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Impacts of dyke development in flood prone areas in the Vietnamese Mekong Delta to downstream flood hazard

Van Khanh Triet Nguyen (1,2), Viet Dung Nguyen (1,2), Hideto Fujii (3), Matti Kummu (4), Bruno Merz (1), and Heiko Apel (1)

(1) GFZ German Research Center for Geoscience, Section 5.4 - Hydrology, Potsdam, Germany (triet@gfz-potsdam.de), (2) SIWRR Southern Institute of Water Resources Research, Ho Chi Minh City, Vietnam, (3) Environmental Science and Technology for Water and Land Use, Yamagata University, Japan, (4) WDRG Water & Development Research Group, Aalto University, Finland

The Vietnamese Mekong Delta (VMD) plays an important role in food security and socio-economic development of the country. Being a low-lying coastal region, the VMD is particularly susceptible to both riverine and tidal floods, which provide, on (the) one hand, the basis for the rich agricultural production and the livelihood of the people, but on the other hand pose a considerable hazard depending on the severity of the floods. But despite of potentially hazardous flood, the area remain active as a rice granary due to its nutrient-rich soils and sediment input, and dense waterways, canals and the long standing experience of the population living with floods. In response to both farmers' requests and governmental plans, the construction of flood protection infrastructure in the delta progressed rapidly in the last twenty years, notably at areas prone to deep flooding, i.e. the Plain of Reeds (PoR) and Long Xuyen Quadrangle (LXQ). Triple rice cropping becomes possible in farmlands enclosed by "full-dykes", i.e. dykes strong and high enough to prevent flooding of the flood plains for most of the floods. In these protected flood plains rice can be grown even during the peak flood period (September to November). However, little is known about the possibly (and already alleged) negative impacts of this fully flood protection measure to downstream areas.

This study aims at quantifying how the flood regime in the lower part of the VMD (e.g. Can Tho, My Thuan, ...) has been changed in the last 2 recent "big flood" events of 2000 and 2011 due to the construction of the full-dyke system in the upper part. First, an evaluation of 35 years of daily water level data was performed in order to detect trends at key gauging stations: Kratie: upper boundary of the Delta, Tan Chau and Chau Doc: areas with full-dyke construction, Can Tho and My Thuan: downstream. Results from the Mann-Kendall (MK) test show a decreasing trend of the annual maximum water level at 3 stations Kratie, Tan Chau and Chau Doc. The MK test statistic results (Z) for these stations are -0.23, -1.39 and -0.84 respectively. In contrary, significant increasing trend (at α = 1%) of annual flood peak at Can Tho and My Thuan is calculated, with the Z value are 5.20 and 4.28. A Monte Carlo experiment by adding assumed observation errors of 5%, 10% and 15% results in similar trend for these stations.

After the trend analysis, a set of scenarios are generated based on various hydrological boundaries, infrastructure developments and climate change scenarios. The scenarios are simulated with the quasi-2D hydrodynamic model for the Mekong Delta (Dung, 2011; Manh, 2014) in order to separate and quantify the impacts of flood protection measures to the flood regime in the lower part of the delta in a spatially explicit manner, with a special focus on the urban and economic centers Can Tho and My Thuan. Based on these scenarios the change in flood hazard caused by the infrastructure development that has to be expected is described and possible mitigation actions are proposed.