

### Hydrological impacts of full-dyke system in flood-prone rice granary areas in the Mekong Delta

Mekong Delta is the rice granary area which produces 90% of exporting rice of Vietnam which is the world's second largest rice exporter. It is feared as one of the mega deltas strongly affected by the most risk from climate change. The objective of the study is to clarify the effect of full-dyke systems constructed for triple rice cropping in flood-prone rice area in the Mekong Delta on hydrological environment in the region through interviews with government agencies and residents, the analysis of river water level and satellite image and to provide a basic knowledge for sustainable rice cultivation to cope with the increasing flood risk under climate change.

Two types of dyke systems are constructed to reduce vulnerability in high-flood areas adjacent to the Cambodian border in the Mekong delta: a high embankment called "full-dyke", which completely prevents farmland from flooding (August – November) ; and a low embankment called "semi-dyke", which prevents flooding up to harvest period (August) of spring-summer rice but allows flood inflow after harvest (Fig.1). Triple rice cropping is feasible in the farmlands enclosed by full-dykes, as rice can grow even in the peak flood season from September to October. In response to farmers' request, the Vietnamese government has promoted construction of full-dykes, hence the areas with full-dyke systems expanded rapidly in the past 10 years especially in An Giang Province (Fig.2).

The comparison of MODIS Terra images between flood in 2011 with 10 years of return period when full-dyke has widely spread in the study area and flood in 2000 with 60 years of return period when full-dyke has constructed only a little. Both inundated area and flooding period are shown larger in 2011 flood than those in 2000 in Kien Giang province located in the west side downstream of An Giang Province (point A) and in Cambodia border located in the upstream of full-dyke area (point B), (Fig. 3). Three points in Fig. 3 were selected for verification, (a) the point with significantly prolonged inundation, (b) with slightly prolonged and (c) the point with little change of inundation and carried out interview survey to the farmers. The result shows farmers view for the changes on flooding period have a good accordance with the results of the satellite images. The water level at CanTho station in Hau River one of main-streams in the Mekong River in recent years shows rising trend from the water level analysis. Comparing the relationship of annual maximum water level between CanTho and ChauDoc from 1979 to 2011 separating into two groups before 2004 and after 2005, the rising trend of water level after 2005 was observed in CanTho compared with the water level before 2004 (Fig. 4).

The research output will be utilized for the study on adaptation measures in the mega deltas with progressive flood risk and also useful as the validation data for hydro-hydraulic model in flood inundation area caused by the expansion of full-dyke system in the Mekong Delta. We should take note land subsidence in urban areas and sea level rise due to global warming also the major causes of water level rise in CanTho, more detailed investigation is required to separate the impact of full-dike systems.



Fig.1 Semi-dyke and Full-dyke (Up: Both sides are semi-dyke area, Middle : Left; Semi-dyke area, Right: Full-dyke area Down : Both sides are full-dyke area)

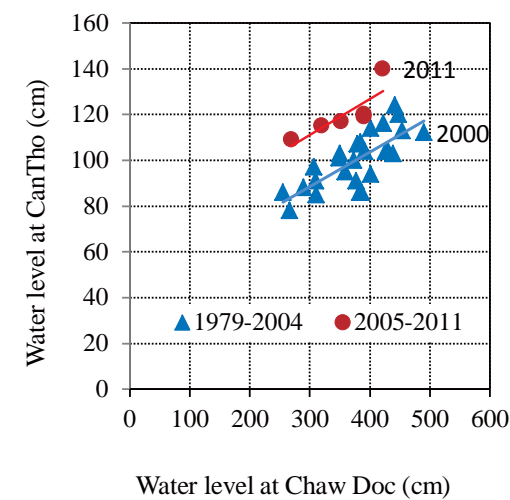


Fig.4 Relationship of yearly maximum water level at ChauDoc and CanTho (2007: missing data)

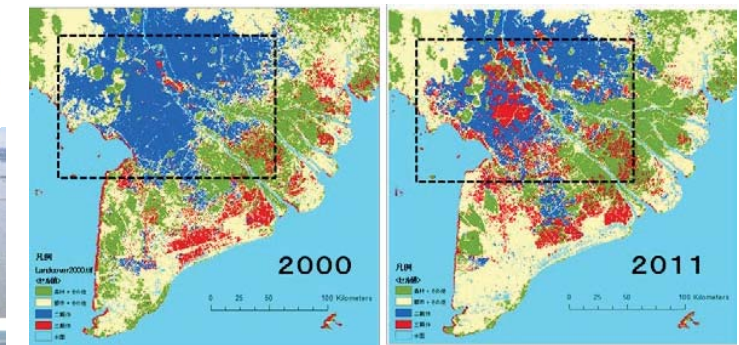


Fig.2 Increase in triple rice cropping in the flood-prone area (dashed line shows the area of Fig.3) Blue : double cropping, Red : Triple cropping, Green : Forest and others

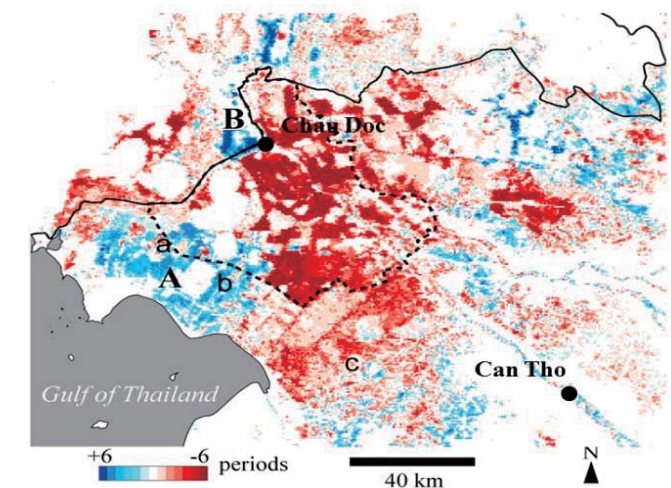


Fig.3 Comparison of inundation duration between 2000 and 2011 flood evaluated by NDWI of MODIS. (Dashed line shows the border of An Giang Province and solid line shows Vietnam and Cambodia border. Blue: inundation period in 2011 is longer than that in 2000; Red: 2011 is shorter than 2000; White: little difference between two years. Prolonged inundation is observed, such as Cambodia (B point) located upstream of An Giang Province and Kien Giang Province (A point) located in the west side of An Giang Province. a, b, c shows verification points. a: prolonged much, b: slightly prolonged, c: not so much change.

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