

## Review

# Regional Flood Frequency Analysis: A Bibliometric Overview

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**Abstract:** In water resources management, environmental and ecological studies, estimation of design streamflow is often needed. For gauged catchments, at-site flood frequency analysis is used for this purpose; however, for ungauged catchments, regional flood frequency analysis (RFFA) is the preferred method. RFFA attempts to transfer flood characteristics from gauged to ungauged catchments based on the assumption of regional homogeneity. A bibliometric analysis on RFFA is presented here using Web of Science (WoS) and Scopus databases. A total of 626 articles were selected from these databases. From the bibliometric analysis, it has been found that Journal of Hydrology and Water Resources Research are the two leading journals reporting RFFA research. In RFFA research, leading countries include Canada, USA, UK, Italy and Australia. In terms of citations, the top performing researchers are Ouanda T, Burn D, Rahman A, Haddad K and Chelbana F. Future research should be directed towards the identification of homogeneous regions, application of efficient artificial intelligence (AI)-based RFFA models, incorporation of climate change impacts and uncertainty analysis.

**Keywords:** floods; regional floods; regional frequency analysis; regionalization; homogeneous regions; probability distribution; bibliometric analysis; L-moments; index flood; ungauged catchments



**Citation:** Ahmed, A.; Yildirim, G.; Haddad, K.; Rahman, A. Regional Flood Frequency Analysis: A Bibliometric Overview. *Water* **2023**, *15*, 1658. <https://doi.org/10.3390/w15091658>

**Academic Editors:** Chang Hwang and Giovanni Riva

Received: 7 March 2023

Revised: 16 April 2023

Accepted: 20 April 2023

Published: 24 April 2023



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## 1. Introduction

Flooding is a natural disaster that often causes extensive economic damage and loss of life [1]. Flooding is becoming more intense and frequent due to climate change [2]. To reduce flood damage at a given location, a flood risk assessment is often carried out. It involves estimation of a design flood, which is defined as a flood discharge associated with an annual exceedance probability. Design floods are used in the design of hydraulic structures and many other flood management tasks. At a gauged location, at-site flood frequency analysis is carried out to estimate design floods. However, many locations where a design flood estimate is needed are ungauged or have little recorded streamflow data. For these ungauged sites, a regional flood frequency analysis (RFFA) is adopted to estimate design floods [3–5]. RFFA may focus on peak, volume, frequency, depth and duration of flood events [6,7].

RFFA consists of two principal steps: identification of homogeneous regions and development of regional flood estimation equations [8,9]. Homogeneous regions can be formed based on a geographical boundary where all the sites in an assumed region form a fixed region [10–13]. Alternatively, a region-of-influence (ROI) approach can be adopted where each of the selected sites forms its own region [14,15]. Regional homogeneity is a vital assumption of RFFA, which may affect relative accuracy of flood quantile estimates [16–19]. To assess the degree of homogeneity in a proposed region, various statistical tests are proposed [20–23]. Regions can be formed on a geographical space or in a catchment attribute space. Various multivariate statistical techniques such as principal component analysis [24,25], cluster analysis [25–27] and canonical correlation analysis [28–30] are used to derive homogeneous regions. More recently, Han et al. [9] applied network theory in identification of homogeneous regions in RFFA.

