

# **The National Flood Frequency Program, Version 3: A Computer Program for Estimating Magnitude and Frequency of Floods for Ungaged Sites**

Compiled by K.G. Ries III and M.Y. Crouse

With sections by J.B. Atkins, R. Dusenbury<sup>1</sup>, M. Gray<sup>1</sup>, M.E. Jennings  
W.H. Kirby, H.C. Riggs, V.B. Sauer, W.O. Thomas, Jr.

<sup>1</sup> Aqua Terra Consultants, Inc.

Water-Resources Investigations Report 02-4168

**U.S. Department of the Interior  
U.S. Geological Survey**

**U.S. Department of the Interior**  
Gale A. Norton, Secretary

**U.S. Geological Survey**  
Charles G. Groat, Director

U.S. Geological Survey, Reston, Virginia: 2002

For sale by U.S. Geological Survey, Information Services  
Box 25286, Denver Federal Center  
Denver, CO 80225

For more information about the USGS and its products:  
Telephone: 1-888-ASK-USGS  
World Wide Web: <http://www.usgs.gov/>

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government

Ries, K.G., III, and Crouse, M.Y., 2002, The National Flood Frequency Program, Version 3:  
A Computer Program for Estimating Magnitude and Frequency of Floods for Ungaged Sites,  
U.S. Geological Survey Water-Resources Investigations Report 02-4168, 42p.

# Contents

## The National Flood Frequency Program, Version 3: A Computer Program for Estimating Magnitude and Frequency of Floods for Ungaged Sites

— Compiled by K.G. Ries III and M.Y. Crouse .....	1
Abstract .....	1

### INTRODUCTION

— By W.O. Thomas, Jr., M.E. Jennings, and K.G. Ries III .....	1
Purpose .....	2
Report Format .....	2
How to Obtain the NFF Software and Documentation .....	2
Acknowledgments .....	2

### HISTORY AND OVERVIEW OF FLOOD REGIONALIZATION METHODS

— By W.O. Thomas, Jr., and K.G. Ries III .....	3
INTRODUCTION .....	3
INDEX-FLOOD PROCEDURES .....	3
ORDINARY-LEAST-SQUARES REGRESSION .....	3
WEIGHTED- AND GENERALIZED-LEAST-SQUARES REGRESSION .....	4
REGION-OF-INFLUENCE REGRESSION .....	4

### RURAL FLOOD-FREQUENCY ESTIMATING TECHNIQUES

— By K.G. Ries III, W.O. Thomas, Jr., and J.B. Atkins .....	5
INTRODUCTION .....	5
WATERSHED AND CLIMATIC CHARACTERISTICS .....	5
HYDROLOGIC FLOOD REGIONS .....	5
MEASURES OF ACCURACY .....	6
TECHNIQUES FOR WATERSHEDS THAT SPAN REGIONAL/STATE BOUNDARIES .....	6
WEIGHTING OF INDEPENDENT ESTIMATES OF RURAL FLOOD FREQUENCY .....	7
Weighting for Streamgaging Stations .....	7
Weighting for Ungaged Sites .....	7

### URBAN FLOOD-FREQUENCY ESTIMATING TECHNIQUES

— By V.B. Sauer .....	8
INTRODUCTION .....	8
NATIONWIDE URBAN EQUATIONS .....	8
LOCAL URBAN EQUATIONS .....	10

**FLOOD HYDROGRAPH ESTIMATION**

—By V.B. Sauer .....	11
----------------------	----

**ESTIMATION OF EXTREME FLOODS**

—By W.O. Thomas, Jr. and W.H. Kirby	
MEASURES OF EXTREME FLOODS .....	12
EXTRAPOLATION FOR THE 500-YEAR FLOOD .....	12

**TESTING AND VALIDATION OF TECHNIQUES**

—By K.G. Ries III .....	15
-------------------------	----

**APPLICABILITY AND LIMITATIONS**

—By J.B. Atkins and K.G. Ries III .....	16
---	----

**SUMMARY OF STATE FLOOD-FREQUENCY TECHNIQUES**

—By K.G. Ries III, H.C. Riggs, and W.O. Thomas, Jr. ....	17
--	----

REFERENCES .....	18
------------------	----

**FIGURES**

1. Schematic of typical drainage basin shapes and subdivision into basin thirds .....	9
2. Regional flood-frequency curve for the Fenholloway River at Foley, Florida (from Jennings and others, 1994) .....	13
3. Map of the conterminous United States showing flood-region boundaries (from Crippen and Bue, 1977) .....	14

