Modeling the river discharge responses to climate variation and vegetation change in the Loess Plateau

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Simulation of the mutual interaction between hydrological processes and vegetation dynamics is important for understanding and predicting regional hydrological change caused by the climate variability and local land use/cover change. Traditional hydrological models simulate the impact of vegetation change using a simple parameterization scheme. Land surface models emphasize the vertical transfer of energy, water and carbon dioxide in the soil-vegetation-atmosphere continuum, however, some important hydrological processes are over simplified in these models. To fill these gaps, this study chose the Community Land Model version 4 (CLM4) and the Geomorphology Based Hydrological Model version 2 (GBHM2), and replaced the runoff generation and flow routing schemes of CLM4 by the schemes used in GBHM2. The new eco-hydrological model was developed in a study basin with semi-arid climate, the Wudinghe River basin (WRB), which located in the middle reach of the Yellow River with a drainage area of 28706 km^2. After a comprehensive calibration and validation, the model was applied for simulation of the eco-hydrological changes in the past five decades. Changes in regional hydrology and ecosystem were analyzed using the simulated results, with a special focus on the understanding of the river discharge responses to climate variation and vegetation change in the Loess Plateau during the recent 30 years.

Keywords: eco-hydrological modeling, land use/cover change, climate change, regional hydrological change