# Regional Flood Frequency Analysis

**Khaled Hamed,A. Ramachandro. Rao**



## **Regional Flood Frequency Analysis:**

*Regional Flood Frequency Analysis* Vijay Singh, 1987-09-30 Proceedings of the International Symposium on Flood Frequency and Risk Analyses May 14 17 1986 Louisiana State University Baton Rouge U S A    Regional Flood Frequency Analysis Canada-New Brunswick Flood Damage Reduction Program, New Brunswick. Environment New Brunswick, Acres Consulting Services, 1977\*    Regional Flood Frequency Analysis for Alaska J. R. Janowicz, D. L. Kane, University of Alaska Fairbanks. Institute of Water Resources, United States. Office of Water Research and Technology, Alaska. Department of Natural Resources, 1983    Regional Flood Frequency Analysis Using a Region of Influence' Approach Sayyed Saeid Eslamian, 1995    Regional Flood Frequency Analysis National Institute of Hydrology, 1985    *Regional Flood Frequency Analysis* Xiaoni Guo, Duane C. Boes, Jose D. Salas, 1990    Regional Flood Frequency Analysis for Arkansas by L-Moments Method Avishek Chhibber, 2006    *Spatially-explicit Regional Flood Frequency Analysis Using L-moment, GIS and Geostatistical Methods* Jean-Luc Daviau, 1998    *Regional Flood Frequency Analysis Based on Multivariate Lognormal Models* Fernando A. Pons, 1992    **Regional Flood Frequency Analysis** Fady A. Khalifeh, 1989    *Improved Methods for Regional Flood Frequency Analysis* Jose D. Salas, Geological Survey (U.S.), Colorado State University. Hydrology and Water Resources Program, 1990    *Regional Flood Frequency Analysis Using L-moments* J. R. M. Hosking, J. R. Wallis, 1990    *A hierarchical approach to regional flood frequency analysis* S. Gabriele, N W. Arnell, 1991    *Regional Flood Frequency Analysis* Vijay Singh, 1987 Proceedings of the International Symposium on Flood Frequency and Risk Analyses May 14 17 1986 Louisiana State University Baton Rouge U S A    Regional Flood Frequency Analysis for Godavari Basin Sub-zone (3F). National Institute of Hydrology, 1991    **Grouping basins for regional flood frequency analysis** S E. Wiltshire, 1985    *Floods in Iowa* Oscar G. Lara, 1974 Compares the results from applying four regional flood frequency methods to flood data collected at 131 gaging stations in Iowa and appraises the reliability of each method    Regional Flood Frequency Analysis Admasu Gebeyehu, 1989    Statistical Techniques for Regional Flood-frequency Analysis S. E. Wiltshire, Newcastle upon Tyne Univ. (GB), 1987    **Flood Frequency Analysis** Khaled Hamed, A. Ramachandro. Rao, 2019-04-30 After five decades the field of Statistical Hydrology continues to evolve and remains a very active area of investigation Researchers continue to examine various distributions methods of estimation of parameters and problems related to regionalization However much of this research appears in journals and reports and usually in a form not easily accessible to practitioners and students Flood Frequency Analysis answers this need by presenting the most popular and promising distributions and estimation procedures in a unified format It offers the details that provide the basis for the computations and illustrates each procedure with real data

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### **Table of Contents Regional Flood Frequency Analysis**

1. Understanding the eBook Regional Flood Frequency Analysis
  - The Rise of Digital Reading Regional Flood Frequency Analysis
  - Advantages of eBooks Over Traditional Books
2. Identifying Regional Flood Frequency Analysis
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Regional Flood Frequency Analysis
  - User-Friendly Interface
4. Exploring eBook Recommendations from Regional Flood Frequency Analysis
  - Personalized Recommendations

- Regional Flood Frequency Analysis User Reviews and Ratings
- Regional Flood Frequency Analysis and Bestseller Lists
- 5. Accessing Regional Flood Frequency Analysis Free and Paid eBooks
  - Regional Flood Frequency Analysis Public Domain eBooks
  - Regional Flood Frequency Analysis eBook Subscription Services
  - Regional Flood Frequency Analysis Budget-Friendly Options
- 6. Navigating Regional Flood Frequency Analysis eBook Formats
  - ePub, PDF, MOBI, and More
  - Regional Flood Frequency Analysis Compatibility with Devices
  - Regional Flood Frequency Analysis Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Regional Flood Frequency Analysis
  - Highlighting and Note-Taking Regional Flood Frequency Analysis
  - Interactive Elements Regional Flood Frequency Analysis
- 8. Staying Engaged with Regional Flood Frequency Analysis
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Regional Flood Frequency Analysis
- 9. Balancing eBooks and Physical Books Regional Flood Frequency Analysis
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Regional Flood Frequency Analysis
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Regional Flood Frequency Analysis
  - Setting Reading Goals Regional Flood Frequency Analysis
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Regional Flood Frequency Analysis
  - Fact-Checking eBook Content of Regional Flood Frequency Analysis

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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