shows only 1.4m in annual maximum differential (maximum sealevel of 1.7m, minimum of 0.3m).

At the above figure, the area intruded by seawater all the year around is the coastal edge from the estuary of Dong Nai River (Can Gio District which is well known as a UNESCO's natural reserved are) to Ha Tien near the Cambodian border. Particularly in the Ca Mau peninsular, the area over 30km from the coastal line are influenced with saline, and it is very hard to produce agricultural crops. Meanwhile, the three inner belts are seasonally intruded by saline, and each degrees depends on the distance from upper side or main streams. It is clear that the upper zone shows lower saline concentration and shorter period of intrusion than the lower or oastal zone. In the original reference, writer uses a Vietnamese word which correspond to "improve" in English as an indicator to classify the delta into this three outer zone, and it might represent the possibility of land improvement for the farming in the Mekong Delta. The last one, which enclose both the upper area from Vinh Long Province and Can Tho Province and the area within about 15km from the main streams, is the area which can be provided freshwater all the year around. This area is the most favorable land for agriculture on the point of water resources, and the major problem of Acid-sulfate soil is not so sever due to continuous sedimentation from upper freshwater basin.

The next figure¹⁾ shows several equivalent lines of saline concentration per a liter. The lines in another material published in 1974, which is quoted in Mr. Hori's book²⁾, are drawn at nearer side to the sea, and this material also describes that the density turns lower, as the discharge of the Mekong River become larger. That is to say, riverine freshwater and mrine saline make a front-line at the inland of the Mekong Delta. According to Mr. Hori, the latitudes of saline concentration for irrigation rice crop are 1-2g/liter at planting season, 5-6g/liter at growth period, and 4g/liter and less at before harvest. Therefore, it is easy to assume that the saline condition in the Mekong Delta is not so advantageous. The water volume at each mouth of tributary is very different each other, therefore, the distance of saline intrusion at each tributary also shows variations. The distance from the sea which shows the saline concentration of 1.0g/liter

