ABSTRACT

Liuying Du. M.S.C.E., Purdue University, May 2016. Spatio-Temporal Analysis on the Impact of Long-Term Climate and Land Use Change on Blue and Green Water over the Ohio River Basin, US. Major Professor: Venkatesh Merwade.

Impacts of climate and land use change on the overall water availability can be quantified in terms of long-term trends in surface and subsurface hydrologic fluxes. This study presents the spatio-temporal characterization of Blue Water (BW) and Green Water (GW) dynamics during the period of 1935 to 2014 in the Ohio River Basin (ORB). The combined and relative contributions of climate and land use changes to BW and GW dynamics are also quantified. The Soil and Water Assessment Tool (SWAT) is used to simulate hydrologic components, and trend analyses (Mann-Kendall and Theil-Sen tests) are performed on the model outputs to detect the trend and magnitude of trends in BW and GW at three different levels, namely the entire basin, regional, and sub-basin levels. Precipitation increase and land use change from agriculture to forest are detected as the dominant indicators of climate and land use change in ORB. As a result, BW and GW in the entire basin has increased due to the combined effects of climate and land use change, but sub-basin and regional results reveal a distinctive spatial pattern. GW has increased significantly in the upper and lower parts of the basin, which can be related to the prominent land use change in those areas; while BW has increased significantly only in the lower part,

likely being associated with the notable precipitation change there. Climate change influences BW significantly, but relatively nominally on GW, whereas land use change increases GW remarkably, but has a counterproductive effect on BW. These results help to understand the collective influence of natural and anthropogenic impacts on hydrologic responses in the ORB, and thereby provide useful information for future water security and planning.