Dissertations

# Uncertainty in Climatic Change Impacts on Multiscale Watershed Systems



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Abstract
Uncertainty in climate change plays a major role in watershed systems. The increase in variability and intensity in temperature and precipitation affects hydrologic cycle in spatial and temporal dimensions. Predicting uncertainty in climate change impacts on watershed systems can help to understand future climate-induced risk on watershed systems and is essential for designing policies for mitigation and adaptation. Modeling the temporal patterns of uncertainties is assessed in the New England region for temperature and precipitation patterns over a long term. The regional uncertainty is modeled using Python scripting and GIS to analyze spatial patterns of climate change uncertainties over space and time. The results show that the regional uncertainty is significant in variation for changes in location and climatic scenarios. Watershed response to climate change under future scenarios is assessed using hydrologic simulation modeling for the Connecticut River watershed. Changes in water budgets are

assessed for each of the subbasins using spatial analysis and process modeling using GIS and Soil and Water Assessment tool (SWAT). The results show that climate change uncertainty in precipitation and temperature can lead to uncertainty in both quantity and quality in the watershed system. A spatiotemporal, dynamic model was applied to subbasins within the Chicopee River Watershed to estimate climate change uncertainty impacts at a micro scale. These changes were assessed relative to changes in land use and climatic change. The results show that there is a significant potential for climate change to increase evaporation, watershed runoff and soil erosion rates and this varied with climate change uncertainty. Finally, water sustainability gradient analysis was applied to the Volga River watershed in Russia to assess potential climate change impacts by combining with downscaled Global Circulation Model estimates and spatial assessment. Results show that runoff and evapotranspiration are projected to increase with potential for more localized floods and drought events effecting both water resources and food supply. Overall results show that climate change uncertainty can impact watershed systems and spatial and temporal assessments is important for developing strategies for adaptation to climatic change conditions at local and regional scales.