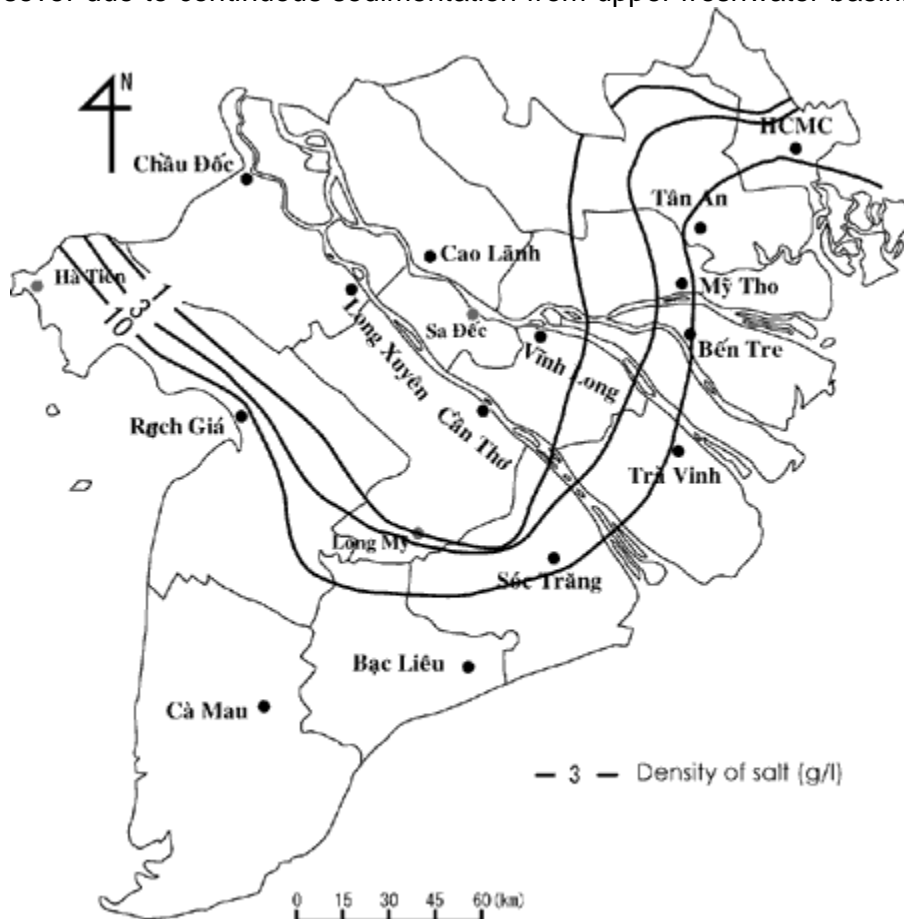


Fig. Density of salinity in surface water in Mekong Delta

is generally defined as 30km at the Hau River, 70km at the My Tho River and the Ba Lai River, 60km at the Co Chien River and 65km at the Ham Luong River¹⁾. These variations at each tributary are also shown in the right-hand figure. This situation represents a tendency in the dry season when the tributaries

are vulnerable to be intruded by saline. In the rainy season, on the other hand, the front-line of fresh water and saline at each tributary is pushed down to the upper about 15km point from the coastal line²⁾. In addition, at the vicinity of Ho Chi Minh City, surface water also include high salt in itself.

On the viewpoint of agricultural production, even in the area which is traversed by the line of 10g/l in above figure like My Tho or Ben Tre, relatively matured irrigation system has enabled local residents to harvest rice crop twice in a year at least. It is too difficult to prevent saline intrusion completely under the condition that numerous rivers and canals connect to the sea like the Mekong Delta, while some delta regions in developed countries like the Mississippi Delta in U.S are well managed with perfect dikes and providing appropriate amount of sedimentation to the back marsh.

2. Floods and inundations in the Mekong Delta

The flood in the Mekong Delta occurs during the rainy season, from May to December, and its peak is in September or October. This natural event is annual one, and its phenomenon is quite different from the flood whose response against the rainfall is very fast like flash in a mountainous area. Vietnamese language approximately has two words, "lu" and "lut", to express the flood. First one, The word "lu" originally means a status of beeing risen water level in a river, while "lut" indicates damages due to the inundation⁴⁾. Generally, Vietnamese called a flood "lu lut". And in the Mekong Delta, the mechanism of flood generation is different like the next table.

The classification of flood in the Mekong Delta

Classification	Generation area	Cause	Main damages
Riverine	Upper main rivers	A rise in river water level	Lives, Houses, Crops
Tidal	Lower rivers and coast	Flood tide	Crops, Salinization
Inland	Whole area	A rise in river water level	Houses, Hygiene
Urban	City	Asphalting, Downpour	Houses, Hygiene

(1) The Riverine Flood

The most dangerous form of the flood in the Mekong Delta on the point of the amount of damage and human life, especially for children and old age, is the riverine flood due to high water originated from up-stream. Generally, some rainfall in a watershed is the chief premise fot the generation of flood. However, as far as the Mekong Delta concerned, it is not able to forecast the output, the flow or water level, from the rainfall as the input, because the Mekong River's basin is too long to formulate. In addition, in the rainy season, some flood water flows into Great Lake, or Tonlesap Lake in Cambodia after running back through the Tonlesap River, and others flows into Dong Thap Province, Viet Nam, directly after overflowed in Cambodian territory. And moreover, some multi-purpose large dams, including a very new dam in China, had already been started operating. Thus, the water flow along the Mekong River is quite confusing. In the case of severe flood in 1966, the day of peak water at My Thuan, Vinh Long Province, Viet Nam, are delayed almost one month against the peak-recorded day at Luang Prabng, Laos, which located at about 2,100km upper point to the South China Sea. This case also shows the cmplexity of water flow along the Mekong River.

It is crucial to understand the movement of flood water from Cambodia to the Mekong Delta in Viet Nam before discussing the flood in the Mekong Delta. The picture here, the flood area within Mekong Delta - Cambodian plain, originated from a UN's document(1966) introduced by Mr. Hori on his book²). The source might be somewhat old and doesn't include the biggest flood in 1966, however, the picture still describes the route of flood water from Cambodian plain to the Mekong Delta in Viet Nam.

