

Quantifying the effects of climate variability and human activities on runoff for Vugia - Thu Bon River Basin in Central of Viet Nam

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ABSTRACT

Vu Gia - Thu Bon basin is located in central Vietnam between Truong Son mountain range on the border with Lao in the west and the East Sea in the east. The basin occupies about 10,350 km² or roughly 90% of the Quang Nam Province and includes Da Nang, a very large city with about 876,000 inhabitants. Total annual rainfall ranges from about 2,000 mm in central and downstream areas to more than 4,000 mm in southern mountainous areas. Rainfall during the monsoon season accounts for 65 to 80% of total annual rainfall. The highest amount of rainfall occurs in October and November which accounts for 40 to 50% of the annual rainfall. Rainfall in the dry season represents about 20 to 35% of the total annual rainfall. The low rainfall season usually occurs from February to April, accounting for only 3 to 5% of the total annual rainfall. The mean annual flow volume in the basin is 19.1×10⁹m³. Similar to the distribution of rainfall, annual flows are distinguished by two distinct seasons (the flood season and the low-flow season). The flood season commonly starts in the mid-September and ends in early January. Flows during the flood season account for 62 to 69% of the total annual water volume, while flows in the dry season comprise 22 to 38% of total annual run-off. The water volume gauged in November, the highest flow month, accounts for 26 to 31% of the total annual run-off while the driest period is April with flows of 2 to 3% of the total annual run-off. There are some hydropower projects in the Vu Gia - Thu Bon basin as the cascade of Song Bung 2, Song Bung 4, and Song Bung 5, the A Vuong project currently under construction, the Dak Mi 1 and Dak Mi 4 projects on the Khai tributary, and the Song Con project on the Con River. Both the Khai tributary and the Song Con join the Bung River downstream of SB5, although the Dak Mi 4 project involves an inter-basin diversion to Thu Bon.

Much attention has recently been focused on the effects that climate variability and human activities have had on runoff. In this study, data from the Vu Gia - Thu Bon River Basin in the central of Viet Nam were analyzed to investigate changes in annual runoff during the period of 1977 - 2010. The nonparametric Mann - Kendall test and the Mann - Kendall - Sneyers test were used to identify trend and step change point in the annual runoff. It was found that the basin had a significant increasing trend in annual runoff. The hydrologic sensitivity analysis method was employed to evaluate the effects of climate variability and human activities on mean annual runoff for the human-induced period based on precipitation and potential evapotranspiration. This study quantitatively distinguishes the effects between climate variability and human activities on runoff, which can do duty for a reference for regional water resources assessment and management.

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