European Geosciences Union
General Assembly 2016
Vienna | Austria | 17–22 April 2016

# Flood Frequency Analysis For Partial Duration Series In Ganjiang River Basin

Sun zhangli①② (sunzhangli@gmail.com), Zhu xiufang①② (zhuxiufang@bnu.edu.cn), Pan yaozhong①②(pyz@bnu.edu.cn)
①College of Resources Science and Technology, Beijing Normal University, Beijing, China
②State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University, Beijing, China

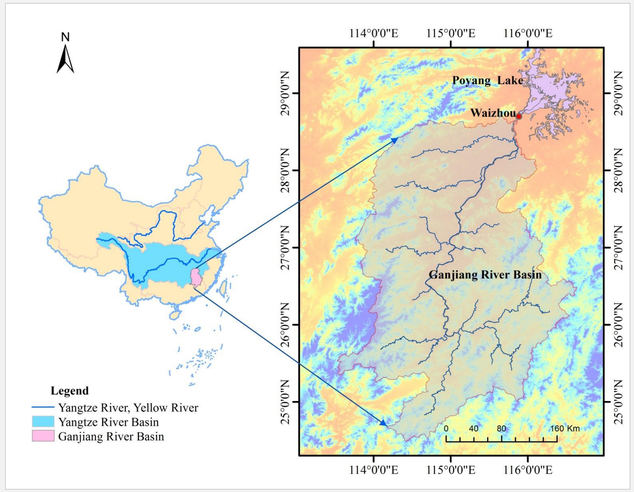
## 1 Introduction

Accurate estimation of flood frequency is key to effective, nationwide flood damage abatement programs. The partial duration series (PDS) method is widely used in hydrologic studies because it considers all events above a certain threshold level. However, the PDS approach remains under-employed mainly because of the complexities associated with its use(Lang, M., 1999).

**Objective:** Review and analyze the PDS approach, and present an application in Ganjiang river basin, and estimate the future flood risk of Ganjiang river basin to serve as a guide to hydrological engineering planning.

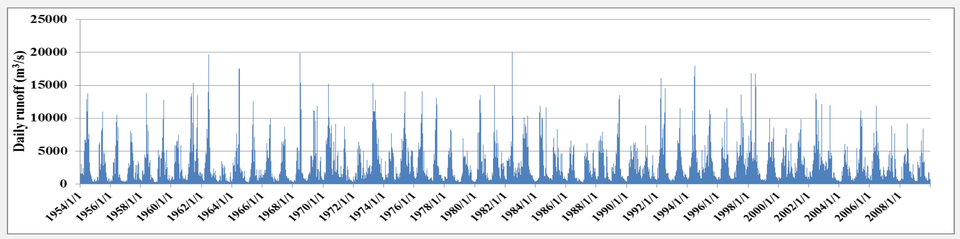
## 2 Study Area & Data

**Study area:** The Ganjiang River is the seventh largest tributary of the Yangtze River, the longest river in China. The basin is situated in the southeast of mainland China with a drainage area about 83,268 km$^2$ at Waizhou hydrologic station as the basin outlet.




The economic of the basin plays an important role in Jiangxi province, however, the basin is topographically complicated with mountainous, and impacted by monsoon and typhoons precipitation system, which bring a great mount of precipitation and trigger landslide and floods very often.

**Data:** daily runoff data of Waizhou station from 1954 to 2009. Data from 《Annual Hydrological Report P.R. China》.




## 3 Methods

**(1) The choice of threshold level.** We choice the minimum of the annual maximum series as the threshold, to ensure that at least once flood event every year.

**(2) the occurrence process obey a Poisson distribution.** The number of exceedances N in t years is Poisson distributed with probability function:

$$P\{N(t)=n\}=\frac{(\lambda t)^n}{n!}\exp(-\lambda t) \qquad (1)$$

λ is the mean annual number of threshold exceedances.

**(3) The verification of the independence of the values.** We use the following formula provided by the Water Resources Council (USWRC, 1976) to ensure the independence of the values:

$$\theta > 5+\ln(A) \quad \text{and} \quad X_{\min} < 0.75\min[Q_1, Q_2] \qquad (2)$$

$A$ : the basin area (km$^2$); $Q_i$ : the maximum daily discharge of flood no. i.

