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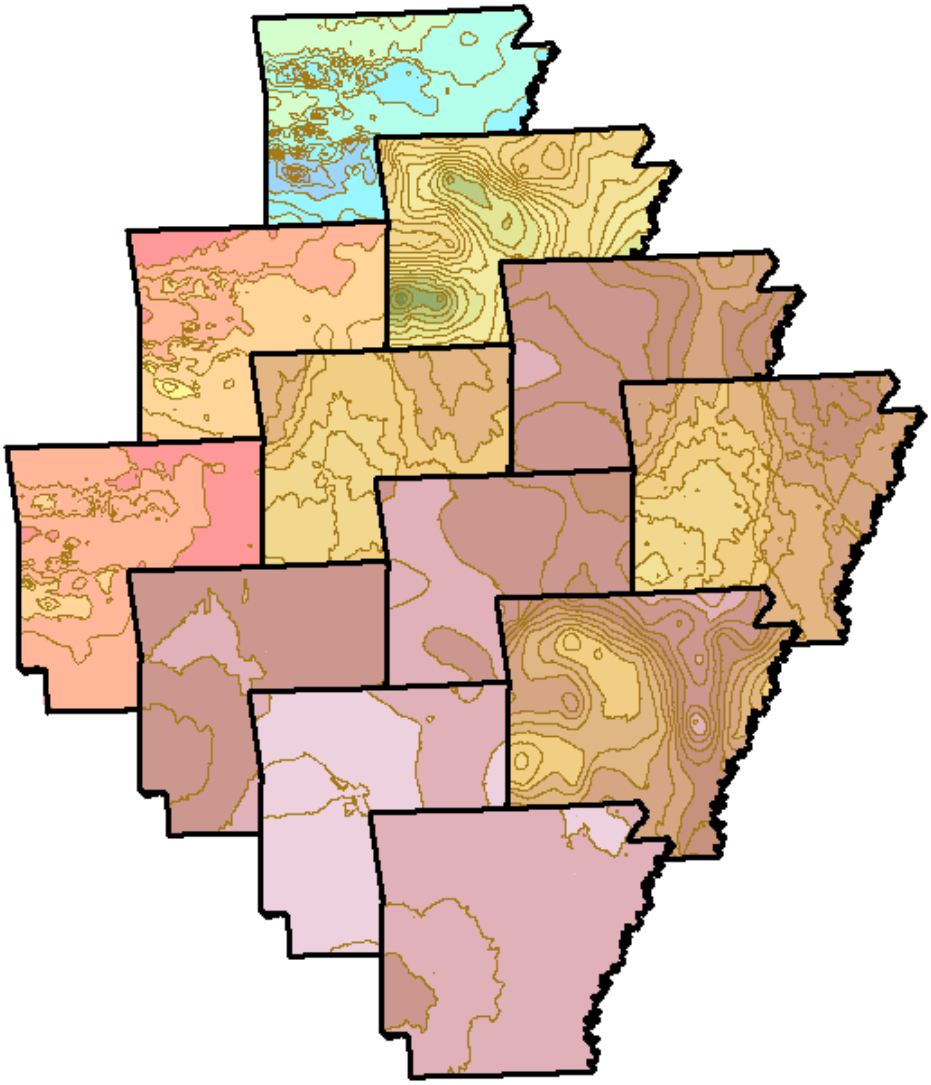
Mean Annual, Seasonal, and Monthly Precipitation and Runoff in Arkansas, 1951–2011



Scientific Investigations Report 2014–5006

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

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By Aaron L. Pugh and Drew A. Westerman

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

U.S. Department of the Interior
SALLY JEWELL, Secretary

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Contents

Figures

Tables

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the North American Vertical Datum of 1988 (NAVD 88).

Mean Annual, Seasonal, and Monthly Precipitation and Runoff in Arkansas, 1951–2011

By Aaron L. Pugh and Drew A. Westerman

Abstract

This report describes long-term annual, seasonal, and monthly means for precipitation and runoff in Arkansas for the period from 1951 through 2011. Precipitation means were estimated using data from the Parameter-elevation Regressions on Independent Slopes Model database; while total runoff, groundwater runoff, and surface runoff means were estimated using data from 123 active and inactive U.S. Geological Survey continuous-record streamflow-gaging stations located in Arkansas and surrounding States. Annual precipitation in Arkansas for the period from 1951 through 2011 had a mean of 49.8 inches. Of the six physiographic sections in Arkansas, the Ouachita Mountains had the largest mean annual precipitation at 53.0 inches, while the Springfield-Salem plateaus had the smallest mean annual precipitation at 45.5 inches. The mean annual total runoff for Arkansas was 17.8 inches. The Ouachita Mountains had the largest mean annual total runoff at 20.4 inches, while the Springfield-Salem plateaus had the smallest mean annual total runoff at 15.0 inches. Runoff is diminished during the dry season, which is attributed to increased losses from evapotranspiration, consumptive uses including irrigation, and increased withdrawals for public and private water supplies. The decline in runoff during the dry season is observed across the State in all physiographic sections. Spatial results for precipitation and runoff are presented in a series of maps that are available for download from the publication Web page in georeferenced raster formats.

Introduction

Water is an important resource that is normally plentiful in Arkansas. Hydrologic studies undertaken to define the occurrence and availability of freshwater aid in the planning and management of this important resource. Annual precipitation and runoff represent the upper limit of water potentially available for development and, consequently, form the base for many hydrologic investigations. Therefore, a study to reevaluate long-term mean annual, seasonal, and monthly precipitation and runoff in Arkansas was needed and is one of several studies completed by the U.S. Geological Survey (USGS) in cooperation with the Arkansas Natural Resources Commission (ANRC). These studies were conducted to update and increase the basic knowledge of hydrologic and hydraulic properties of Arkansas' surface-water and groundwater resources and are part of ANRC's efforts to update the Arkansas State Water Plan.

Background Information

Runoff is the volume of water in a stream resulting from precipitation, snowmelt, or irrigation flowing from the drainage basin over a specific period of time. Runoff measured at the drainage-basin outlet is the net streamflow of the stream, including both contributions from groundwater discharge (hereafter termed groundwater runoff) and surface or overland flow (hereafter termed surface runoff) (Langbein and Iseri, 1960) to the stream with losses occurring from evapotranspiration, groundwater recharge, and consumptive uses. Runoff can be expressed by a variety of numerical variables, but average depth of water over the drainage basin, in inches (in.), is the most commonly used unit of measurement and was used for this report.

Runoff is directly affected by climate, land use, vegetation, geology, soil type, elevation, slope, topography, drainage network patterns, lakes, and reservoirs. Many of these physical characteristics have been classified spatially into physiographic regions, which provide a convenient methodology for examining runoff. Fenneman (1946) developed a broad-scale, three-tiered classification for the United States that organizes similar regions into divisions, provinces, and sections.

Arkansas contains parts of six physiographic sections including the Springfield-Salem plateaus, the Boston Mountains, the Arkansas Valley, the Ouachita Mountains, the Mississippi Alluvial Plain, and the West Gulf Coastal Plain (fig. 1). The Springfield-Salem plateaus and the Boston Mountains are dissected areas with steep valley walls and narrow valley floors. The Springfield-Salem plateaus are underlain by southward-dipping Ordovician through Pennsylvanian limestone and dolostone. Sinkholes, springs, and caves are common in the limestone of the

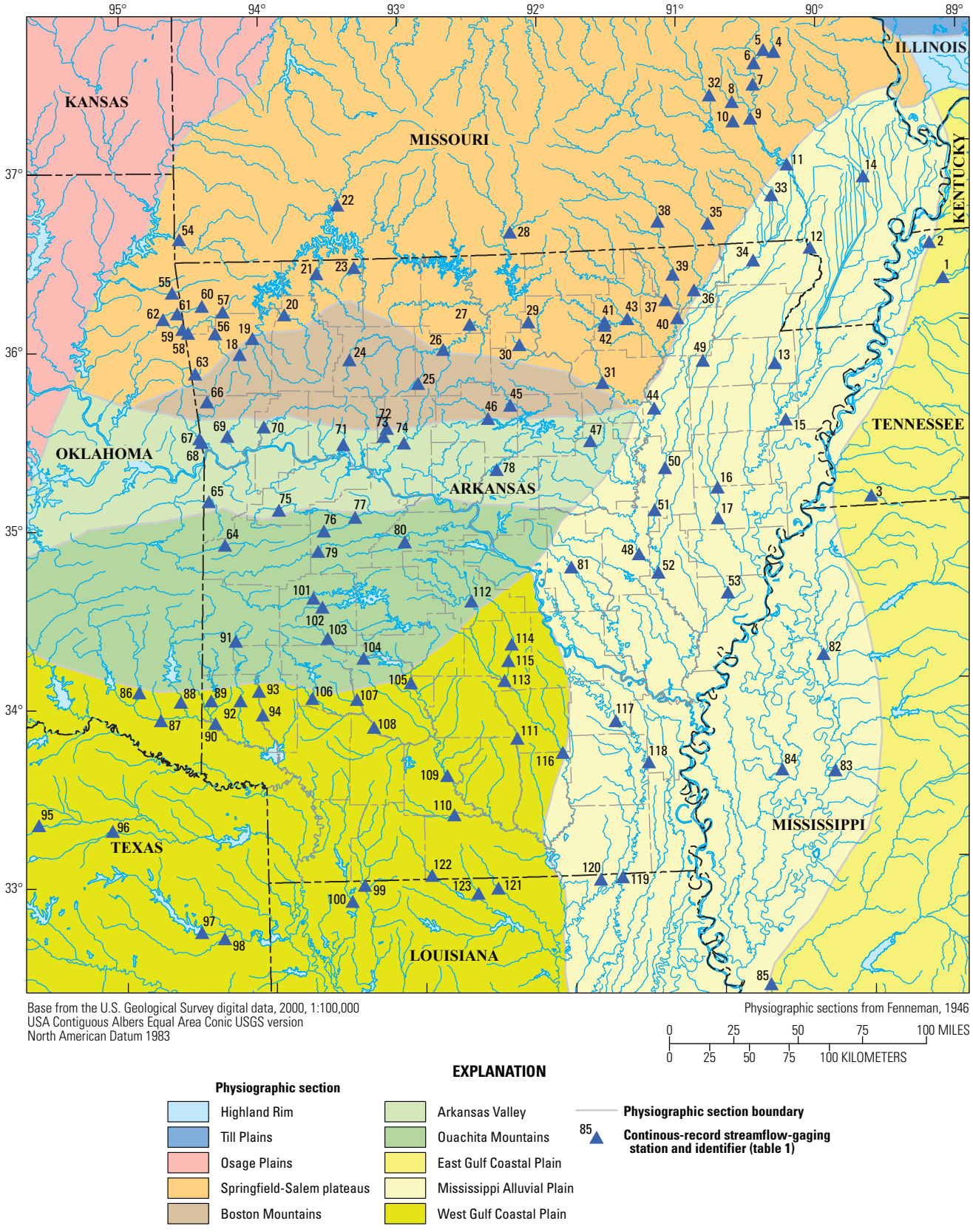


Figure 1. Locations of selected continuous-record streamflow-gaging stations and physiographic sections in Arkansas and sourrounding States.

Springfield-Salem plateaus with less karst development in the dolostone. The Boston Mountains are underlain by Pennsylvanian sandstone and shale deposited by south/southwestward flowing streams during times of low sea level. The Arkansas Valley is a low-lying region surrounding the Arkansas River and its valley. Parts of the section include mountain ridges that rise above the lowlands, separated by broad valleys. The surficial geology in the Arkansas Valley consists of a sequence of coal-bearing, weathered, Pennsylvanian sandstone and shale overlain by Quaternary alluvial sediments along the Arkansas River. The Ouachita Mountains consist of a mostly east-west trending series of sharp ridges, which are often buckled and distorted, separated by narrow to broad valleys underlain by Ordovician through Pennsylvanian shale, sandstone, novaculite, chert, and minor limestone. The Mississippi Alluvial Plain is a relatively level plain containing mostly unconsolidated alluvial sediments of gravel, sand, silt, clay, and loess. The West Gulf Coastal Plain is a south-sloping plain of gently rolling hills. The northwestern part of the West Gulf Coastal Plain in Arkansas is underlain by Cretaceous gravel, sand, clay, marl, and limestone; the remaining part is underlain by Tertiary clay, sand, and silt with lignite deposits and Quaternary gravel, sand, and clay (Arkansas Geological Survey, 2013).

Purpose and Scope

The purpose of this report is to describe the results of a study of long-term mean annual, seasonal, and monthly precipitation and runoff in Arkansas for the period from 1951 through 2011 and describe the factors related to precipitation and runoff variability. The results of the study are presented in a series of maps depicting mean annual and seasonal precipitation, total runoff, groundwater runoff, and surface runoff, which were prepared by using a geostatistical interpolation model, and graphs of mean monthly precipitation and runoff.

Limitations

Typically, runoff maps are constructed by contouring runoff values calculated from data at specific locations, such as streamflow-gaging stations. Simple contouring of runoff point data does not account for the spatial variability in the factors that affect runoff including climate, land use, vegetation, geology, soil type, elevation, slope, topography, drainage network patterns, lakes, and reservoirs. Ideally, regional runoff equations would be developed that incorporate all of these factors. The development of regional equations is time consuming, expensive, and beyond the scope of this report. To improve on the traditional contouring method, a geostatistical interpolation model (esri, 2010) was used to produce the runoff raster maps presented in this report.

Interpolated data provide a continuous grid of cells across an area of interest with each cell representing an individual and unique data value. Data interpolation models make predications from known data and produce a continuous grid of new values for all locations including those with known data. Different interpolation models are governed by different sets of equations; accordingly, one model will represent the data better than another. Ideally, the interpolated grid would be generated from evenly spaced, high-quality point data that represent the potential spatial variability. However, this rarely is the case and sometimes the data can be overrepresented in populated areas and be sparse in others. For example, Daly and others (2008) noted the precipitation data might not match well against the point data level, but value comparisons were similar when data were averaged over larger areas. This aspect can be related to all the interpolated grids provided as part of this report.

The accuracy of runoff estimates depends on the period of record used for the analysis. Records for a station operated during a period of extreme climatological conditions, such as mostly wet or mostly dry years, exhibit a bias toward the extreme. A long-term station with a record representative of long-term climatological conditions provides a more reliable runoff estimate because extremes have less weight in the determination of runoff characteristics.

Groundwater runoff estimates were made using base-flow index (BFI) (Wahl and Wahl, 1988, 1995) values calculated from USGS continuous-record streamflow-gaging station data. Because the flow data were not parsed by month or season before BFI values were determined, the user should consider annual groundwater runoff estimates more reliable than monthly or seasonal estimates.

Total runoff estimates, and in turn, groundwater and surface runoff estimates for the Mississippi Alluvial Plain section should be used judiciously. Runoff estimates are affected by anthropogenic influences such as stream regulation, effluent discharge, and groundwater depletion, which change the natural flow of a stream. Streams within the Mississippi Alluvial Plain have been hydrologically altered (channelized, impounded, and diverted) to suit agricultural purposes (Justus, 2003). Also, analysis of the Mississippi embayment aquifer system groundwater budget by the Mississippi Embayment Regional Aquifer Study (MERAS) indicated changes in groundwater storage have occurred. The study suggested that, as of about 1986, the Mississippi embayment aquifer system is no longer providing groundwater runoff to the streams, but that the streams are providing recharge to the aquifer system (Clark and others, 2011). Furthermore, it appears the substantial number of large reservoirs in the upper watersheds of the White and Black Rivers have created a ridge of artificial elevated runoff values in the lower parts of these watersheds located in the Mississippi Alluvial Plain. Because this study examined long-term means (1951–2011), recent changes in hydrologic conditions are not well represented in the results presented.

Previous Studies

Mean annual precipitation and mean annual runoff data for Arkansas are in need of reevaluation. The last known statewide study of average annual precipitation and average annual runoff (Freiwald, 1984) was completed 30 years ago and was compiled for the period 1951 through 1980. Hedman and others (1987) developed precipitation and runoff maps of the Ozark region, which included parts of northern Arkansas. Patterson (1971) included a small precipitation map of Arkansas that only included data through 1958 in a flood study report. Moix and Galloway (2004) characterized base flow (groundwater runoff), water-quality, and stream gain and loss in the Buffalo River Basin in north-central Arkansas for the period of July and August 2003. Langbein (1949), Busby (1966), and Gebert and others (1987) developed runoff maps for the whole United States. Wolock (2003a, 2003b) published geospatial raster digital data sets for a base-flow index grid (Wolock, 2003a) and for estimated mean annual natural groundwater recharge (Wolock, 2003b) for the conterminous United States.

Methods

The following sections describe the methods used to estimate mean annual, seasonal, and monthly precipitation and runoff in Arkansas for the period 1951–2011. These include the method used to determine the wet and dry seasons, how precipitation estimates were derived, the selection of continuous-record streamflow-gaging stations, how runoff estimates (including total runoff, groundwater runoff, and surface runoff) were derived, and how runoff surfaces were interpolated.

Determination of Wet and Dry Seasons

Wet and dry seasons were determined by using the Independent-Samples t-Test on the mean monthly total runoff data (see the Runoff section of the report). The Independent-Samples t-Test compares means for two groups and evaluates whether the means for two groups are significantly different from each other (Dowdy and Wearden, 1983). The monthly mean total runoff data were divided into two groups, wet season (μ_W) and dry season (μ_D), and tested using the null hypothesis (H_0): $\mu_W = \mu_D$, and the alternative hypothesis (H_1): $\mu_W \neq \mu_D$, at a 95-percent confidence level ($\alpha = 0.05$). The test was repeated with the monthly data being divided into different groupings of wet and dry seasons. Grouping the months of December through May into the wet season and June through November into the dry season produced results having a significant difference between wet season and dry season with the largest t value and the smallest pooled variance.