**TABLES**

1. Frequency computations for Sucarnoochee River at Livingston, Alabama .....	6
---	---

## APPENDIX A —

### NATIONAL FLOOD FREQUENCY PROGRAM USERS' MANUAL

— By R. Dusenbury, M. Gray, and K.G. Ries III .....	21
DOWNLOADING AND INSTALLING THE PROGRAM .....	21
STARTING THE PROGRAM .....	22
MAIN WINDOW .....	23
Menu Items .....	26
File menu .....	26
Graph menu .....	28
Help menu .....	29
Manual.....	29
Web site.....	31
About .....	32
EDIT SCENARIO WINDOW.....	33
FREQUENCY WINDOW .....	34
HYDROGRAPH WINDOW .....	37
WEIGHT WINDOW .....	39

## FIGURES

A-1. View of the National Flood Frequency Program startup window, which allows selection of the system of units for input and output, specification of a user name, and selection of a project status file .....	22
A-2. The main window of the National Flood Frequency Program at start up .....	23
A-3. The main window of the National Flood Frequency Program showing the State selection scroll-down list .....	24
A-4. The main window of the National Flood Frequency Program showing results of rural and urban computations for an example site in Illinois .....	25
A-5. The Open Status File window of the National Flood Frequency Program .....	26
A-6. The Save Status File window of the National Flood Frequency Program .....	27
A-7. The Save Report File window of the National Flood Frequency Program .....	27
A-8. Example report file output .....	27
A-9. The National Flood Frequency Program Users' Manual window showing navigation by hierarchical structure .....	29

A-10. The National Flood Frequency Program Users' Manual window showing navigation by use of the index of help topics .....	30
A-11. The National Flood Frequency Program Users' Manual window showing navigation by use of the search facility .....	31
A-12. The National Flood Frequency Program About NFF window. ....	32
A-13. The National Flood Frequency Program Edit Scenario window showing the variables that need to be entered to solve the equations for the selected Region B .....	33
A-14. The National Flood Frequency Program Edit Scenario window showing the variables that need to be entered to solve the equations for a site with drainage area in both selected Regions A and B .....	33
A-15. The National Flood Frequency Program Edit Scenario window showing the variables that need to be entered to solve the national urban equations .....	34
A-16. The National Flood Frequency Program Frequency window with a rural and an urban scenario selected for plotting .....	34
A-17. The National Flood Frequency Program Frequency Plot window showing rural and urban frequency plots for a sample site .....	35
A-18. The National Flood Frequency Program Graph Edit window showing the Axes tab on top .....	36
A-19. The National Flood Frequency Program Font window .....	36
A-20. The National Flood Frequency Program Hydrograph window with a recurrence interval of 10 years and rural and urban scenarios selected for plotting .....	37
A-21. The National Flood Frequency Program Hydrograph Plot window showing rural and urban hydrograph plots for a sample site, with the lag time set at 5 hours for the rural hydrograph and at 4 hours for the urban hydrograph .....	38
A-22. The National Flood Frequency Program Hydrograph List window showing rural and urban hydrograph lists for a sample site .....	38
A-23. The National Flood Frequency Program Weight window showing weighting for a streamgaging station .....	39
A-24. The National Flood Frequency Program Weight window showing weighting for an ungaged site .....	40

## **APPENDIX B —**

SUMMARY OF EQUATIONS FOR ESTIMATING BASIN LAGTIME .....	41
--	----