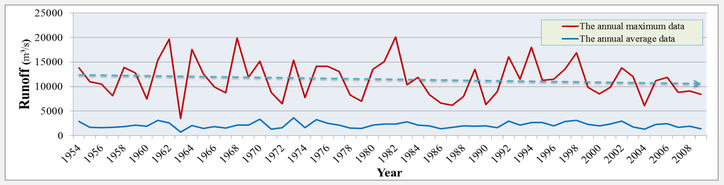
**(4) Samples extracted by PDS obey exponential distribution.**

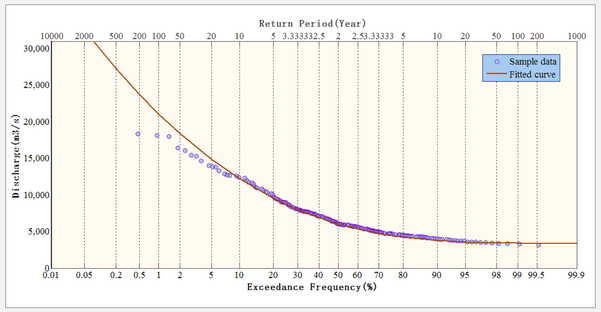
$$F(x)=1-\exp[(x-s)/\alpha] \qquad (3)$$

$\alpha$ is scale parameter, which controls the spread of the observed distribution; s is threshold level, which controls the position of the distribution function along horizontal axis.

## 4 Results & Discussion

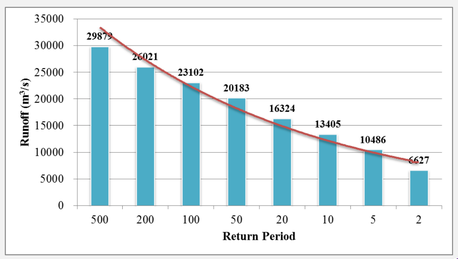
**(1) The annual maximum series.**
The annual average curve keeps stable, The annual maximum curve is slight downward trend.




**(2) Flood frequency analysis**
According to the threshold and Eq.2, 212 sample data were obtained. Based on the exponential distribution(Eq.3), we got flood frequency curve on Hazen probability ruling paper. The flood frequency curve shows the detail information of magnitude of flood events to frequency of occurrence, such as the maximum flow with a 0.01 exceedance probability (corresponding to a 100-year flood peak under stationary conditions) was 23102 m$^3$/s, while that with a 0.1 exceedance probability was 13405 m$^3$/s.

**(3) Return Period**
The right figure shows the runoff for return period of 2, 5, 10, 20, 50, 100, 200 and 500 years according to exponential model. The Ganjiang river basin has a large drainage area and a sever runoff, for the return period of 2 years, the runoff of Waizhou station is 6627 m$^3$/s, for the return period of 100 years, the runoff is 23102 m$^3$/s.




## 5 conclusions

(1) The annual average runoff in the Ganjiang River basin is stable, while the annual maximum showed a slight downward trend, which could be guided to the water resources utilization.
(2) For the flood frequency and return period analysis, we got the magnitude of flood events to their frequency of occurrence, which will serve as a guide to hydrological engineering planning, design, and management for policymakers and decision makers associated with hydrology.

## References

(1) United States Water Resources Concil, Guidelines for determining flood flow frequency, Bull. 17B, Hydrol. Comm., Water Resour. Counc., Washington, D.C., 1982.
(2) Lang, M., T.B.M.J. Ouarda, and B. Bobée, Towards operational guidelines for over-threshold modeling. Journal of Hydrology, 1999. 225(3–4): p. 103-117.
(3) Serra, C., et al., Partial duration series distributions of the European dry spell lengths for the second half of the twentieth century. Theoretical and Applied Climatology, 2014. 123(1): p. 63-81

北京師範大學 BEIJING NORMAL UNIVERSITY
北京师范大学 地表过程与资源生态国家重点实验室 ESPRE State Key Laboratory of Earth Surface Processes and Resource Ecology

*Learn, so as to instruct others*
*Act, to serve as example to all*

*Beijing Normal University No. 19, XinJieKouWai St., HaiDian District, Beijing 100875, P. R. China*