Influences of land use and climate changes on hydrologic system in the northeastern river basin of Thailand

Nuanchan Singkran, Jaruporn Tosang, Doungjai Waijaroen, Naree Intharawichian, Ornanong Vannarart, Pitchaya Anantawong, Karika Kunta, Poonsak Wisetsopa, Tanomkwan Tipvong, Naruekamon Janjirawuttikul, Fatah Masthawee, Sanguanpran Amornpananawat and Sukrit Kirtsaeng

ABSTRACT

This study was a first attempt to portray the effects of land use and climate changes (CCs) on the hydrologic system in the Lamtakhong Basin in northeastern Thailand, which has been disturbed by various human activities, making it difficult to determine these impacts on hydrologic conditions. The hydrologic Soil and Water Assessment Tool model was set up with land use and soil data of 2002 and observed flow and weather data during 1999–2000. After the model was calibrated and validated against observed flow data during 2001–2009, its land use change scenario with input land use data of 2011 and its CC scenario with input weather data during 2010–2065 were simulated. The results showed that changing land use over the 10-year period had trivial influences on the hydrologic system, whereas changing climate over the 56-year period appeared to affect both water yields and flows. Water scarcity will tend to take place across the Lamtakhong Basin in the near future. Longer periods of severe droughts and floods might occasionally occur, particularly downstream. These findings will be useful for land and water resources managers and policy-makers to manage land and water resources in the river basin.

Key words | aquatic, downscale, spatial, temporal, terrestrial, watershed

INTRODUCTION

Population growth, human activities, and other socio-economic changes have put tremendous pressure on ecosystems leading to overexploitation of natural resources (particularly the conversion of natural land covers to various types of land uses), and these have intensified the climate change (CC) phenomenon as the results of energy generation-related emission of greenhouse gases (e.g., Calder 1999; Ficklin et al. 2009; Brookes et al. 2010; Liu et al.)