Variability, Change and Prediction of Hydro-climatic Elements in the Hai River Basin of China

X. Ding\textsuperscript{1}, Y. Jia\textsuperscript{2}

\textsuperscript{1}Department of Water Environment, Institute of Water Resources and Hydropower Research (IWHR), Beijing, China; \textsuperscript{2}Department of Water Resources, Institute of Water Resources and Hydropower Research (IWHR), Beijing, China

Many observational facts and studies have shown that the hydro-climatic conditions in the Hai river basin which is the political and cultural center of China changed significantly over last half of the 20th century. This study attempts to evaluate the variability and change of hydro-climatic elements in the basin including precipitation, temperature, evapotranspiration and runoff based on observations and a hydrological model WEP-L (Water and Energy transfer Process in Large river basins), as well as predict the trends of these elements under changing environment including climate change and human activities. Specifically, the temporal variations and sudden changes of precipitation, temperature, evapotranspiration and runoff during last 50 years (1956-2005) in the basin are analyzed using moving-average method, linear regression method and Mann-Kendall method. In addition, the spatial variations of these elements are also analyzed using EOF (Empirical Orthogonal Function) method. For future conditions, the precipitation and temperature data are obtained from the average dataset of 20 global climate models using REA (Reliability Ensemble Averaging) method, together with the future land use data based on national land use planning documents, evapotranspiration and runoff data are obtained through WEP-L simulations. Thus, the prediction of the elements under changing environment can be given. The results indicate that: 1) during 1956-2005, the precipitation and runoff in the basin decreased, while the temperature and evapotranspiration increased; 2) during 2021-2050, the four elements will increase with different extent. This study may provide decision support for integrated management and planning of water resources in the highly water-stressed basin.