Session I – Climate Change and Challenges to Ecological and Economic Sustainability
2:10 PM

Flow Variation Responses to Climate Change in the Mainstream of the Upper Mekong River

Shaojuan Li

School of Urban Management and Resources Environment, Yunnan University of Finance and Economics, Kunming, China, Email: lsj2002_1@yahoo.com

Abstract

Over the past ten years, concerns about the influence of large hydropower dams in the Upper Mekong on ecological and social systems in downstream regions have been the focus of heated debate. The opinions and results, however, are quite varied. Chinese researchers are limited to the Upper Mekong River basin (UMB), and overseas researchers are limited to the Lower Mekong. There is still lack of analysis of the transboundary ecological and hydrological responses to global changes of driver factors (e.g. climate changes and human activities, especially regarding dam construction and operation). Little attention has been paid to the multi-timescale correlation between the upstream and downstream flow variations.

In this paper, based on meteorologic data and the flow records from 1960 to 2003 at main hydrological sites in the mainstream of UMB, a quantitative examination has been undertaken into the hydrological responses to climatic changes (including precipitation, air temperature, and land evaporation). Results are based on the binomial coefficient weighted average method and five-year moving average method, correlation analysis, Morlet wavelet analysis and other statistical methods. The main new results are as following:

The distribution of the key regions of precipitation (KRP) and land evaporation (KRE) are investigated in relation to the mainstream flow variations. The results show that the precipitation variation in KRP has the most significant influences on the variations of year flow (YF) and mean flow in the flood period variations (FF) in the upstream regions. In the mid-downstream regions, the characteristic flow [including YF, FF and the mean flow in drought period (DF)] variations are influenced by not only the flow variation upstream, but also precipitation and land evaporation in corresponding KRP and KRE. Especially after 1995, the DF variations at Gajiu and Yunjinghong sites (in the downstream area) show different trends with the Jiuzhou sites (in the upstream area), but similar trends with precipitation and land evaporation in KRP and KRE in the downstream area. This means that the influences of climate change on DF variations at

the two sites in the downstream regions are more significant than that of the flow variation in the midstream area.

The analysis of periodic oscillation of flow variation shows that, as for the cycle variation of YF and FF in the upstream, solar activity may have more influence than the precipitation in the KFP, while the latter generally influences the 5-year and 2-year flow oscillations. In the midstream area, the climate changes in KRP and KRE predominantly influence the decadal cycle variation of YF and FF. The influences of climate change on the inter-annual oscillation of flow variations are mainly exhibited before 1985. In the downstream regions, the climate changes in KRP and KRE predominantly influence the 2-year oscillation of flow variation at Gajiu site. At Yunjinghong site, the precipitation and land evaporation variations greatly influence both inter-annual and decadal oscillation of flow variation, which bring similar periodic oscillation features to the flow and climate variations.

Therefore, the flow variations (YF, FF, and DF) at the timescales greater than 10 days are mainly influenced by the climate (precipitation and land evaporation) changes.