Geophysical Research Abstracts
Vol. 15, EGU2013-669, 2013
EGU General Assembly 2013

Identifying the relationship between the precipitation in the source region of the Yellow River and climatic patterns

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The hydrological cycle has been greatly affected by climate change and human activities, and it is significant to analyse the hydrological change that occurred in past decades in order to understand it and predict the future change. The source region of the Yellow River contributes about 35% of the total water yield in the Yellow River basin, which plays an important role in meeting downstream water resources requirements, so it is essential to study the precipitation characteristics and find its physical explanation. In this study, the precipitation trend was investigated by linear regression and Mann-Kendall test using the daily data from 1961 to 2010. Principal component analysis (PCA) and Singular value decomposition (SVD) were used to find relation between the precipitation in the source region of the Yellow River and global climatic phenomena using climatic indices. It is found that the precipitation change varies at different stations because of the temporal and spatial difference, and it has a slight downward trend for the last 50 years in the whole area. PCA revealed direct or inverse relationships between some of these climatic indices and precipitation. The first two modes of PCA are analyzed as the ones that can most easily be associated to physical phenomena. It shows that precipitation is related to North Atlantic Oscillation and West Pacific, and inversely related to Polar Eurasia teleconnection. SVD was applied to the cross-covariance matrix between precipitation and climatic indices. The results of SVD confirm the relationship got from PCA. The revealed precipitation change might prove useful in prediction of precipitation and in integrated water resources management in the river basin level. The main timescale of the annual precipitation investigated is an essential part of the development of optimal reservoir planning and operation policies for power generation, water supply and flood control for the mid and down-stream of the Yellow River.