After running through Sambor rapid at Cambodia, the Mekong River begins flooding at Kampong Cham to both side of the river. Overflow to the left bank flows into the basin of Vam Co Dong and Vam Co Tay, after passing through own basin. The narrow areas between Vam Co Dong and Vam Co Tay are old alluvial terrace. These area are relatively high and can escape from inundation (two white part enclosed by blue inundation area on the map). Some of the flood water also flow into the basin of Saigon River (or Dong Nai River), therefore, the concept or definition of Mekon's basin is very obscure in and around the Mekong Delta, especially in the rainy season. And a huge wetland at Dong Thap Province (Plane de John / Plane of reed) has very unique role in such inundation. Such flood water ignores river and spreads by low land or canals in the Mekong Delta.

Meanwhile, flood water overflowing to right bank at Kampong Cham runs back along the Tonle Sap River to Lake Tonle Sap, or the Great Lake which performs as a natural flood control basin of the Mekong Delta. The role of flood water control by the lake against the flow of the Mekong Delta is quite important to figure out the hydrology of the Mekong Delta.

+++ Lake Tonle Sap (Great Lake) +++

Lake Tonle Sap is the source of Tonle Sap River which runs through Phnom Penh. This huge lake was under the sea when Indo-China region are suffered from sea intrusion in the Recent period (approximately 5,000-6,000 years ago). Therefore the inundation area on the preceding map was also under the sea in this period. From June, beginning of the rainy season in the Mekong Delta, river water begins to run back along the Tonle Sap River, as the water level increases in the Mekong River. And then, the water flow returns to regular direction, from Lake Tonle Sap to the Mekong Delta, during the dry season.

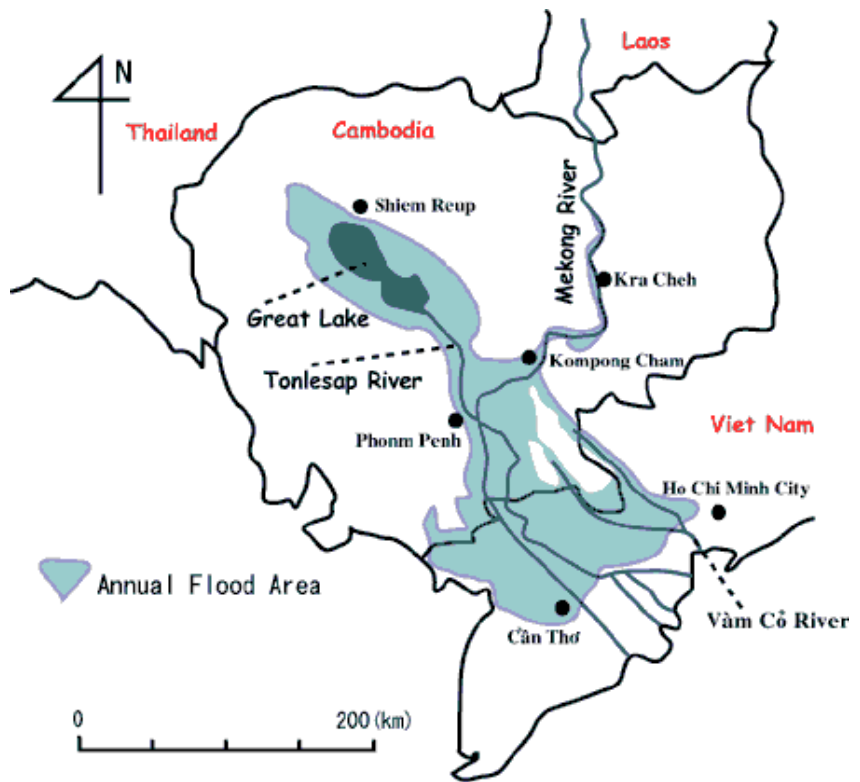


Fig. An image of flood area of Cambodia - Mekong Delta



Great Lake near Siem Reup, 2001

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Web site: Mekong Delta in Viet Nam (<http://cantho.cool.ne.jp>)