Precipitation

The precipitation data used for this study were derived from the Parameter-elevation Regressions on Independent Slopes Model (PRISM; PRISM Climate Group, 2013), which is spatially gridded and available on a monthly and annual time step for the period of interest. PRISM data include the interpolation of point data from precipitation monitoring stations, the pattern and effects of mountainous terrain, and other climatic parameters influencing precipitation in the development of a continuous grid for the United States (PRISM Climate Group, 2013). The precipitation data were distributed across Arkansas at a cell size resolution of approximately 2.5 miles (mi) on a side. Annual and seasonal values were produced by summing the appropriate monthly grids.

Selection of Continuous-Record Streamflow-Gaging Stations

Runoff values in this report were estimated from data collected at 123 active and inactive USGS continuous-record streamflow-gaging stations located in Arkansas and surrounding States (fig. 1, table 1 at end of report). Continuous-record streamflow-gaging stations record continuous stream stage (gage height) from which daily, monthly, and annual mean streamflow were computed. Annual, seasonal, and monthly runoff values were estimated from annual daily mean and monthly mean discharge values from continuous-record streamflow-gaging stations with 20 or more years of data for the period from 1951 through 2011 (U.S. Geological Survey, 2013); a few stations with less than 20 years of record (table 1) were included to provide data in areas where no data were otherwise available. Some continuous-record streamflow-gaging stations were eliminated from the study because they were located downstream from large reservoirs or springs, which adversely affected runoff estimates. To improve interpolation near the State borders, gaging stations located outside of Arkansas also were chosen. Of the 123 continuous-record streamflow-gaging stations chosen, 81 were from Arkansas, 7 from northern Louisiana, 4 from western Mississippi, 16 from southern Missouri, 8 from eastern Oklahoma, 3 from western Tennessee, and 4 from northeastern Texas (fig. 1, table 1).

Runoff

Means for total runoff, groundwater runoff, and surface runoff were estimated on an annual, seasonal, and monthly basis for the 123 active and inactive USGS continuous-record streamflow-gaging stations. Annual total runoff estimates for each gaging station were made using annual daily mean discharge data (U.S. Geological Survey, 2013), while seasonal and monthly total runoff estimates were made using monthly mean discharge data (U.S. Geological Survey, 2013). Annual, seasonal, and monthly groundwater runoff estimates were made by multiplying the annual, seasonal, and monthly total

runoff estimates for each gaging station by the BFI values associated with each gaging station. Annual, seasonal, and monthly surface runoff estimates for each gaging station were made by subtracting the groundwater runoff estimate from the total runoff estimate. These data were plotted geographically and interpolated using a geostatistical method to produce the runoff map figures presented in this report.

Total Runoff

Mean annual total runoff was estimated using annual daily mean discharge data (U.S. Geological Survey, 2013) from selected USGS continuous-record streamflow-gaging stations. The annual mean daily flow estimates were converted to total annual flow and divided by the drainage area to determine the annual total runoff. The annual total runoff estimates were summed and divided by the number of years of gaging record to determine the mean annual total runoff estimates (table 2 at end of report and appendix 1). (Appendix 1 is an Excel spreadsheet containing location information, drainage areas, PRISM precipitation estimates, and annual, monthly, and seasonal runoff estimates for each USGS continuous-record streamflow-gaging station analyzed. Appendix 1 is available online only at http://pubs.usgs.gov/sir/2014/5006/.

The total mean runoff estimates for the wet and dry seasons were determined using monthly mean discharge data (U.S. Geological Survey, 2013) from selected USGS continuous-record streamflow-gaging stations for each year of the gaging record. The wet season was defined by grouping data from the months of December through May, while the dry season was defined by grouping data from the months of June through November. The monthly mean discharge data were multiplied by the number of days in the month to determine the total monthly mean flow and divided by the drainage area to determine the monthly mean runoff. The monthly mean runoff values for the months in the wet and dry seasons, respectively, were summed and divided by the number of years of gaging record to determine the mean wet and dry season total runoff (table 2 and appendix 1).

Groundwater Runoff

Mean groundwater runoff is the portion of the total runoff from seepage of water from the ground into a stream channel. Groundwater runoff is estimated by multiplying the total runoff by the BFI. The BFI is the ratio of groundwater runoff to total runoff, expressed as a percentage. A BFI reference grid for the conterminous United States based on point estimates from analysis of USGS continuous-record streamflow-gaging station data was first published in 2003 by Wolock (2003a). Wolock has maintained this BFI database and provided this study with average BFI values for the streamflow-gaging stations used for analysis (D.M. Wolock, U.S. Geological Survey, written commun., 2013) (table 2 and appendix 1). Wolock computed BFI values using an automated hydrograph separation computer program called the BFI program (Wahl and Wahl, 1988, 1995). Additional information on the BFI program is available on the BFI Web page at http://www.usbr.gov/pmts/hydraulics_lab/twahl/bfi/index.html.

Surface Runoff

Surface runoff is that part of the total runoff that travels over the land surface to the nearest stream channel or that part of the total runoff of a drainage basin that has not passed beneath the land surface since precipitation. Surface runoff was estimated by subtracting the groundwater runoff from the total runoff (table 2 and appendix 1).

Runoff Surface Interpolation

Five different surface interpolation models were tested to determine which model produced the most accurate surfaces for the mean annual runoff point data. Surface interpolation models create a continuous raster surface from input point values by computing a value for each raster cell on the continuous surface. It was important to use a model that can maximize the ability to match known data points and also have a strong predictive ability by accounting for variability. Interpolation models are generally divided into deterministic and geostatistical methods. Four deterministic interpolation models were tested: the Inverse Distance Weighted (IDW) model; the Natural Neighbor (NN) model; the Spline model; and the Topo to Raster (Topo) model. Kriging was the only geostatistical model tested (esri, 2010).

To test the accuracy of the different interpolation models, the original mean annual runoff dataset was divided into two parts. The first part, called the training set, was used to model a raster surface, and the second part, called the test set, was used to compare and validate the modeled raster surface. From the original 126 mean annual runoff data points, 11 points were randomly selected for the test dataset. The remaining 115 mean annual runoff data points were used for the training dataset. Using the training dataset, nine raster surfaces were interpolated using model default values, one each for IDW, NN, and Topo, two for Spline (one using regularized default values and one using tension default values), and four Kriging (one using Simple Kriging default values, one using Universal Kriging with no transformation type default values, one using Universal Kriging with a Log Order transformation default values, and one using Universal Kriging with a Box-Cox transformation default values). From these nine raster surfaces, the cell value at each test site location was determined. The test site raster cell values were compared with the corresponding mean annual runoff values from the test set and the percent differences and absolute differences for each point were calculated. The raster surface developed using the Simple Kriging model provided the lowest mean percent difference (3.66 with a standard deviation [σ] of 2.34) and the lowest mean absolute difference (6.31 with a σ of 0.57). This same test methodology was used to determine

what Simple Kriging input values produced the most accurate raster surface. The Simple Kriging model using 19 input data points within a spherical radius provided the lowest mean percent difference (3.23 with a σ of 1.85) and the lowest mean absolute difference (5.58 with a σ of 0.51). The runoff maps in this report were developed from nine raster surfaces interpolated using the Simple Kriging model with 19 input data points within a spherical radius and with a cell size resolution of approximately 1.4 mi on a side.

To quantify the accuracy of the Simple Kriging model used to generate the nine runoff maps, the root mean squared error (RMSE) was calculated for each model. The RMSE provides an indication of how closely a model predicts the measured value (esri, 2010). The smaller the RMSE value, the more closely the model prediction matches the measured values. The RMSE values for mean annual, wet season, and dry season total runoff were 0.70, 2.21, and 1.07 in., respectively. The RMSE values for mean annual, wet season, and dry season groundwater runoff were 1.38, 0.90, and 0.57 in., respectively. The RMSE values for mean annual, wet season, and dry season surface runoff were 1.47, 0.49, and 0.59 in., respectively. RMSE values were calculated using the following equation:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(p_i - r_i\right)^2}$$

where

n is the number of paired predicted and estimated values,

p_i is the i^{th} value predicted by the geostatistical interpolation model, and

r_i is the i^{th} runoff value estimated from gaging station data.

Raster Maps

Estimates for precipitation and runoff are presented in a series of 12 single map figures (figs. 2–13) and one multimap figure (fig. 14). These maps were created using PRISM raster data for precipitation and the raster estimates from the runoff interpolations for annual, wet season, and dry season runoff. The georeferenced raster and contour layers used to create these figures are available online in a geographic information system (GIS) raster format and a keyhole markup language (KML) compatible format (appendixes 2 and 3 available online only at http://pubs.usgs.gov/sir/2014/5006/).

Annual, Seasonal, and Monthly Mean Precipitation

Precipitation in Arkansas is normally abundant and well distributed throughout the year with the largest amounts occurring in the Ouachita Mountains section and the smallest amounts occurring in the Springfield-Salem plateaus section. The mean annual precipitation in Arkansas for the period from 1951 through 2011 was 49.8 in. (figs. 2 and 14, table 3 at end of report) with monthly means ranging from 3.0 in. occurring in August to 5.2 in. occurring in May (table 4 at end of report). Arkansas' mean wet season precipitation was 26.9 in., ranging from 20.6 in. at a location in the Springfield-Salem plateaus section to 34.1 in. at a location in the Ouachita Mountains section (figs. 3 and 14, table 3). Arkansas' mean dry season precipitation was 22.9 in., ranging from 19.7 in. at a location in the Mississippi Alluvial Plain section to 31.2 in. at a location in the Ouachita Mountains section (figs. 4 and 14, table 3).

The Ouachita Mountains section received the largest mean annual precipitation at 53.0 in. and the largest mean dry season precipitation at 24.9 in. (table 3). The minimum mean monthly precipitation in the Ouachita Mountains section was 3.0 in. occurring in August, while the maximum mean monthly precipitation was 5.7 in. occurring in May (table 4). The Ouachita Mountains section, and to lesser extent, the Boston Mountains section received larger amounts of precipitation because of the local orographic lifting of moisture moving over these sections and falling as precipitation (Foti, 2011; U.S. Department of Agriculture, 1971, 1975a, 1975b).

The Springfield-Salem plateaus section received the smallest mean annual precipitation at 45.5 in. and the smallest mean wet season precipitation at 23.2 in. (table 3). The minimum mean monthly precipitation in the Springfield-Salem plateaus section was 2.7 in. occurring in January, while the maximum mean monthly precipitation was 5.0 in. occurring in May (table 4). The Springfield-Salem plateaus section, and to a lesser extent, the Arkansas Valley section received smaller amounts of precipitation because of local orographic lifting in the Boston and Ouachita Mountains, resulting in leeward rain shadows reducing precipitation in the Springfield-Salem plateaus and Arkansas Valley sections (Foti, 2011; U.S. Department of Agriculture, 1975a, 1975b).

The Mississippi Alluvial Plain section received an intermediate amount of mean annual precipitation at 49.9 in. but had the largest mean wet season precipitation at 28.3 in. and the smallest mean dry season precipitation at 21.6 in. (table 3). The minimum mean monthly precipitation in the Mississippi Alluvial Plain section was 2.9 in. occurring in August, while the maximum mean monthly precipitation was 5.1 in. occurring in April and May (table 4). Precipitation in the Mississippi Alluvial Plain during the wet season was associated with warm frontal systems or wintery low pressure systems approaching from the Southern Plains or the Gulf of Mexico and provided a reliable source of moisture, while sporadic single storm events provided less reliable precipitation during the dry season (U.S. Department of Agriculture, 1971, 1978).

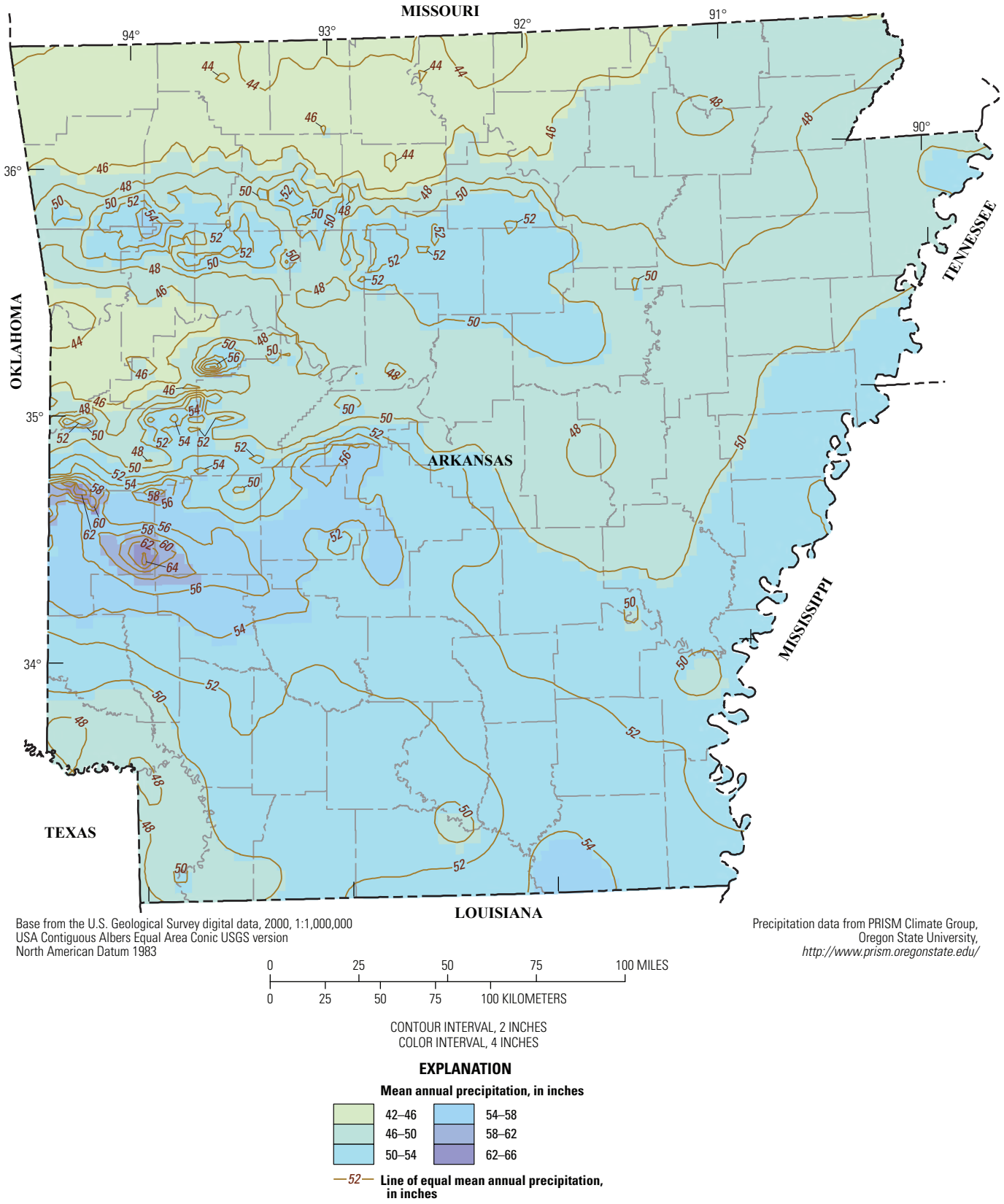


Figure 2. Mean annual precipitation in Arkansas, 1951–2011.

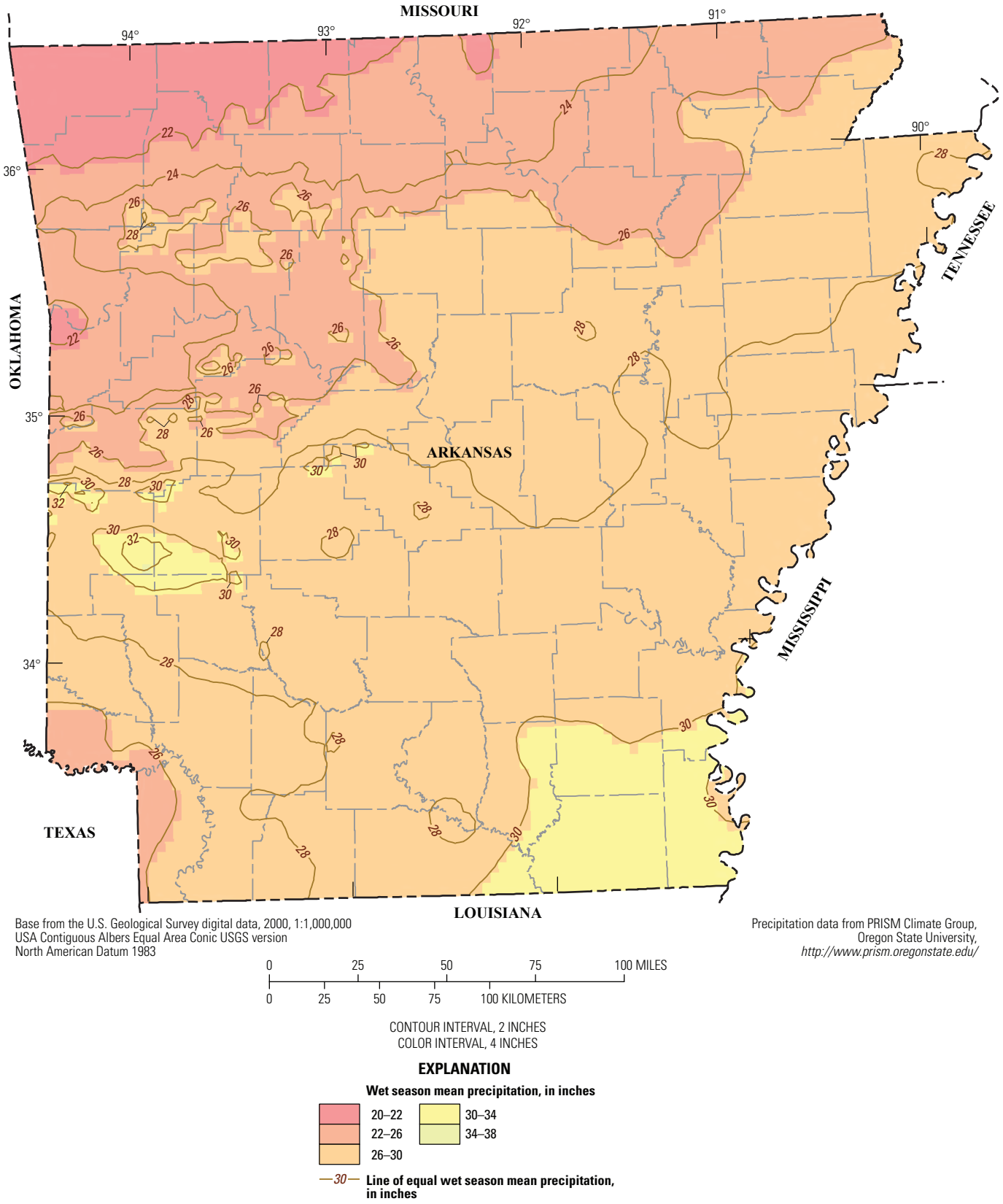


Figure 3. Map showing mean wet season precipitation in Arkansas, 1951–2011.

