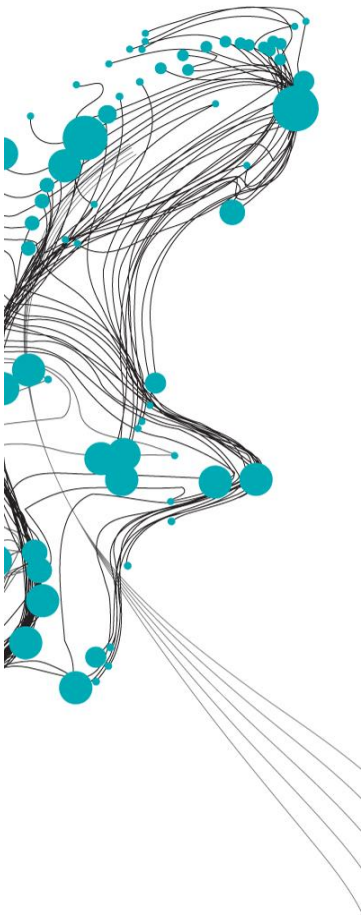
COINCIDENCE OF STORM SURGES AND RIVER DISCHARGES DUE TO TYPHOONS IN THE PAMPANGA DELTA



The Pampanga delta (Philippines) is due to its geographical location prone to typhoons which can result in extreme discharges and storm surges in Manila Bay. So far in most flood risk studies, river discharges and storm surges have been considered independent, but if there would exist dependence between storm surges and river discharges, this might have a significant influence on design levels and expected inundations.

In this study, the importance of taking into account the coincidence of storm surges and discharges in exposure and risk studies in the Pampanga delta has been explored. This research shows that there is an average time lag of 36 hours between the occurrence of storm surge and discharge peaks in the Pampanga delta. It was also shown that there is an increased probability of joint occurrence of extreme discharges and extreme storm surges in comparison with the independent probability.

The effect of the joint occurrence of extreme storm surges and extreme discharges on the flood extent is investigated using inundation maps of hypothetical scenarios with different combinations of storm surge, tide and discharge. With these scenarios, the importance of storm surges, river discharges, tides and the timing of those components relative to each other were investigated. Inundations were simulated by the hydrodynamic model Delft3D-FLOW. The forcing data used in Delft3D-FLOW consists of river discharges, which were simulated based on the hydrological wflow model, and wind and pressure fields that are derived from historical typhoon tracks.

The results of the simulations in Delft3D-FLOW show that the inundation extent and depth are dominated by the river discharge. But neglecting the joint occurrence of storm surges and high discharges results in an underestimation of the inundations over a large area. Furthermore, the results show that the timing of the tide with respect to the storm surge has a significant influence on the inundation depth over a large area in the Pampanga delta.

In exposure and risk studies in the Pampanga delta, it is therefore recommended to take into account the joint occurrence of storm surges, discharge peaks and high tides. To mitigate flooding, it is recommended to explore measures that increase the time lag between the storm surge and discharge peaks and that cut-off the discharge peaks itself. For longtime planning, it is also highly recommended to take into account the extraordinary land subsidence and sea level rise in exposure and risk studies in the surroundings of Manila Bay.

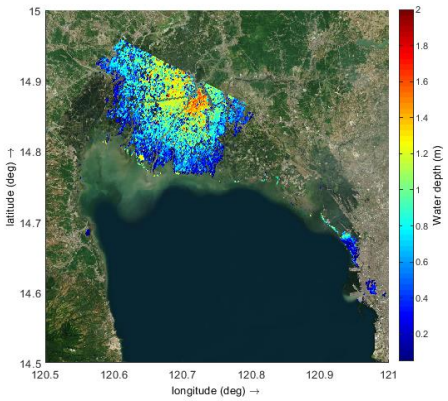


Figure 1 Simulated inundations due to the joint occurrence of storm surge, river discharge and high tide.

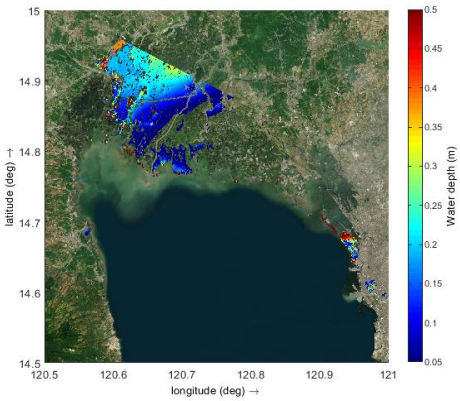


Figure 2 Underestimation of the simulated inundations when the storm surge is excluded.

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