Hydrological Response of Selected River Basins to Intense Rainfall in the Philippines

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ABSTRACT

The Philippines is frequently affected by tropical cyclones (TCs) and other convective systems resulting in repeated intense rainfall events. Likewise, our country is composed of many river basins and too much rainwater could cause flooding when rainfall surpasses the basins' carrying capacity. The occurrences of flooding within river basins leave large-scale damages affecting a large portion of the population. Thus, understanding the flood response of river basins is needed in effective disaster risk management. Despite the severity of the flooding in the past, however, limited studies have been undertaken on the hydrometeorological behavior of the country's catchments. Focus is placed mainly on the recovery efforts and damage assessment rather than further understanding how the watershed responds to meteorological forcings. This study aims to investigate the catchment response to intense rainfall using observed and modeled data of three selected river basins with different characteristics. It targets to draw a general conclusion regarding their responses to intense rainfall under which flooding are generated using observational and modeling methods

The first part focuses on the Pampanga River Basin (PRB), a large river system equipped with gauging stations for monitoring and flood forecasting. Hydrological responses in terms of flood onset and lag time as being affected by TCs directly or indirectly are to be explored using the observed data from 2013 to 2018. Flood events will be selected based on the assessed threshold levels (alert, alarm, critical) established by the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA). The second part focuses on Matina River Basin (MRB), a small ungauged river basin in the highly urbanized Davao City. The hydrological response of this data-scarce river to intense rainfall brought by localized thunderstorms will be examined by simulating flash flood events using the Physically Based Distributed Hydrological Model (PBDHM). Lastly, the flood hydrological response of the Cagayan River basin due to the influence of historical warming on the rainfall characteristics of TY Vamco will be analyzed. The characteristics of rainfall will be investigated using the Weather Research and Forecasting (WRF) model by applying the pseudo - global warming method with a 40-year regression of sea surface temperature (SST), temperature, and relative humidity

profiles from JRA-55 reanalysis data. Subsequently, the river discharge is to be simulated using modeled rainfall utilizing the Rainfall-Runoff and Inundation (RRI) model.

Keywords: river basin, flood, physically based distributed hydrological model, rainfall-runoff and inundation model