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Hydrological analysis and modeling in a changing environment – progress, challenges and future studies in a rapidly changing nation like China

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Abstract: Hydrological analysis and modeling in a river basin, a region or the globe are essential for water resources assessment, flood forecasting and impact study of climate and environment change. Development and application of hydrological analysis methods and models at different spatial and temporal scales have been carried out since later part of the 19th century, when the rational model was introduced. Since then, the development of hydrological models has gone through several stages, i.e. from the rational method through conceptual to physically-based models, from lumped to distributed models, and from catchment scale to regional and global scale models. While following international trends, the development of the hydrological sciences in China has demonstrated its own characteristics and uniqueness due to its complex issues involving a rapidly changing climate regime, heavily engineered river systems, landuse change and non-standardised data sets. Considerable progress has been achieved to date in hydrological research in China; however, significant ongoing challenges to the hydrological analysis and modeling remain to be addressed since in a changing world, model inputs, outputs, parameters, relationship between inputs and outputs may all vary and become nonstationary, violating the basic assumption of the most existing statistical methods and models. The presentation will first briefly review the history and progress of the development of hydrological science and models, and then discuss the methods used to determining different types of nonstationarity, and address the difference of types, extents, and causes of nonstationarity of individual hydrological components as well as their relationships found in major river basins of China. The presentation finally highlights current limitations and provides a view about the foreseeable developments in hydrological analysis and modeling in a rapidly changing nation like China.