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Long-term trend of climate variables in the upper Dong Nai river basin in Vietnam

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Dong Nai river and Mekong delta downstream are located in and supplied the major water resources to the whole Southern of Vietnam. In the state of continuous changes in water resources due to climate changes, there are several controversy about the potential impact of sediment transport and river flows downstream due to either the cascade hydroelectric power plant system or dam construction in the upper of Mekong delta. Therefore, management and planning for efficient use of Dong Nai river water resource is very important. Furthermore, that it is necessary to consider the hydrological regime change by the effects of climate variable. On the other hand, solving the problems of water shortage in the dry season and flood control in rainy season are also important for issues of water management at Dong Nai river basin. In this study we evaluated changes in two main factors of the water balance equation (both rainfall and evapotranspiration) to assess long-term change in the hydrological regime in the upper area of Dong Nai river basin. This key theme was divided into the following two sub-goals. The first goal was to analyze long term spatial and temporal rainfall trends. The second goal was to analyze the long-term trend of meteorological factors determining evapotranspiration such as air temperature, wind speed, solar radiation and sunshine duration. The results were used to assess their impact to evapotranspiration.

The meteorological and hydrological data of the basin for the last 20 years (from 1993 to 2012) were analyzed based on the Empirical Mode Decomposition (EMD) method. The EMD method has been pioneered by Huang et al. (1998) for adaptively representing nonstationary time-series data as sum of zero-mean amplitude modulation-frequency modulation (AM-FM) components by iteratively conducting the sifting process. These components called Intrinsic Mode Functions (IMFs) allow the calculation of a meaningful multi-component instantaneous frequency.

The results show temperature slightly increased of 2% in all areas and rainfall in rainy season increased of 10% in highland, 15% in midland and 5% in lowland. Whereas we have found the downtrend in all meteorological factors, while the reduction of wind speed were greatly with 15% but they are very small in related humidity (0.3%) and sunrise duration (1%). Solar radiation was slightly decreased of 8% and discharge was increased of 8% steadily. EMD is not only the quantitative results as above but it also shows shape of trend curves, from which we can verify change in climate variables in analyzed period. EMD could be widely used to detect trend over time of meteorological time series data.