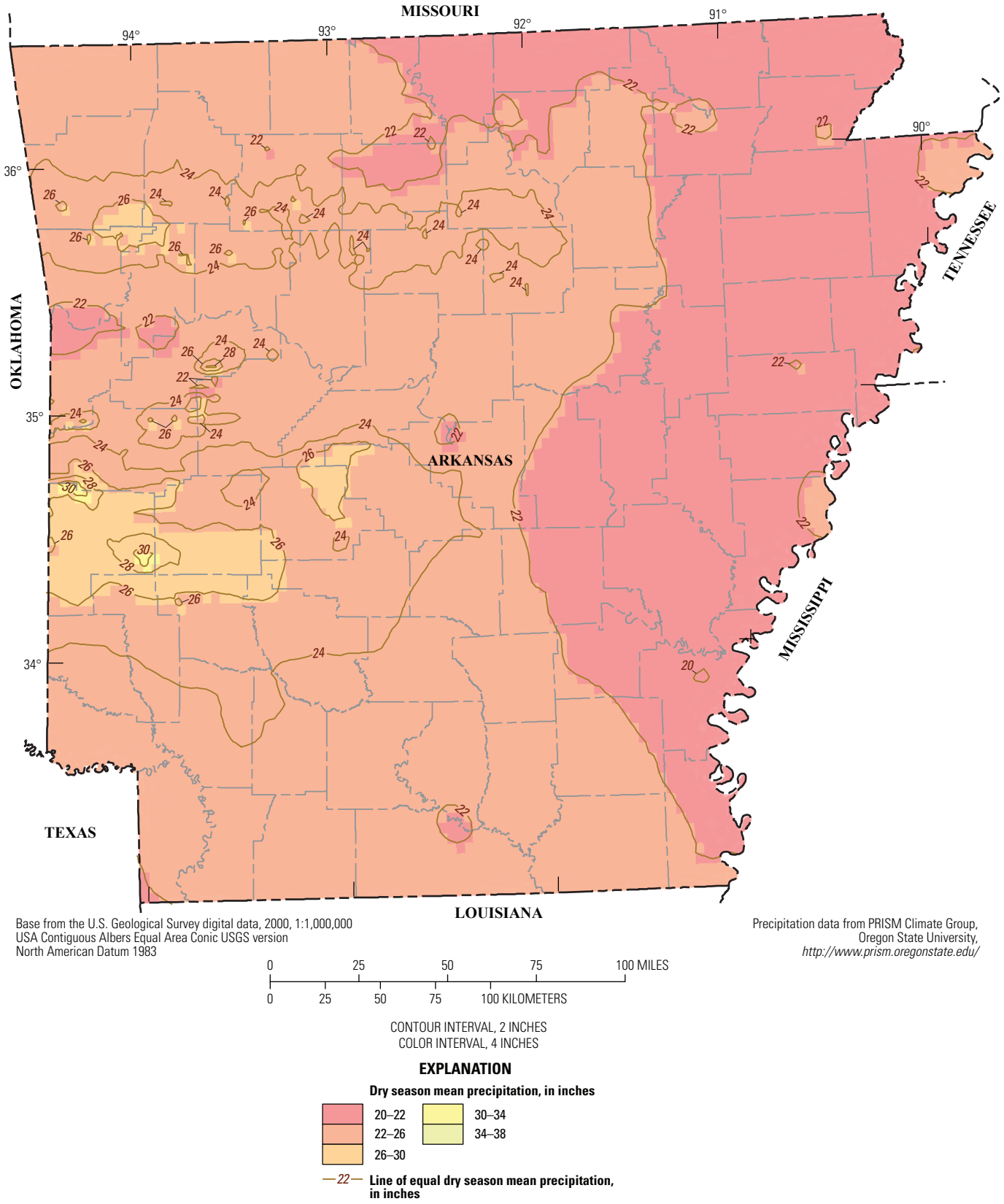


Figure 4. Map showing mean dry season precipitation in Arkansas, 1951–2011.

Mean Annual, Seasonal, and Monthly Runoff

Runoff occurs chiefly as a residual of precipitation after demands for evapotranspiration, groundwater recharge, and consumptive uses have been supplied. Maximum runoff occurs during periods of intense precipitation on saturated soils when there is little time for losses from evapotranspiration, groundwater recharge, or consumptive uses to occur before the water enters a stream. Arkansas experiences a wide range of runoff resulting from local differences in climate, land use, vegetation, geology, soil type, elevation, slope, topography, drainage network patterns, lakes, and reservoirs.

Mean Annual, Seasonal, and Monthly Total Runoff

The mean annual, wet season, and dry season total runoff patterns for Arkansas generally reflect precipitation patterns while experiencing greater losses from increased evapotranspiration and consumptive uses during the dry season. The mean annual, wet season, and dry season total runoff for 1951–2011 in Arkansas was 17.8 in., 13.2 in., and 4.3 in., respectively (table 3). Statewide, the smallest mean monthly total runoff occurred in August, with a value of 0.4 in., while the largest mean monthly total runoff occurred in March and April, with values of 2.6 in. (table 4).

The Ouachita Mountains section experienced the largest mean annual total runoff at 20.4 in., the largest mean wet season total runoff at 14.8 in., and the largest mean dry season total runoff at 4.6 in. (figs. 5, 6, 7 and 14, table 3). The minimum mean monthly total runoff in the Ouachita Mountains section was 0.3 in., occurring in August, while the maximum mean monthly total runoff was 3.0 in., occurring in March (table 4). The larger mean total runoff values in the Ouachita Mountains section may be attributed to larger precipitation amounts, steeper gradients, and relatively impermeable surficial geology. Rapid runoff associated with these variables limits time available for evapotranspiration and groundwater recharge, increasing surface runoff and reducing total runoff losses.

The Springfield-Salem plateaus section experienced the smallest mean annual total runoff at 15.0 in. and the smallest mean wet season total runoff at 11.7 in. (figs. 5, 6, and 14, table 3). The minimum mean monthly total runoff in the Springfield-Salem plateaus section was 0.4 in., occurring in August, while the maximum mean monthly total runoff was 2.5 in., occurring in April (table 4). The Springfield-Salem plateaus section consists of dissected karst, limestone and dolostone with relatively thin soils on steep slopes. The smaller mean total runoff values in the Springfield-Salem plateaus are the result of smaller precipitation amounts and the rapid infiltration through the thin soils and into the underlying karst limestone and dolostone.

The Boston Mountains and Arkansas Valley sections are different topographically and geologically, but through different mechanisms, both yield the smallest mean dry season total runoff of 4.1 in. (figs. 7 and 14, table 3). The minimum mean monthly total runoff in the Boston Mountains and Arkansas Valley sections was 0.3 in., occurring in August, while the maximum mean monthly total runoff was 2.8 in., occurring in April in the Boston Mountains and in March and April in the Arkansas Valley (table 4). The Boston Mountains section contains a large percentage of forested areas, which intercept and quickly take up precipitation resulting in large runoff losses from evapotranspiration. The Arkansas Valley consists of gently undulating, low topography underlain by weathered limestone and sandstone. The combination of low slopes and weathered bedrock produces larger runoff losses to evapotranspiration and groundwater recharge resulting in smaller total runoff in the Arkansas Valley.

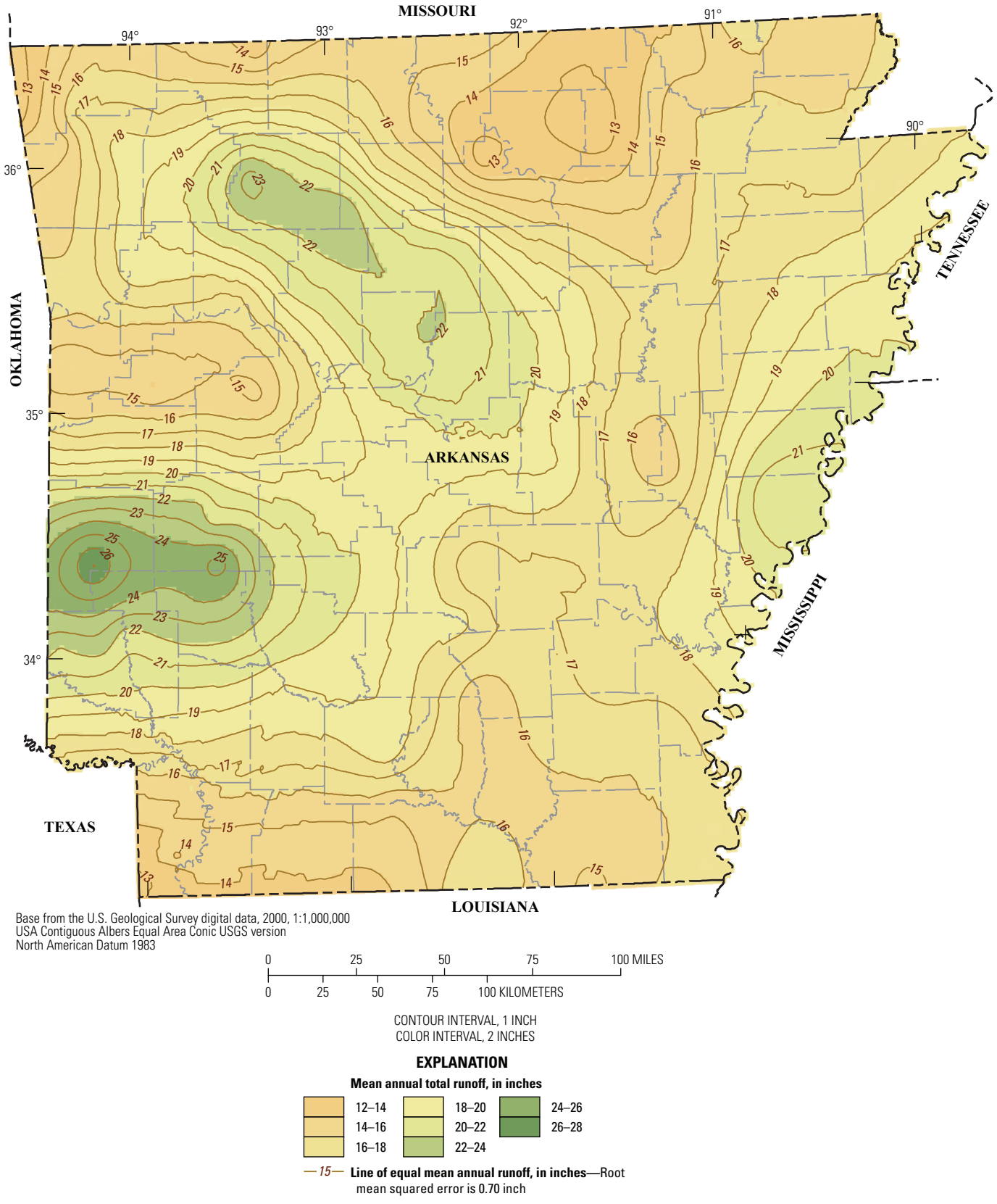


Figure 5. Mean annual total runoff in Arkansas, 1951–2011.

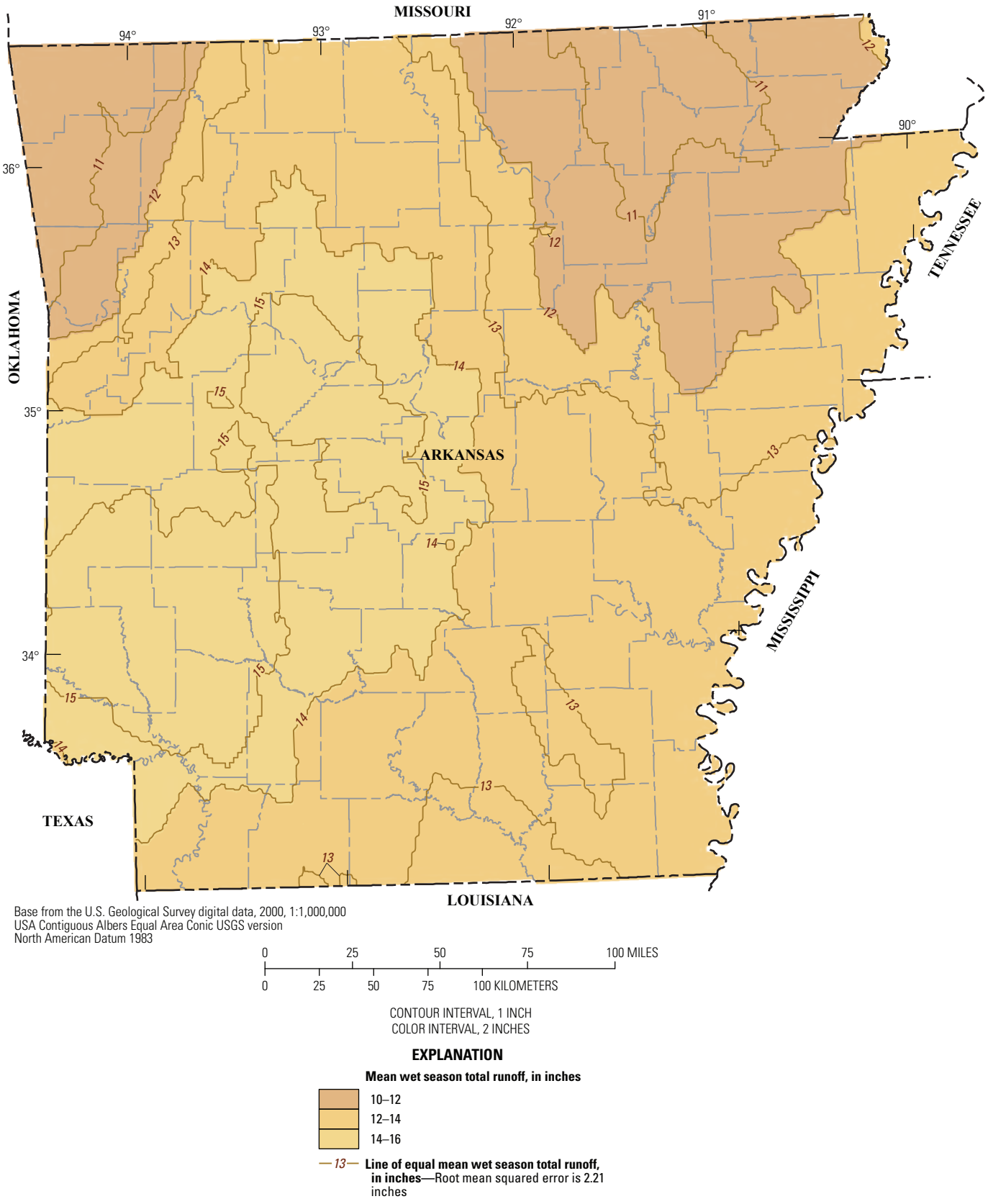


Figure 6. Map showing mean wet season total runoff in Arkansas, 1951–2011.

