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Climate change impacts in Zhuoshui watershed, Taiwan

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There are 5.3 typhoons hit Taiwan per year on average in last decade. Typhoon Morakot in 2009, the most severe typhoon, causes huge damage in Taiwan, including 677 casualty and roughly NT$ 110 billion ($3.3 billion USD) in economic loss. Some researches documented that typhoon frequency will decrease but increase in intensity in western North Pacific region. It is usually preferred to use high resolution dynamical model to get better projection of extreme events; because coarse resolution models cannot simulate intense extreme events. Under that consideration, dynamical downscaling climate data was chosen to describe typhoon satisfactorily.

One of the aims for Taiwan Climate Change Projection and Information Platform (TCCIP) is to demonstrate the linkage between climate change data and watershed impact models. The purpose is to understand relative disasters induced by extreme rainfall (typhoons) under climate change in watersheds including landslides, debris flows, channel erosion and deposition, floods, and economic loss.

The study applied dynamic downscaling approach to release climate change projected typhoon events under RCP 8.5, the worst-case scenario. The Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability (TRIGRS) and FLO-2D models, then, were used to simulate hillslope disaster impacts in the upstream of Zhuoshui River. CCHE1D model was used to elevate the sediment erosion or deposition in channel. FVCOM model was used to asses a flood impact in urban area in the downstream. Finally, whole potential loss associate with these typhoon events was evaluated by the Taiwan Typhoon Loss Assessment System (TLAS) under climate change scenario. Results showed that the total loss will increase roughly by NT$ 49.7 billion ($1.6 billion USD) in future in Zhuoshui watershed in Taiwan.

The results of this research could help to understand future impact; however model bias still exists. Because typhoon track is a critical factor to consider regional disaster risk and the projection of typhoon is still highly uncertain and typhoon number is very limited in a single model simulation. Since Taiwan is a small island, different typhoon tracks induce different level of disaster impacts in watersheds. Therefore, more samples dynamic downscaled typhoon events are needed for analysis to improve and increase reliability in future. Considering dynamical downscaling methods consume massive computing power, developing a new statistical downscaling approach and new method to release daily climate change data to hourly data could be a short-term solution.