

## DISSERTATION INFORMATION

- **Research Title:** ASSESSMENT OF SURFACE WATER RESOURCE CHANGES AND DROUGHT IMPACTS ON RICE PRODUCTION IN THE MEKONG DELTA
- Field of Study: Water Resource Engineering
- Code: 9580212
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### ABSTRACT

Over the past 30 years, the Mekong Delta (MD) region has frequently experienced fluctuations in surface water resources (SWR), drought, saltwater intrusion, climate change, ENSO events and sea level rise. These environmental changes have a profound effect on numerous socio-economic activities, especially rice production (RP). These impacts on RP cause rice yield fluctuations, increasing the vulnerability of people's livelihoods in rural MD areas. Therefore, this research aims to: comprehensively evaluate changes in SWR factors, drought and their impacts on rice production in the Mekong Delta; then propose effective solutions to mitigate, adapt to fluctuations in these factors. The key findings of the thesis are summarized as follows:

- To assess fluctuations in SWR and rainfall trends, the thesis has selected and developed trend-based statistical analysis tools to improve trend analysis (ITA) and improved the polygon trend analysis (IPTA) tailored for the MD region. With these introduced and improved tools, the detection of daily water levels (DWL) and rainfall trends is more effective compared to other methods such as the Mann-Kendall method. In addition, ITA can now evaluate the trends of 3 data series DWL clusters. Furthermore, this thesis combines the Pettitt method to determine change points with testing with the historical timeline of natural

fluctuating events and socio-economic development in the research area has identified the appropriate causes of these fluctuations.

- The results of statistical analysis of SWR, it can be seen that the MD is facing significant fluctuations in SWR after 2009. These factors caused freshwater shortages, early saline peaks, and increased saline intrusion in the Tien and Hau River mouth areas during the dry season.
- To evaluate drought changes, the thesis employed IPTA to show that climate change has caused the monthly rainfall trend to decrease in April which has caused more drought. The study also shows that the SPEI-4 index result points out that there has been an increase in frequency, intensity, and spatial distribution of meteorological droughts in the dry season in recent years in the MD, closely associated with El Niño and climate change.
- Regarding the correlation between SWR factors and drought affecting rice production, by using the main factor regression correlation analysis method and survey method, the thesis has shown that the drought factor has the most impact on Winter-Spring (WS) rice yield, followed by SWR factors. In addition, to assess the impact on farming households' livelihoods, survey data of farmers producing three crops in flooded areas in recent years with indexes of components affecting livelihood vulnerability (LVI) have been analyzed, the results show that farm household livelihoods are most vulnerable by climate change and natural disasters that have created fluctuations in SWR factors and drought.
- Another novel finding of the thesis is to build regression models of rice yield with factors of SWR and drought, which has helped to quantitatively evaluate the effectiveness of increasing rice productivity of the non-structural solution. Specifically, for WS yield in An Giang province, it can be now determined according to the equation (3.1) and for WS yield in Ben Tre province, the proposed equation (3.2).
- For unstructured solution, farmers need to diversify their crops and adjust their planting seasons in harmony with natural conditions in areas currently practicing monoculture with rice.... For structural solutions, the dissertation simulated operational scenarios of mobile dam thresholds at Can Tho and My Thuan. The results show that the dams effectively raised water levels in the upper MD.

In summary, this thesis enhances the strategic knowledge of SWR planning management and supports the development of sustainable RP activities in the MD region, in line with natural conditions.