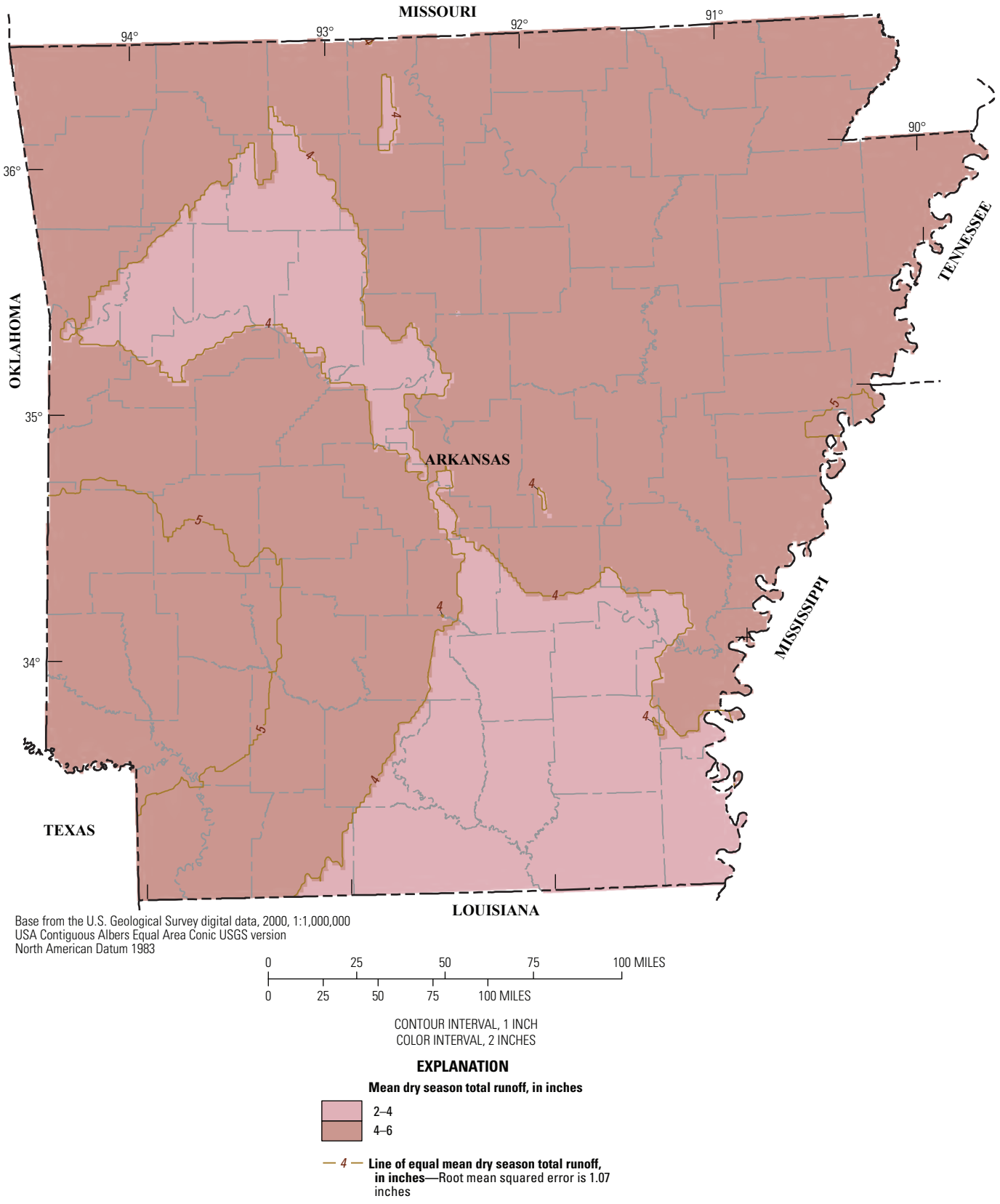


Figure 7. Map showing mean dry season total runoff in Arkansas, 1951–2011.

Mean Annual, Seasonal, and Monthly Groundwater Runoff

The mean annual, wet season, and dry season groundwater runoff in Arkansas are generally equal to approximately one-third of the mean annual, wet season, and dry season total runoff, and thus, follow the same general patterns. The mean annual, wet season, and dry season groundwater runoff for 1951–2011 in Arkansas was 6.1 in., 4.5 in., and 1.6 in., respectively (table 3). Statewide, the smallest mean monthly groundwater runoff occurred in July, August, September, and October with a value of 0.2 in., while the largest mean monthly groundwater runoff occurred in March and April with a value of 0.9 in. (table 4).

The Mississippi Alluvial Plain section experienced the largest mean annual groundwater runoff at 7.5 in., the largest mean wet season groundwater runoff at 5.6 in., and one of the largest mean dry season groundwater runoffs at 2.0 in. (figs. 8, 9, 10 and 14, table 3). The minimum mean monthly groundwater runoff was 0.2 in., occurring in September, while the maximum mean monthly groundwater runoff was 1.1 in., occurring in March (table 4). The Mississippi Alluvial Plain section overlies the Mississippi embayment aquifer system. Analysis from the MERAS model of the groundwater-flow budget suggests that through approximately 1986, the Mississippi embayment aquifer system lost slightly more water to overlying streams then was recharged back into the aquifer system. After 1986, the study suggests the Mississippi embayment aquifer system received slightly more water from overlying streams than was lost (Clark and others, 2011). The uppermost hydrogeologic unit of the Mississippi embayment aquifer system is the Mississippi River Valley alluvial aquifer. Recent studies of the Mississippi River Valley alluvial aquifer potentiometric surface indicate groundwater flow is away from the major rivers within the Mississippi Alluvial Plain section, suggesting these rivers are losing water to recharge the underlying Mississippi River Valley alluvial aquifer (Schrader, 2008, 2010). Because runoff values listed in this report are 61 year means, these more recent changes in the surface-groundwater interactions are not reflected in the results. Readers are cautioned to consider this stipulation before using the Mississippi Alluvial Plain groundwater runoff data.

The Springfield-Salem plateaus section also experienced the largest mean dry season groundwater runoff at 2.0 in. (figs. 10 and 14, table 3). The minimum mean monthly groundwater runoff in the Springfield-Salem plateaus was 0.2 in., occurring in August, while the maximum mean monthly groundwater runoff was 1.0 in., occurring in March and April (table 4). The Springfield-Salem plateaus are underlain by karstified limestone and dolostone, which releases water from groundwater storage to the streams producing larger dry season groundwater recharge values.

The Ouachita Mountains section experienced the smallest mean annual groundwater runoff at 4.9 in., the smallest mean wet season groundwater runoff at 3.7 in., and one of the smallest mean dry season groundwater runoffs at 1.2 in. (figs. 8, 9, 10 and 14, table 3). The minimum mean monthly groundwater runoff in the Ouachita Mountains section was 0.1 in., occurring in August and September, while the maximum mean monthly groundwater runoff was 0.8 in., occurring in March (table 4). The Ouachita Mountains section is underlain by relatively impermeable surficial geology resulting in little groundwater storage available to provide groundwater recharge to the streams.

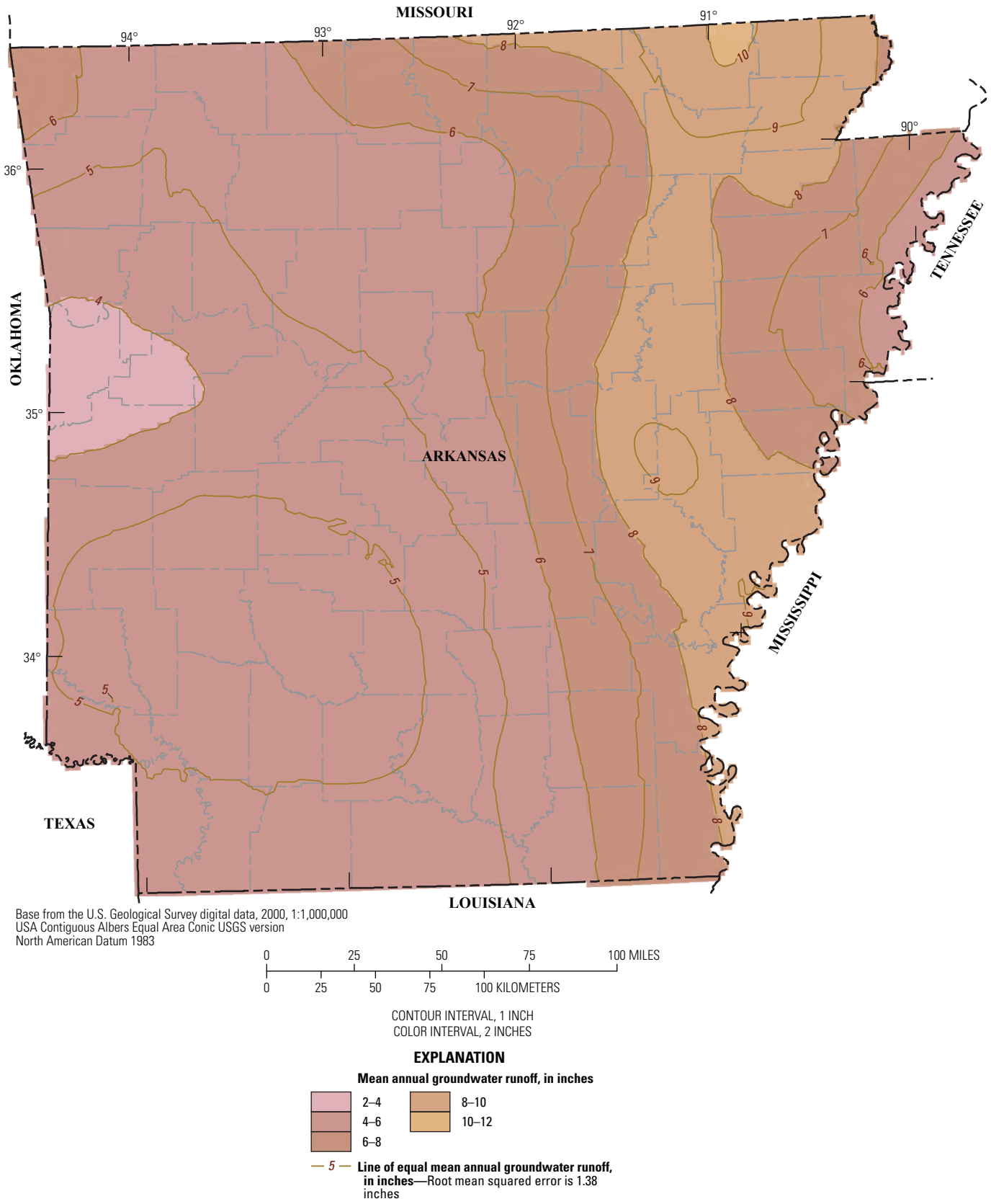


Figure 8. Mean annual groundwater runoff in Arkansas, 1951–2011.

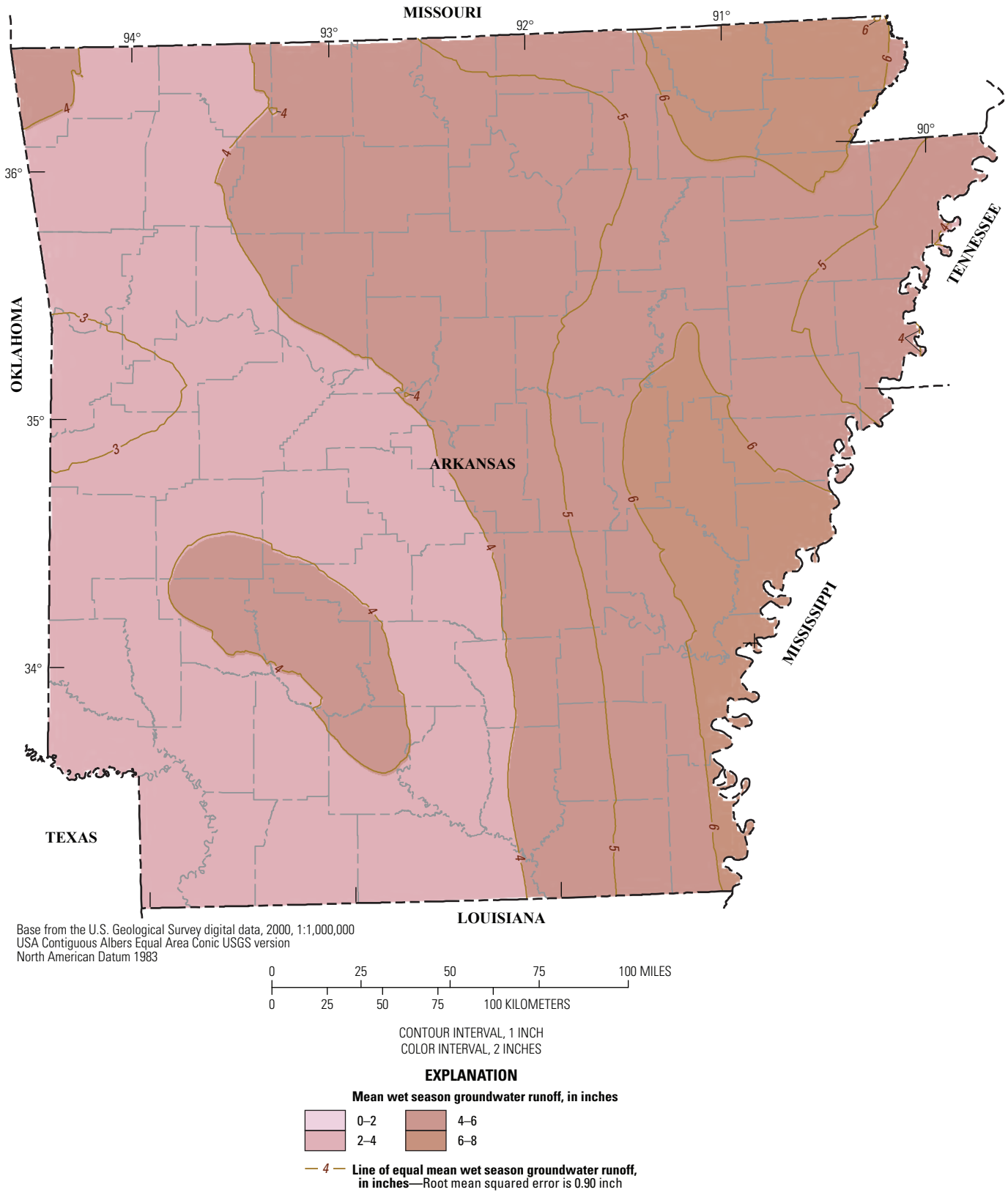


Figure 9. Mean wet season groundwater runoff in Arkansas, 1951–2011.

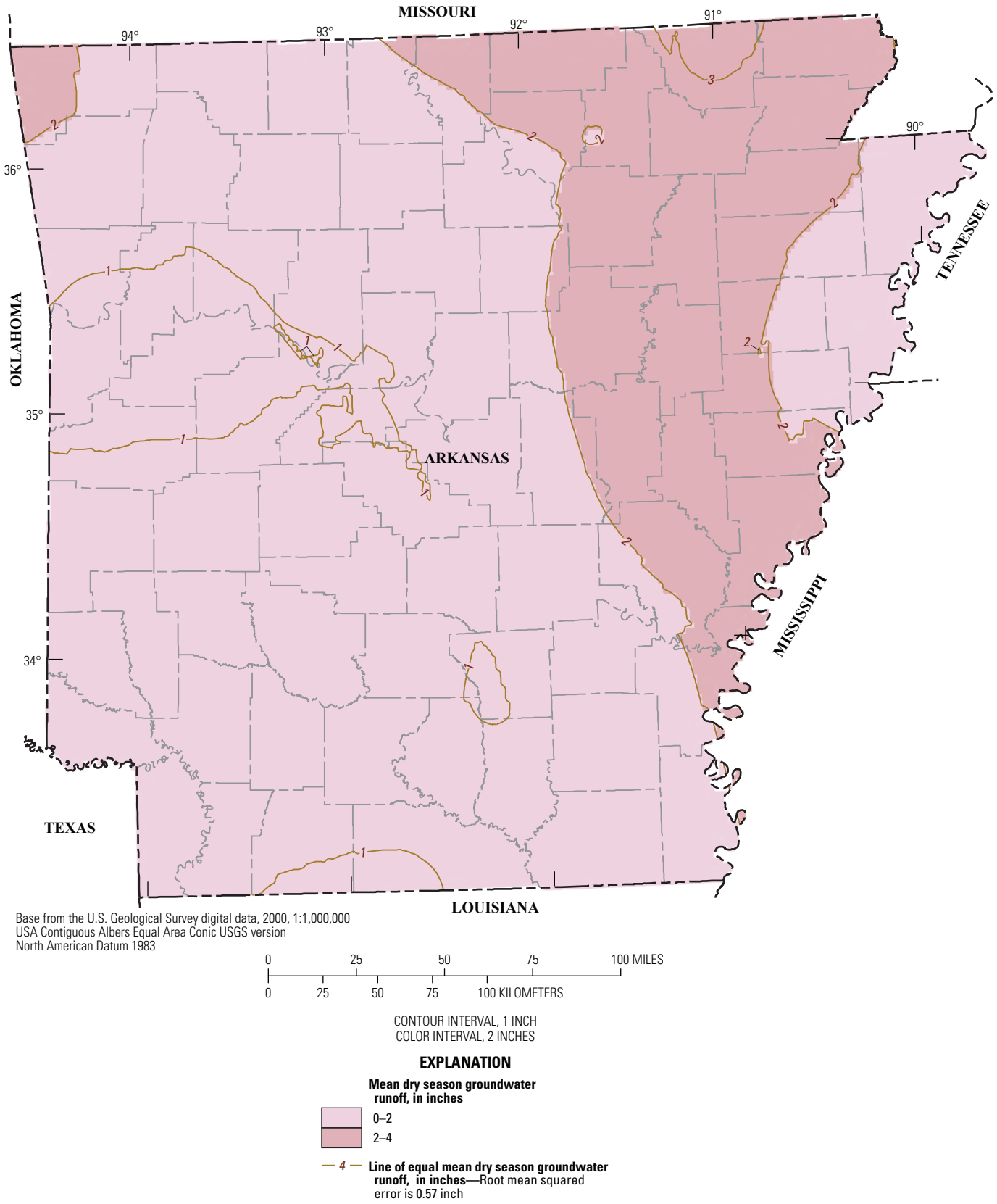


Figure 10. Mean dry season groundwater runoff in Arkansas, 1951–2011.

Mean Annual, Seasonal, and Monthly Surface Runoff

The mean annual, wet season, and dry season surface runoff in Arkansas are generally equal to approximately two-thirds of the mean annual, wet season, and dry season total runoff, and thus, follow the same general patterns. The mean annual, wet season, and dry season surface runoff for 1951–2011 in Arkansas was 11.4 in., 8.8 in., and 2.7 in., respectively (table 3). Statewide, the smallest mean monthly surface runoff occurred in August, with a value of 0.2 in., while the largest mean monthly surface runoff occurred in March, with a value of 1.8 in. (table 4).

The Ouachita Mountains section experienced the largest mean annual surface runoff at 14.5 in., the largest mean wet season surface runoff at 11.7 in., and the largest mean dry season surface runoff at 3.4 in. (figs. 11–14, table 3). The minimum mean monthly surface runoff in the Ouachita Mountains section was 0.2 in., occurring in August, while the maximum mean monthly surface runoff was 2.4 in., occurring in March (table 4). The larger mean surface runoff values in the Ouachita Mountains section may be attributed to larger precipitation amounts, steeper gradients, and relatively impermeable surficial geology. Rapid runoff associated with these variables limits time available for evapotranspiration and groundwater recharge, increasing surface runoff and reducing total runoff losses.

The Springfield-Salem plateaus section experienced the smallest mean annual surface runoff at 9.3 in., and the smallest mean wet season surface runoff at 5.7 in. (figs. 11, 12, and 14, table 3). The minimum mean monthly surface runoff in the Springfield-Salem plateaus section was 0.2 in., occurring in August, while the maximum mean monthly surface runoff was 1.5 in., occurring in April (table 4). The smaller surface runoff values occurred in the Springfield-Salem plateaus because the area receives smaller precipitation amounts and because the underling karst limestone and dolostone facilitate groundwater recharge.

The Mississippi Alluvial Plain section experienced the smallest mean dry season surface runoff at 2.3 in. (figs. 13–14, table 3). The minimum mean monthly surface runoff in the Mississippi Alluvial Plain section was 0.3 in., occurring in each of the four months of July, August, September, and October, while the maximum mean monthly surface runoff was 1.6 in., occurring in December (table 4).The Mississippi Alluvial Plain is a relatively level plain containing unconsolidated alluvial deposits capped by clay in many areas. The combination of low slopes and the impermeable clay cap produces large runoff losses to evapotranspiration, and in areas where the clay cap is missing, there are large runoff losses to groundwater recharge. Together these large runoff losses result in relatively small surface runoff values in the Mississippi Alluvial Plain.

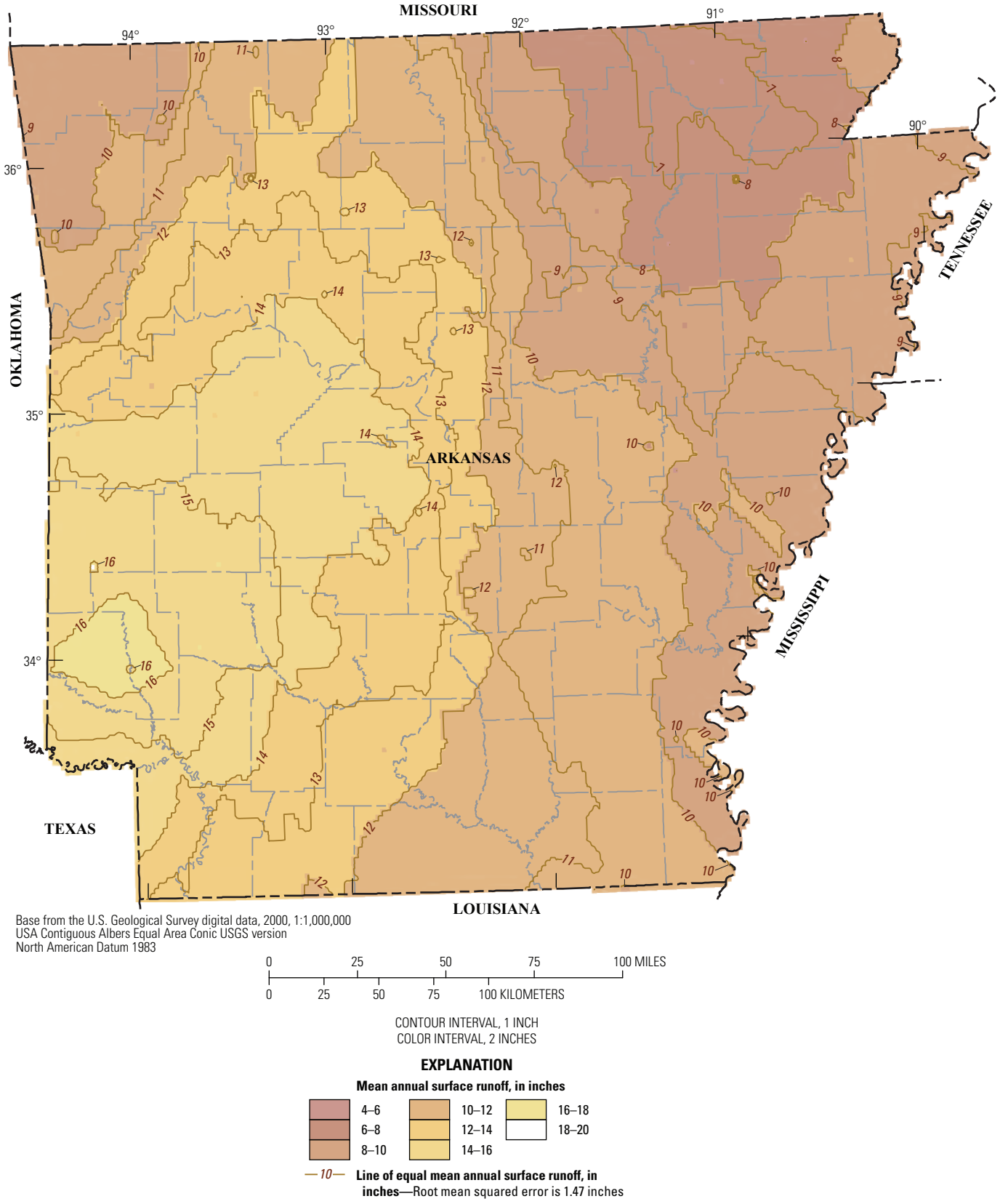


Figure 11. Mean annual surface runoff in Arkansas, 1951–2011.

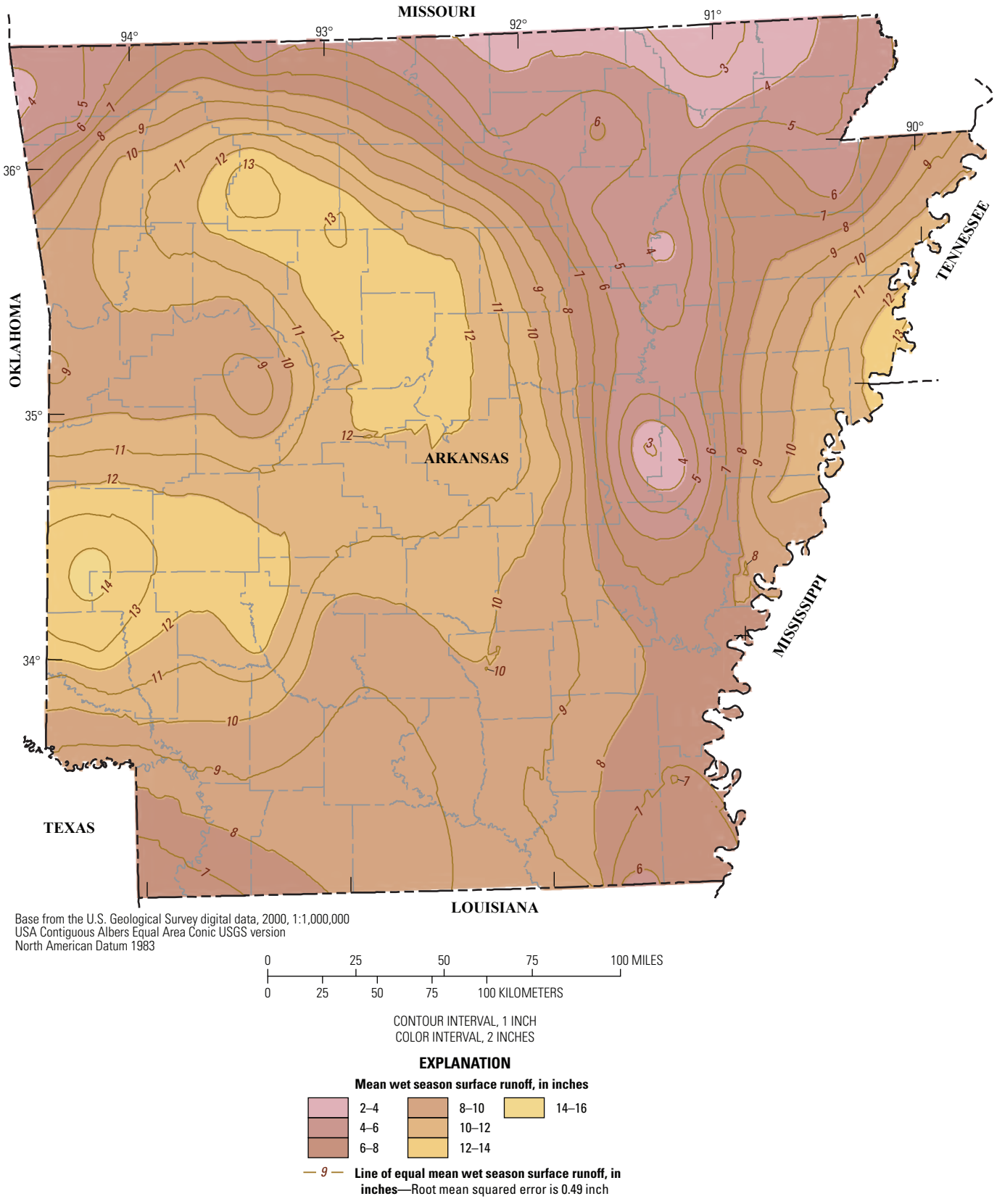


Figure 12. Map showing mean wet season surface runoff in Arkansas, 1951–2011.

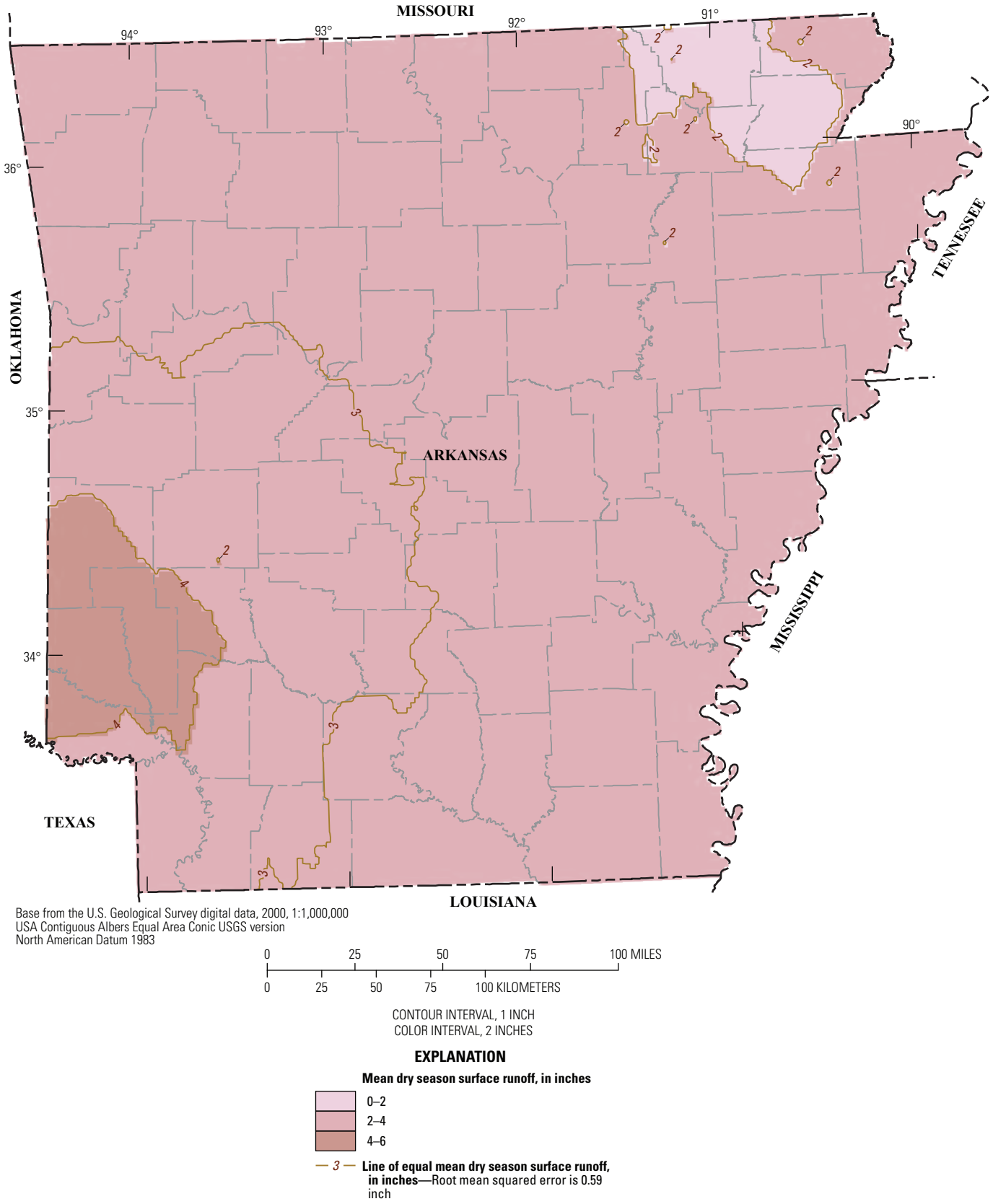
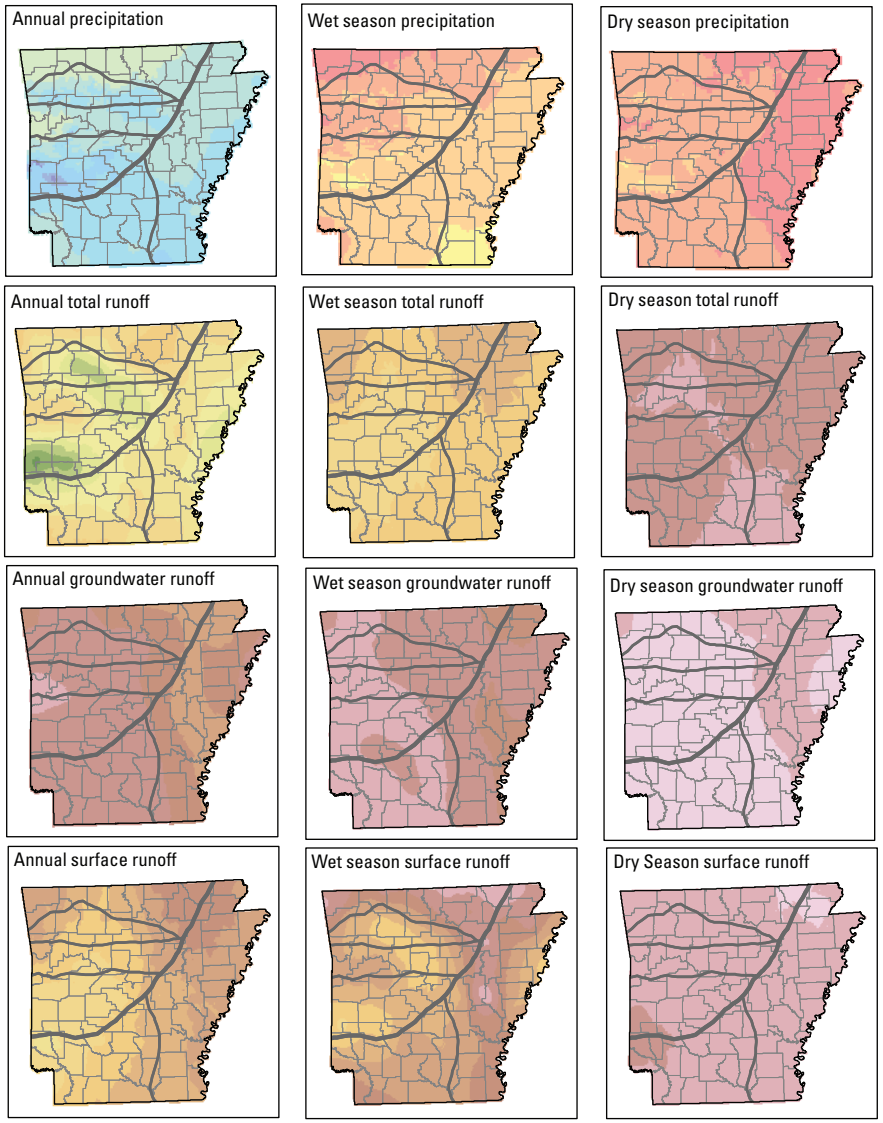


Figure 13. Map showing mean dry season surface runoff in Arkansas, 1951–2011.



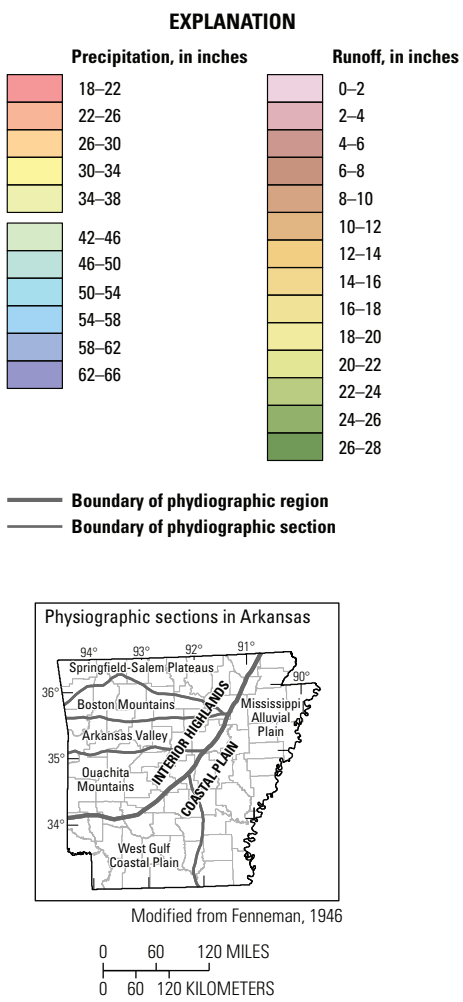


Figure 14. Maps showing mean annual and mean seasonal precipitation and runoff in Arkansas, 1951–2011.

Temporal Distribution of Precipitation and Runoff

Precipitation for the period 1951–2011 in Arkansas was abundant and relatively evenly distributed through the year. The maximum mean monthly precipitation was in May (5.2 in., 10.6 percent of annual total), and the minimum was in August (3.0 in., 6.0 percent of annual total) (fig. 15, tables 4–5 at end of report). Similar distributions of precipitation were observed in each physiographic section, although maximum and minimum values varied and may have occurred in a preceding or succeeding month (fig. 16, tables 4–5).

Runoff for the period 1951–2011 in Arkansas had the same general pattern as precipitation. Arkansas' mean monthly total runoff was highest in March (2.6 in., 15.0 percent of annual total) and lowest in August (0.4 in., 2.3 percent of annual total) (fig. 15, tables 4–5). Similar distributions of runoff were observed in each physiographic section although maximum and minimum values varied and may have occurred in a preceding or succeeding month (fig. 16, tables 4–5).

During the dry season, the reduction in runoff results from decreased precipitation and increased losses from evapotranspiration and consumptive uses (increased irrigation, withdrawals for public and private water supplies). The reduction in runoff during the dry season is observed across the State in all physiographic sections (figs. 15–16, tables 3–5).

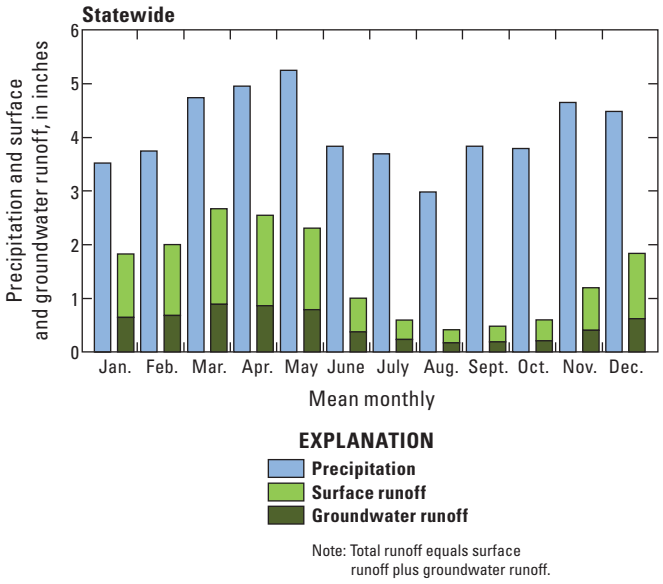


Figure 15. Mean monthly precipitation and runoff for Arkansas, 1951–2011.

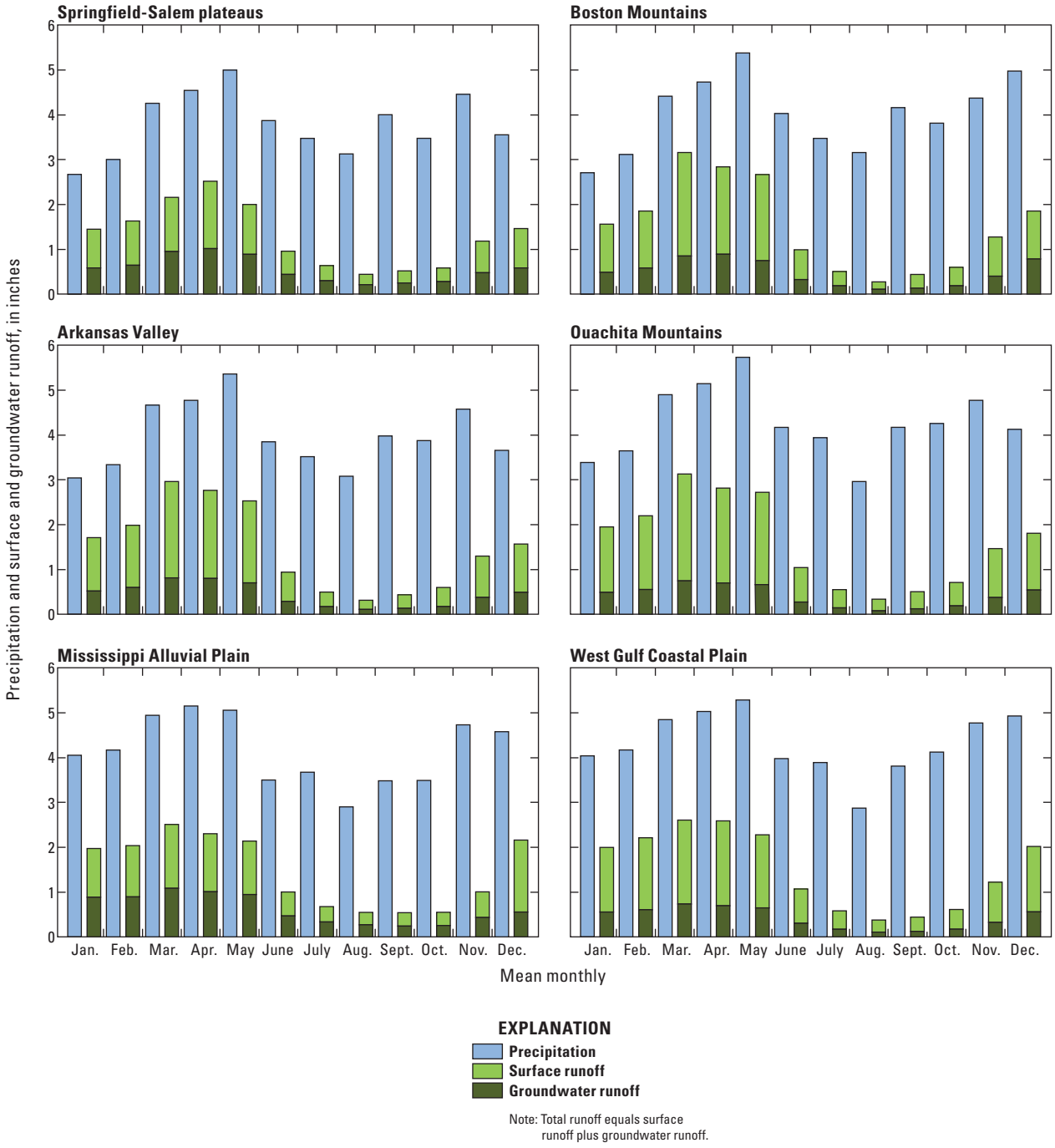


Figure 16. Mean monthly precipitation and runoff for physiographic sections in Arkansas, 1951–2011.

Summary

This report describes long-term annual, seasonal, and monthly means for precipitation and runoff in Arkansas for the period from 1951 through 2011. Precipitation means were estimated using data from the Parameter-elevation Regressions on Independent Slopes Model database; while total runoff, groundwater runoff, and surface runoff means were estimated using data from 123 active and inactive U.S. Geological Survey continuous-record streamflow-gaging stations located in Arkansas and surrounding States. Precipitation in Arkansas is abundant and relatively well distributed throughout the year. Annual precipitation in Arkansas for the period from 1951 through 2011 had a mean of 49.8 in. Of the six physiographic sections in Arkansas, the Ouachita Mountains had the largest mean annual precipitation at 53.0 in., while the Springfield-Salem plateaus had the smallest mean annual precipitation at 45.5 in. The mean wet season precipitation in Arkansas was 26.9 in. The Mississippi Alluvial Plain had the largest mean wet season precipitation at 28.3 in., and the Springfield-Salem plateaus had the smallest mean wet season precipitation at 23.2 in. The mean dry season precipitation in Arkansas was 22.9 in. The Ouachita Mountains had the largest mean dry season precipitation at 24.9 in., and the Mississippi Alluvial Plain had the smallest mean dry season precipitation at 21.6 in.

Arkansas exhibits a wide range of runoff values resulting from differences in climate, land use, vegetation, geology, soil type, elevation, slope, topography, drainage network patterns, lakes, and reservoirs. The mean annual total runoff for 1951–2011 in Arkansas was 17.8 in. The Ouachita Mountains had the largest mean annual total runoff at 20.4 in., while the Springfield-Salem plateaus had the smallest mean annual total runoff at 15.0 in. The mean annual groundwater runoff for Arkansas was 6.1 in. The Mississippi Alluvial Plain had the largest mean annual groundwater runoff at 7.5 in., while the Ouachita Mountains had the smallest mean annual groundwater runoff at 4.9 in. The mean annual surface runoff for Arkansas was 11.4 in. The Ouachita Mountains had the largest mean annual surface runoff at 14.5 in., while the Springfield-Salem plateaus had the smallest mean annual surface runoff at 9.3 in.

The mean wet season total runoff for 1951–2011 in Arkansas was 13.2 in. The Ouachita Mountains had the largest mean wet season total runoff at 14.8 in., and the Springfield-Salem plateaus had the smallest mean wet season total runoff at 11.7 in. The mean wet season groundwater runoff for Arkansas was 4.5 in. The Mississippi Alluvial Plain had the largest mean wet season groundwater runoff at 5.6 in., while the Ouachita Mountains had the smallest mean wet season groundwater runoff at 3.7 in. The mean wet season surface runoff for Arkansas was 8.8 in. The Ouachita Mountains had the largest mean wet season surface runoff at 11.7 in., while the Springfield-Salem plateaus had the smallest mean wet season surface runoff at 5.7 in.

Runoff is diminished during the dry season, which is attributed to increased losses from evapotranspiration, consumptive uses including irrigation, and increased withdraws for public and private water supplies. The decline in runoff during the dry season is observed across the State in all physiographic sections. The mean dry season total runoff for Arkansas was 4.3 in. The Ouachita Mountains had the largest mean dry season total runoff at 4.6 in., while the Boston Mountains and Arkansas Valley had the smallest mean dry season total runoff at 4.1 in. The mean dry season groundwater runoff for Arkansas was 1.6 in. The Springfield-Salem plateaus and the Mississippi Alluvial Plain had the largest mean dry season groundwater runoff at 2.0 in., while the Arkansas Valley, Ouachita Mountains, and West Gulf Coastal Plain had the smallest mean dry season groundwater runoff at 1.2 in. The mean dry season surface runoff for Arkansas was 2.7 in. The Ouachita Mountains had the largest mean dry season surface runoff at 3.4 in., while the Mississippi Alluvial Plain had the smallest mean dry season surface runoff at 2.3 in.

Precipitation and runoff for the period 1951 through 2011 in Arkansas was abundant and relatively evenly distributed through the year. Arkansas' mean monthly precipitation was largest in May at 5.2 in. (10.6 percent of annual total) and smallest in August at 3.0 in. (6.0 percent of annual total). Arkansas' mean monthly total runoff was largest in March at 2.6 in. (15.0 percent of annual total) and smallest in August with a value of 0.4 in. (2.3 percent of annual total). Similar distributions of precipitation and runoff were observed in each physiographic section, although maximum and minimum values varied and may have occurred in a preceding or succeeding month.

Estimates for precipitation and runoff are presented in a series of 12 single map figures and one multimap figure. The digital data used to create the 12 single map figures are available online in a GIS raster format and a KML compatible format (http://pubs.usgs.gov/sir/2014/5006/).

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Table 1. Selected continuous-streamflow gaging stations analyzed for runoff within Arkansas and surrounding States.

[dd, degrees and decimal degrees; mi², square miles]

Map number	Station number	Station name	Latitude (dd)	Longitude (dd)	Contributing drainage area (mi²)	Period of measurements	
						Start year	End year
1	07026040	Obion River at Highway 51 near Obion, Tenn.	36.2408	-89.2176	1,875	1930	2010
2	07026500	Reelfoot Creek near Samburg, Tenn.	36.4423	-89.2965	110	1951	1972
3	07032200	Nonconnah Creek near Germantown, Tenn.	35.0498	-89.8190	68.2	1970	2010
4	07035000	Little St. Francis River at Fredericktown, Mo.	37.5594	-90.3129	90.5	1984	2011
5	07035500	Barnes Creek near Fredericktown, Mo.	37.5724	-90.3837	4.03	1956	1974
6	07035800	St. Francis River near Mill Creek, Mo.	37.5024	-90.4579	505	1988	2011
7	07036100	St. Francis River near Saco, Mo.	37.3845	-90.4739	664	1984	2011
8	07037000	Big Creek at Des Arc, Mo.	37.2925	-90.6290	99.6	1984	2003
9	07037500	St. Francis River near Patterson, Mo.	37.1945	-90.5033	956	1922	2011
10	07037700	Clark Creek near Piedmont, Mo.	37.1859	-90.6296	4.39	1957	1975
11	07039500	St. Francis River at Wappapello, Mo.	36.9281	-90.2653	1,311	1942	2011
12	07040100	St. Francis River at St. Francis, Ark.	36.4556	-90.1378	1,770	1931	2009
13	07040450	St. Francis River at Lake City, Ark.	35.8208	-90.4325	2,370	1931	2009
14	07043500	Little River Ditch No. 1 near Morehouse, Mo.	36.8345	-89.7301	450	1946	2011
15	07047600	Tyronza River near Tyronza, Ark.	35.5051	-90.3801	290	1950	1973
16	07047942	LAnguille River near Colt, Ark.	35.1447	-90.8781	535	1971	2011
17	07047950	LAnguille River at Palestine, Ark.	34.9728	-90.8856	786	1950	2010
18	07048000	West Fork White River at Greenland, Ark.	35.9829	-94.1726	83.1	1946	1982
19	07048600	White River near Fayetteville, Ark.	36.0731	-94.0811	400	1964	2011
20	07049000	War Eagle Creek near Hindsville, Ark.	36.2000	-93.8550	263	1953	2011
21	07050500	Kings River near Berryville, Ark.	36.4272	-93.6208	527	1940	2011
22	07052500	James River at Galena, Mo.	36.8054	-93.4616	987	1922	2011
23	07053250	Yocum Creek near Oak Grove, Ark.	36.4544	-93.3561	52.8	1994	2011
24	07055646	Buffalo River near Boxley, Ark.	35.9389	-93.4050	57.4	1994	2011
25	07055875	Richland Creek near Witts Spring, Ark.	35.7972	-92.9289	67.4	1996	2011
26	07056000	Buffalo River near St. Joe, Ark.	35.9831	-92.7472	829	1940	2011
27	07057000	Buffalo River near Rush, Ark.	36.1173	-92.5546	1,096	1929	1969
28	07057500	North Fork River near Tecumseh, Mo.	36.6230	-92.2481	561	1945	2011
29	07060500	White River at Calico Rock, Ark.	36.1167	-92.1431	9,980	1943	2011
30	07060710	North Sylamore Creek near Fifty Six, Ark.	35.9917	-92.2139	58.1	1966	2011
31	07061000	White River at Batesville, Ark.	35.7603	-91.6411	11,070	1951	2011
32	07061500	Black River near Annapolis, Mo.	37.3381	-90.7888	484	1940	2011
33	07063000	Black River at Poplar Bluff, Mo.	36.7596	-90.3881	1,245	1951	2011
34	07064000	Black River near Corning, Ark.	36.4019	-90.5414	1,750	1948	2011
35	07068000	Current River at Doniphan, Mo.	36.6220	-90.8476	2,038	1922	2011
36	07069000	Black River at Pocahontas, Ark.	36.2542	-90.9703	4,840	1951	2011
37	07069500	Spring River at Imboden, Ark.	36.2056	-91.1717	1,180	1937	2011
38	07071500	Eleven Point River near Bardley, Mo.	36.6487	-91.2008	793	1951	2011
39	07072000	Eleven Point River near Ravenden Springs, Ark.	36.3464	-91.1142	1,130	1930	2011
40	07072500	Black River at Black Rock, Ark.	36.1025	-91.0978	7,370	1948	2011
41	07073000	Strawberry River near Evening Shade, Ark.	36.0990	-91.6085	217	1940	1978

Table 1. Selected continuous-streamflow gaging stations analyzed for runoff within Arkansas and surrounding States.—Continued

[dd, degrees and decimal degrees; mi², square miles]

Map number	Station number	Station name	Latitude (dd)	Longitude (dd)	Contributing drainage area (mi²)	Period of measurements	
						Start year	End year
42	07073500	Piney Fork at Evening Shade, Ark.	36.0806	-91.6110	99.2	1940	1983
43	07074000	Strawberry River near Poughkeepsie, Ark.	36.1111	-91.4494	473	1937	2003
44	07074500	White River at Newport, Ark.	35.6053	-91.2889	19,900	1943	2011
45	07075000	Middle Fork of Little Red River at Shirley, Ark.	35.6567	-92.2928	302	1940	2011
46	07075300	South Fork of Little Red River at Clinton, Ark.	35.5869	-92.4514	148	1962	2011
47	07076517	Little Red River near Dewey, Ark.	35.4381	-91.7458	1,340	1997	2011
48	07077000	White River at DeValls Bluff, Ark.	34.7944	-91.4447	23,400	1950	2010
49	07077380	Cache River at Egypt, Ark.	35.8575	-90.9331	701	1965	2011
50	07077500	Cache River at Patterson, Ark.	35.2697	-91.2364	1,040	1928	2003
51	07077555	Cache River near Cotton Plant, Ark.	35.0356	-91.3225	1,170	1988	2010
52	07077800	White River at Clarendon, Ark.	34.6857	-91.3154	25,555	1929	1980
53	07077950	Big Creek at Poplar Grove, Ark.	34.5557	-90.8457	385	1971	1992
54	07189000	Elk River near Tiff City, Mo.	36.6315	-94.5869	851	1940	2011
55	07191220	Spavinaw Creek near Sycamore, Okla.	36.3347	-94.6414	132	1962	2011
56	07194800	Illinois River at Savoy, Ark.	36.1031	-94.3444	167	1980	2011
57	07195000	Osage Creek near Elm Springs, Ark.	36.2219	-94.2883	130	1951	2011
58	07195430	Illinois River South of Siloam Springs, Ark.	36.1086	-94.5333	575	1996	2011
59	07195500	Illinois River near Watts, Okla.	36.1301	-94.5722	630	1956	2011
60	07195800	Flint Creek at Springtown, Ark.	36.2561	-94.4336	14.2	1962	2011
61	07195855	Flint Creek near West Siloam Springs, Okla.	36.2161	-94.6053	59.8	1980	2011
62	07196000	Flint Creek near Kansas, Okla.	36.1865	-94.7069	116	1956	2011
63	07196900	Baron Fork at Dutch Mills, Ark.	35.8800	-94.4864	40.6	1959	2011
64	07247000	Poteau River at Cauthron, Ark.	34.9189	-94.2994	203	1975	2011
65	07249400	James Fork near Hackett, Ark.	35.1625	-94.4069	147	1959	2011
66	07249500	Cove Creek near Lee Creek, Ark.	35.7223	-94.4080	35.3	1951	1969
67	07249985	Lee Creek near Short, Okla.	35.5172	-94.4642	420	1931	2011
68	07250000	Lee Creek near Van Buren, Ark.	35.4945	-94.4497	426	1931	1991
69	07251500	Frog Bayou at Rudy, Ark.	35.5258	-94.2714	216	1951	2011
70	07252000	Mulberry River near Mulberry, Ark.	35.5769	-94.0153	373	1939	2011
71	07256500	Spadra Creek at Clarksville, Ark.	35.4683	-93.4631	61.1	1953	2010
72	07257000	Big Piney Creek near Dover, Ark.	35.5495	-93.1585	61.1	1951	1991
73	07257006	Big Piney Creek at Highway 164 near Dover, Ark.	35.5058	-93.1814	306	1993	2011
74	07257500	Illinois Bayou near Scottsville, Ark.	35.4664	-93.0411	241	1948	2011
75	07258500	Petit Jean River near Booneville, Ark.	35.1069	-93.9236	241	1939	2010
76	07260000	Dutch Creek at Waltreak, Ark.	34.9869	-93.6131	81.4	1946	2011
77	07260500	Petit Jean River at Danville, Ark.	35.0586	-93.3956	764	1947	2011
78	07261000	Cadron Creek near Guy, Ark.	35.2986	-92.4039	169	1955	2011
79	07261500	Fourche LaFave River near Gravelly, Ark.	34.8725	-93.6572	410	1940	2011
80	07263000	South Fourche LaFave River near Hollis, Ark.	34.9119	-93.0561	210	1942	1986
81	07264000	Bayou Meto near Lonoke, Ark.	34.7367	-91.9158	207	1955	2011
82	07280000	Tallahatchie River near Lambert, Miss.	34.1807	-90.2154	1,980	1961	1979

Table 1. Selected continuous-streamflow gaging stations analyzed for runoff within Arkansas and surrounding States.—Continued

[dd, degrees and decimal degrees; mi², square miles]

Map number	Station number	Station name	Latitude (dd)	Longitude (dd)	Contributing drainage area (mi²)	Period of measurements	
						Start year	End year
83	07287000	Yazoo River at Greenwood, Miss.	33.5244	-90.1817	7,450	1908	1979
84	07288500	Big Sunflower River at Sunflower, Miss.	33.5473	-90.5431	767	1936	2010
85	07290000	Big Black River near Bovina, Miss.	32.3478	-90.6969	2,812	1937	2010
86	07337900	Glover River near Glover, Okla.	34.0976	-94.9022	320	1962	2012
87	07338500	Little River below Lukfata Creek, near Idabel, Okla.	33.9412	-94.7585	1,228	1971	2011
88	07339000	Mountain Fork near Eagletown, Okla.	34.0418	-94.6199	800	1970	2011
89	07339500	Rolling Fork near DeQueen, Ark.	34.0475	-94.4128	182	1949	1979
90	07340000	Little River near Horatio, Ark.	33.9194	-94.3867	2,660	1969	2011
91	07340300	Cossatot River near Vandervoort, Ark.	34.3800	-94.2364	89.6	1968	2011
92	07340500	Cossatot River near DeQueen, Ark.	34.0450	-94.2125	361	1939	1979
93	07341000	Saline River near Dierks, Ark.	34.0961	-94.0850	124	1939	2010
94	07341200	Saline River near Lockesburg, Ark.	33.9622	-94.0617	256	1975	2011
95	07342500	South Sulphur River near Cooper, Tex.	33.3565	-95.5950	527	1992	2011
96	07343500	White Oak Creek near Talco, Tex.	33.3223	-95.0927	494	1973	2011
97	07346000	Big Cypress Bayou near Jefferson, Tex.	32.7496	-94.4988	850	1958	2011
98	07346070	Little Cypress Bayou near Jefferson, Tex.	32.7129	-94.3460	675	1947	2011
99	07348700	Bayou Dorcheat near Springhill, La.	32.9946	-93.3966	605	1958	2011
100	07349500	Bodcau Bayou near Sarepta, La.	32.9051	-93.4830	546	1951	1991
101	07356000	Ouachita River near Mount Ida, Ark.	34.6100	-93.6975	414	1942	2011
102	07356500	South Fork Ouachita River at Mount Ida, Ark.	34.5604	-93.6360	61	1950	1969
103	07359610	Caddo River near Caddo Gap, Ark.	34.3828	-93.6061	136	1989	2011
104	07359800	Caddo River near Alpine, Ark.	34.2668	-93.3627	312	1939	1969
105	07360000	Ouachita River at Arkadelphia, Ark.	34.1212	-93.0463	2,311	1951	1976
106	07361000	Little Missouri River near Murfreesboro, Ark.	34.0487	-93.7202	380	1950	1976
107	07361500	Antoine River at Antoine, Ark.	34.0389	-93.4181	178	1955	2011
108	07361600	Little Missouri River near Boughton, Ark.	33.8782	-93.3046	1,079	1950	1976
109	07362000	Ouachita River at Camden, Ark.	33.5964	-92.8181	5,360	1929	2011
110	07362100	Smackover Creek near Smackover, Ark.	33.3753	-92.7767	385	1962	2011
111	07362500	Moro Creek near Fordyce, Ark.	33.7922	-92.3333	240	1952	2012
112	07363000	Saline River at Benton, Ark.	34.5678	-92.6103	550	1951	2011
113	07363200	Saline River near Sheridan, Ark.	34.1161	-92.4056	1,120	1971	2011
114	07363300	Hurricane Creek near Sheridan, Ark.	34.3195	-92.3446	204	1962	1994
115	07363400	Hurricane Creek below Sheridan, Ark.	34.2286	-92.3725	261	1996	2011
116	07363500	Saline River near Rye, Ark.	33.7008	-92.0258	2,100	1938	2011
117	07364133	Bayou Bartholomew at Garrett Bridge, Ark.	33.8664	-91.6561	380	1988	2011
118	07364150	Bayou Bartholomew near McGehee, Ark.	33.6278	-91.4458	576	1939	2011
119	07364200	Bayou Bartholomew near Jones, La.	32.9904	-91.6557	1,187	1983	2011
120	07364300	Chemin-A-Haut Bayou near Beekman, La.	32.9821	-91.8057	271	1956	1978
121	07364700	Bayou De Loutre near Laran, La.	32.9554	-92.4999	141	1956	1976
122	07365800	Cornie Bayou near Three Creeks, La.	33.0381	-92.9406	180	1957	1986
123	07366200	Little Corney Bayou near Lillie, La.	32.9293	-92.6329	208	1956	2011

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Contributing drainage area (mi²)	Period of measurements			Base-flow index	Mean annual			
				Start year	End year	Number of years analyzed		Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
1	07026040	Obion River at Highway 51 near Obion, Tenn.	1,875	1930	2010	44	0.38	50.76	20.95	7.95	12.98
2	07026500	Reelfoot Creek near Samburg, Tenn.	110	1951	1972	22	0.078	50.61	14.58	1.16	13.70
3	07032200	Nonconnah Creek near Germantown, Tenn.	68.2	1970	2010	37	0.029	52.89	20.00	0.63	20.99
4	07035000	Little St. Francis River at Fredericktown, Mo.	90.5	1984	2011	19	0.255	43.78	18.45	4.68	13.66
5	07035500	Barnes Creek near Fredericktown, Mo.	4.03	1956	1974	19	0.157	43.59	16.34	2.57	13.81
6	07035800	St. Francis River near Mill Creek, Mo.	505	1988	2011	21	0.263	44.24	15.95	4.11	11.51
7	07036100	St. Francis River near Saco, Mo.	664	1984	2011	19	0.258	44.74	19.13	4.93	14.18
8	07037000	Big Creek at Des Arc, Mo.	99.6	1984	2003	18	0.358	45.18	19.87	7.09	12.72
9	07037500	St. Francis River near Patterson, Mo.	956	1922	2011	59	0.304	45.81	16.41	4.97	11.39
10	07037700	Clark Creek near Piedmont, Mo.	4.39	1957	1975	19	0.32	45.74	14.23	4.25	9.02
11	07039500	St. Francis River at Wappapello, Mo.	1,311	1942	2011	59	0.489	47.33	16.19	7.90	8.25
12	07040100	St. Francis River at St. Francis, Ark.	1,770	1931	2009	47	0.532	46.62	16.24	8.62	7.58
13	07040450	St. Francis River at Lake City, Ark.	2,370	1931	2009	36	0.647	48.33	16.55	10.51	5.73
14	07043500	Little River Ditch No. 1 near Morehouse, Mo.	450	1946	2011	55	0.371	46.56	16.46	6.07	10.29
15	07047600	Tyronza River near Tyronza, Ark.	290	1950	1973	23	0.259	49.28	18.70	4.91	14.05
16	07047942	LAnguille River near Colt, Ark.	535	1971	2011	41	0.339	49.69	18.31	6.17	12.04
17	07047950	LAnguille River at Palestine, Ark.	786	1950	2010	39	0.363	50.17	18.53	6.63	11.63
18	07048000	West Fork White River at Greenland, Ark.	83.1	1946	1982	32	0.235	45.72	16.69	3.90	12.69
19	07048600	White River near Fayetteville, Ark.	400	1964	2011	44	0.271	44.88	19.04	5.10	13.73
20	07049000	War Eagle Creek near Hindsville, Ark.	263	1953	2011	30	0.277	44.71	16.71	4.24	11.07
21	07050500	Kings River near Berryville, Ark.	527	1940	2011	40	0.309	44.06	14.75	4.61	10.32
22	07052500	James River at Galena, Mo.	987	1922	2011	61	0.444	43.53	13.68	6.06	7.59
23	07053250	Yocum Creek near Oak Grove, Ark.	52.8	1994	2011	18	0.428	43.54	12.91	5.22	6.97
24	07055646	Buffalo River near Boxley, Ark.	57.4	1994	2011	15	0.236	46.42	24.64	5.75	18.61
25	07055875	Richland Creek near Witts Spring, Ark.	67.4	1996	2011	16	0.264	48.94	23.87	6.22	17.33
26	07056000	Buffalo River near St. Joe, Ark.	829	1940	2011	61	0.331	44.05	17.12	5.65	11.42
27	07057000	Buffalo River near Rush, Ark.	1,096	1929	1969	19	0.332	44.54	14.67	4.86	9.77
28	07057500	North Fork River near Tecumseh, Mo.	561	1945	2011	61	0.722	43.37	17.60	12.67	4.88
29	07060500	White River at Calico Rock, Ark.	9,980	1943	2011	61	0.497	45.42	13.61	6.75	6.83
30	07060710	North Sylamore Creek near Fifty Six, Ark.	58.1	1966	2011	46	0.276	45.82	11.29	3.10	8.12
31	07061000	White River at Batesville, Ark.	11,070	1951	2011	25	0.548	47.72	14.99	8.69	7.17

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Contributing drainage area (mi²)	Period of measurements			Base-flow index	Mean annual			
				Start year	End year	Number of years analyzed		Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
32	07061500	Black River near Annapolis, Mo.	484	1940	2011	61	0.469	45.10	16.88	7.89	8.93
33	07063000	Black River at Poplar Bluff, Mo.	1,245	1951	2011	61	0.651	46.52	15.01	9.74	5.22
34	07064000	Black River near Corning, Ark.	1,750	1948	2011	57	0.633	46.56	14.64	9.19	5.33
35	07068000	Current River at Doniphan, Mo.	2,038	1922	2011	61	0.734	46.62	18.70	13.69	4.96
36	07069000	Black River at Pocahontas, Ark.	4,840	1951	2011	30	0.715	46.66	15.42	10.91	4.35
37	07069500	Spring River at Imboden, Ark.	1,180	1937	2011	54	0.604	47.76	16.51	9.93	6.51
38	07071500	Eleven Point River near Bardley, Mo.	793	1951	2011	61	0.788	45.56	13.34	10.47	2.82
39	07072000	Eleven Point River near Ravenden Springs, Ark.	1,130	1930	2011	54	0.757	46.84	14.02	10.61	3.41
40	07072500	Black River at Black Rock, Ark.	7,370	1948	2011	61	0.727	48.50	16.10	11.67	4.38
41	07073000	Strawberry River near Evening Shade, Ark.	217	1940	1978	28	0.313	47.27	12.46	4.01	8.80
42	07073500	Piney Fork at Evening Shade, Ark.	99.2	1940	1983	33	0.336	47.27	11.76	4.00	7.90
43	07074000	Strawberry River near Poughkeepsie, Ark.	473	1937	2003	46	0.49	46.92	13.68	6.67	6.94
44	07074500	White River at Newport, Ark.	19,900	1943	2011	61	0.718	47.58	15.12	10.83	4.25
45	07075000	Middle Fork of Little Red River at Shirley, Ark.	302	1940	2011	36	0.242	50.60	20.27	4.88	15.29
46	07075300	South Fork of Little Red River at Clinton, Ark.	148	1962	2011	43	0.301	51.33	21.95	6.55	15.22
47	07076517	Little Red River near Dewey, Ark.	1,340	1997	2011	15	0.346	49.58	18.39	6.40	12.09
48	07077000	White River at DeValls Bluff, Ark.	23,400	1950	2010	41	0.818	49.29	15.23	12.44	2.77
49	07077380	Cache River at Egypt, Ark.	701	1965	2011	47	0.243	47.32	17.06	4.13	12.85
50	07077500	Cache River at Patterson, Ark.	1,040	1928	2003	39	0.6	49.23	16.88	9.78	6.52
51	07077555	Cache River near Cotton Plant, Ark.	1,170	1988	2010	23	0.481	49.49	16.19	7.73	8.34
52	07077800	White River at Clarendon, Ark.	25,555	1929	1980	30	0.762	49.92	15.20	11.44	3.57
53	07077950	Big Creek at Poplar Grove, Ark.	385	1971	1992	22	0.373	50.68	22.74	8.29	13.93
54	07189000	Elk River near Tiff City, Mo.	851	1940	2011	61	0.436	43.10	12.76	5.54	7.17
55	07191220	Spavinaw Creek near Sycamore, Okla.	132	1962	2011	50	0.511	44.23	11.71	5.97	5.71
56	07194800	Illinois River at Savoy, Ark.	167	1980	2011	18	0.271	44.96	13.62	3.68	9.90
57	07195000	Osage Creek near Elm Springs, Ark.	130	1951	2011	40	0.613	44.55	18.20	8.64	5.45
58	07195430	Illinois River South of Siloam Springs, Ark.	575	1996	2011	16	0.49	45.09	15.08	7.31	7.61
59	07195500	Illinois River near Watts, Okla.	630	1956	2011	56	0.453	45.09	13.89	6.26	7.56
60	07195800	Flint Creek at Springtown, Ark.	14.2	1962	2011	50	0.509	44.92	14.47	7.47	7.21
61	07195855	Flint Creek near West Siloam Springs, Okla.	59.8	1980	2011	32	0.546	44.97	10.96	5.95	4.95
62	07196000	Flint Creek near Kansas, Okla.	116	1956	2011	49	0.509	45.12	13.65	6.97	6.73

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Contributing drainage area (mi²)	Period of measurements			Base-flow index	Mean annual			
				Start year	End year	Number of years analyzed		Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
63	07196900	Baron Fork at Dutch Mills, Ark.	40.6	1959	2011	53	0.283	47.38	15.38	4.36	11.05
64	07247000	Poteau River at Cauthron, Ark.	203	1975	2011	37	0.164	48.17	16.44	2.70	13.74
65	07249400	James Fork near Hackett, Ark.	147	1959	2011	53	0.201	45.06	13.64	2.74	10.90
66	07249500	Cove Creek near Lee Creek, Ark.	35.3	1951	1969	19	0.203	48.78	14.60	2.96	11.63
67	07249985	Lee Creek near Short, Okla.	420	1931	2011	59	0.255	45.20	18.03	4.59	13.40
68	07250000	Lee Creek near Van Buren, Ark.	426	1931	1991	41	0.26	45.20	16.78	4.33	12.34
69	07251500	Frog Bayou at Rudy, Ark.	216	1951	2011	24	0.249	46.54	16.05	3.97	11.98
70	07252000	Mulberry River near Mulberry, Ark.	373	1939	2011	46	0.302	48.09	19.42	5.87	13.57
71	07256500	Spadra Creek at Clarksville, Ark.	61.1	1953	2010	20	0.267	47.17	16.48	4.42	12.13
72	07257000	Big Piney Creek near Dover, Ark.	61.1	1951	1991	41	0.294	48.57	20.44	6.00	14.41
73	07257006	Big Piney Creek at Highway 164 near Dover, Ark.	306	1993	2011	16	0.286	48.26	21.50	6.06	15.14
74	07257500	Illinois Bayou near Scottsville, Ark.	241	1948	2011	31	0.244	47.39	20.74	5.04	15.61
75	07258500	Petit Jean River near Booneville, Ark.	241	1939	2010	44	0.158	45.80	13.36	2.10	11.21
76	07260000	Dutch Creek at Waltreak, Ark.	81.4	1946	2011	37	0.189	48.14	15.84	2.99	12.84
77	07260500	Petit Jean River at Danville, Ark.	764	1947	2011	36	0.311	49.13	14.02	4.27	9.46
78	07261000	Cadron Creek near Guy, Ark.	169	1955	2011	57	0.3	49.60	21.94	6.52	15.22
79	07261500	Fourche LaFave River Near Gravelly, Ark.	410	1940	2011	55	0.224	50.08	17.97	4.00	13.84
80	07263000	South Fourche LaFave River near Hollis, Ark.	210	1942	1986	36	0.158	49.74	18.41	2.87	15.28
81	07264000	Bayou Meto near Lonoke, Ark.	207	1955	2011	57	0.28	48.36	19.51	5.42	13.93
82	07280000	Tallahatchie River near Lambert, Miss.	1,980	1961	1979	19	0.606	53.97	19.41	11.88	7.72
83	07287000	Yazoo River at Greenwood, Miss.	7,450	1908	1979	29	0.81	53.89	19.91	16.32	3.83
84	07288500	Big Sunflower River at Sunflower, Miss.	767	1936	2010	37	0.377	54.33	18.99	7.21	11.92
85	07290000	Big Black River near Bovina, Miss.	2,812	1937	2010	60	0.394	54.31	18.89	7.36	11.31
86	07337900	Glover River near Glover, Okla.	320	1962	2012	51	0.174	50.06	20.72	3.63	17.21
87	07338500	Little River below Lukfata Creek, near Idabel, Okla.	1,228	1971	2011	41	0.264	49.47	20.23	5.31	14.81
88	07339000	Mountain Fork near Eagletown, Okla.	800	1970	2011	42	0.228	50.72	24.22	5.48	18.56
89	07339500	Rolling Fork near DeQueen, Ark.	182	1949	1979	29	0.186	51.68	21.44	3.94	17.24
90	07340000	Little River near Horatio, Ark.	2,660	1969	2011	43	0.306	50.92	20.75	6.32	14.33
91	07340300	Cossatot River near Vandervoort, Ark.	89.6	1968	2011	44	0.253	55.77	28.46	7.16	21.13
92	07340500	Cossatot River near DeQueen, Ark.	361	1939	1979	29	0.223	51.79	23.04	5.08	17.69
93	07341000	Saline River near Dierks, Ark.	124	1939	2010	32	0.212	52.58	20.79	4.42	16.43

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Contributing drainage area (mi²)	Period of measurements			Base-flow index	Mean annual			
				Start year	End year	Number of years analyzed		Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
94	07341200	Saline River near Lockesburg, Ark.	256	1975	2011	37	0.28	51.28	20.29	5.72	14.71
95	07342500	South Sulphur River near Cooper, Tex.	527	1992	2011	20	0.103	43.78	9.65	0.98	8.54
96	07343500	White Oak Creek near Talco, Tex.	494	1973	2011	39	0.081	44.96	14.04	1.14	12.88
97	07346000	Big Cypress Bayou near Jefferson, Tex.	850	1958	2011	34	0.447	46.48	9.91	4.49	5.55
98	07346070	Little Cypress Bayou near Jefferson, Tex.	675	1947	2011	61	0.43	46.88	10.51	4.50	5.97
99	07348700	Bayou Dorcheat near Springhill, La.	605	1958	2011	54	0.291	50.07	13.40	3.89	9.48
100	07349500	Bodcau Bayou near Sarepta, La.	546	1951	1991	41	0.454	50.10	13.84	6.25	7.51
101	07356000	Ouachita River near Mount Ida, Ark.	414	1942	2011	61	0.273	53.22	22.98	6.25	16.64
102	07356500	South Fork Ouachita River at Mount Ida, Ark.	61	1950	1969	19	0.21	55.19	20.06	4.19	15.74
103	07359610	Caddo River near Caddo Gap, Ark.	136	1989	2011	23	0.342	56.36	26.82	9.14	17.58
104	07359800	Caddo River near Alpine, Ark.	312	1939	1969	19	0.259	55.93	22.25	5.70	16.31
105	07360000	Ouachita River at Arkadelphia, Ark.	2,311	1951	1976	26	0.368	53.07	20.04	7.29	12.53
106	07361000	Little Missouri River near Murfreesboro, Ark.	380	1950	1976	26	0.211	53.38	22.03	4.59	17.16
107	07361500	Antoine River at Antoine, Ark.	178	1955	2011	57	0.215	52.29	21.30	4.55	16.62
108	07361600	Little Missouri River near Boughton, Ark.	1,079	1950	1976	26	0.257	52.00	18.72	4.77	13.79
109	07362000	Ouachita River at Camden, Ark.	5,360	1929	2011	59	0.417	51.65	19.85	8.16	11.41
110	07362100	Smackover Creek near Smackover, Ark.	385	1962	2011	50	0.25	51.26	14.65	3.68	11.03
111	07362500	Moro Creek near Fordyce, Ark.	240	1952	2012	43	0.172	52.47	14.32	2.50	12.02
112	07363000	Saline River at Benton, Ark.	550	1951	2011	39	0.238	52.82	19.17	4.59	14.69
113	07363200	Saline River near Sheridan, Ark.	1,120	1971	2011	21	0.3	52.10	19.27	5.70	13.31
114	07363300	Hurricane Creek near Sheridan, Ark.	204	1962	1994	33	0.244	52.05	15.43	3.72	11.53
115	07363400	Hurricane Creek below Sheridan, Ark.	261	1996	2011	16	0.211	51.69	16.85	3.49	13.04
116	07363500	Saline River near Rye, Ark.	2,100	1938	2011	60	0.364	53.13	16.75	6.06	10.59
117	07364133	Bayou Bartholomew at Garrett Bridge, Ark.	380	1988	2011	24	0.355	50.86	18.02	6.36	11.56
118	07364150	Bayou Bartholomew near McGehee, Ark.	576	1939	2011	61	0.457	51.66	15.98	7.28	8.64
119	07364200	Bayou Bartholomew near Jones, La.	1,187	1983	2011	29	0.67	53.70	15.69	10.52	5.18
120	07364300	Chemin-A-Haut Bayou near Beekman, La.	271	1956	1978	23	0.151	54.31	14.17	2.22	12.49
121	07364700	Bayou De Loutre near Laran, La.	141	1956	1976	21	0.291	53.19	18.25	5.16	12.57
122	07365800	Cornie Bayou near Three Creeks, La.	180	1957	1986	30	0.212	52.25	13.58	2.83	10.50
123	07366200	Little Corney Bayou near Lillie, La.	208	1956	2011	54	0.244	53.29	13.50	3.24	10.04

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Mean wet season				Mean dry season			
			Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)	Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
1	07026040	Obion River at Highway 51 near Obion, Tenn.	28.16	15.36	5.84	9.52	22.61	5.57	2.12	3.45
2	07026500	Reelfoot Creek near Samburg, Tenn.	28.20	11.50	0.90	10.60	22.40	3.36	0.26	3.10
3	07032200	Nonconnah Creek near Germantown, Tenn.	30.37	16.66	0.48	16.18	22.51	4.95	0.14	4.81
4	07035000	Little St. Francis River at Fredericktown, Mo.	22.23	13.72	3.50	10.22	21.52	4.62	1.18	3.45
5	07035500	Barnes Creek near Fredericktown, Mo.	22.09	12.51	1.96	10.55	21.46	3.86	0.61	3.26
6	07035800	St. Francis River near Mill Creek, Mo.	22.31	12.60	3.31	9.28	21.84	3.02	0.79	2.23
7	07036100	St. Francis River near Saco, Mo.	22.84	14.51	3.74	10.76	21.88	4.60	1.19	3.41
8	07037000	Big Creek at Des Arc, Mo.	23.12	14.34	5.13	9.21	21.99	5.47	1.96	3.51
9	07037500	St. Francis River near Patterson, Mo.	23.77	12.91	3.92	8.98	22.00	3.45	1.05	2.40
10	07037700	Clark Creek near Piedmont, Mo.	23.68	10.24	3.28	6.96	22.07	3.03	0.97	2.06
11	07039500	St. Francis River at Wappapello, Mo.	25.23	12.74	6.23	6.51	22.03	3.41	1.67	1.74
12	07040100	St. Francis River at St. Francis, Ark.	26.00	12.59	6.70	5.89	20.73	3.61	1.92	1.69
13	07040450	St. Francis River at Lake City, Ark.	26.75	12.41	8.03	4.38	21.54	3.83	2.48	1.35
14	07043500	Little River Ditch No. 1 near Morehouse, Mo.	25.18	12.22	4.53	7.68	21.32	4.15	1.54	2.61
15	07047600	Tyronza River near Tyronza, Ark.	27.95	13.62	3.53	10.10	21.33	5.34	1.38	3.96
16	07047942	LAnguille River near Colt, Ark.	28.25	13.13	4.45	8.68	21.42	5.08	1.72	3.36
17	07047950	LAnguille River at Palestine, Ark.	28.64	13.94	5.06	8.88	21.53	4.32	1.57	2.75
18	07048000	West Fork White River at Greenland, Ark.	22.20	12.90	3.03	9.87	23.46	3.69	0.87	2.82
19	07048600	White River near Fayetteville, Ark.	21.48	14.34	3.89	10.46	23.32	4.49	1.22	3.27
20	07049000	War Eagle Creek near Hindsville, Ark.	21.54	11.81	3.27	8.54	23.14	3.49	0.97	2.52
21	07050500	Kings River near Berryville, Ark.	21.19	11.21	3.46	7.75	22.83	3.72	1.15	2.57
22	07052500	James River at Galena, Mo.	20.40	9.41	4.18	5.23	23.09	4.23	1.88	2.35
23	07053250	Yocum Creek near Oak Grove, Ark.	20.94	8.00	3.42	4.57	22.55	4.20	1.80	2.40
24	07055646	Buffalo River near Boxley, Ark.	23.46	19.64	4.63	15.00	22.72	4.72	1.11	3.61
25	07055875	Richland Creek near Witts Spring, Ark.	25.25	18.47	4.88	13.59	23.62	5.07	1.34	3.74
26	07056000	Buffalo River near St. Joe, Ark.	22.69	13.45	4.45	9.00	21.33	3.62	1.20	2.42
27	07057000	Buffalo River near Rush, Ark.	22.70	11.81	3.92	7.89	21.73	2.82	0.93	1.88
28	07057500	North Fork River near Tecumseh, Mo.	21.73	11.32	8.17	3.15	21.59	6.23	4.50	1.73
29	07060500	White River at Calico Rock, Ark.	23.34	8.09	4.02	4.07	22.10	5.49	2.73	2.76
30	07060710	North Sylamore Creek near Fifty Six, Ark.	23.54	8.83	2.44	6.39	22.13	2.39	0.66	1.73
31	07061000	White River at Batesville, Ark.	25.29	9.67	5.30	4.37	22.44	6.19	3.39	2.80

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Mean wet season				Mean dry season			
			Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)	Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
32	07061500	Black River near Annapolis, Mo.	22.94	11.82	5.55	6.28	22.13	4.99	2.34	2.65
33	07063000	Black River at Poplar Bluff, Mo.	24.95	10.14	6.60	3.54	21.51	4.82	3.14	1.68
34	07064000	Black River near Corning, Ark.	25.91	10.44	6.61	3.83	20.59	4.08	2.58	1.50
35	07068000	Current River at Doniphan, Mo.	25.18	11.97	8.79	3.19	21.34	6.67	4.90	1.77
36	07069000	Black River at Pocahontas, Ark.	25.44	10.69	7.65	3.05	21.13	4.57	3.27	1.30
37	07069500	Spring River at Imboden, Ark.	25.93	11.68	7.06	4.63	21.82	4.76	2.87	1.88
38	07071500	Eleven Point River near Bardley, Mo.	23.72	8.49	6.69	1.80	21.82	4.80	3.78	1.02
39	07072000	Eleven Point River near Ravenden Springs, Ark.	25.43	9.15	6.93	2.22	21.39	4.86	3.68	1.18
40	07072500	Black River at Black Rock, Ark.	26.36	11.24	8.17	3.07	22.12	4.81	3.49	1.31
41	07073000	Strawberry River near Evening Shade, Ark.	24.85	9.98	3.12	6.86	22.42	2.83	0.89	1.94
42	07073500	Piney Fork at Evening Shade, Ark.	24.85	9.29	3.12	6.17	22.42	2.60	0.87	1.73
43	07074000	Strawberry River near Poughkeepsie, Ark.	24.80	10.43	5.11	5.32	22.10	3.18	1.56	1.62
44	07074500	White River at Newport, Ark.	25.67	9.98	7.16	2.81	21.84	5.10	3.66	1.44
45	07075000	Middle Fork of Little Red River at Shirley, Ark.	26.69	16.07	3.89	12.18	23.90	4.11	0.99	3.11
46	07075300	South Fork of Little Red River at Clinton, Ark.	27.28	17.47	5.26	12.21	24.01	4.30	1.30	3.01
47	07076517	Little Red River near Dewey, Ark.	26.83	11.63	4.02	7.60	22.70	6.87	2.38	4.49
48	07077000	White River at DeValls Bluff, Ark.	28.02	10.09	8.26	1.84	21.27	5.11	4.18	0.93
49	07077380	Cache River at Egypt, Ark.	25.99	11.98	2.91	9.07	21.32	5.00	1.21	3.78
50	07077500	Cache River at Patterson, Ark.	27.49	12.02	7.21	4.81	21.74	4.27	2.56	1.71
51	07077555	Cache River near Cotton Plant, Ark.	27.99	11.62	5.59	6.03	21.49	4.46	2.14	2.31
52	07077800	White River at Clarendon, Ark.	28.28	10.25	7.81	2.44	21.63	4.77	3.63	1.14
53	07077950	Big Creek at Poplar Grove, Ark.	29.14	17.21	6.42	10.79	21.54	5.02	1.87	3.15
54	07189000	Elk River near Tiff City, Mo.	19.77	8.83	3.85	4.98	23.35	3.88	1.69	2.19
55	07191220	Spavinaw Creek near Sycamore, Okla.	20.75	7.72	3.95	3.78	23.46	3.95	2.02	1.93
56	07194800	Illinois River at Savoy, Ark.	21.53	9.50	2.57	6.92	23.43	4.09	1.11	2.98
57	07195000	Osage Creek near Elm Springs, Ark.	21.33	8.34	5.12	3.23	23.21	5.75	3.52	2.22
58	07195430	Illinois River South of Siloam Springs, Ark.	21.39	9.69	4.75	4.94	23.68	5.22	2.56	2.66
59	07195500	Illinois River near Watts, Okla.	21.40	9.08	4.11	4.97	23.67	4.73	2.14	2.59
60	07195800	Flint Creek at Springtown, Ark.	21.41	8.86	4.51	4.35	23.53	5.82	2.96	2.86
61	07195855	Flint Creek near West Siloam Springs, Okla.	21.19	7.03	3.84	3.19	23.78	3.87	2.12	1.76
62	07196000	Flint Creek near Kansas, Okla.	21.19	8.72	4.44	4.28	23.87	4.98	2.54	2.45

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Mean wet season				Mean dry season			
			Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)	Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
63	07196900	Baron Fork at Dutch Mills, Ark.	22.96	10.68	3.02	7.66	24.45	4.72	1.34	3.39
64	07247000	Poteau River at Cauthron, Ark.	24.66	12.48	2.05	10.44	23.48	3.95	0.65	3.30
65	07249400	James Fork near Hackett, Ark.	22.79	10.47	2.10	8.37	22.22	3.17	0.64	2.53
66	07249500	Cove Creek near Lee Creek, Ark.	23.82	11.40	2.32	9.09	25.02	3.19	0.65	2.54
67	07249985	Lee Creek near Short, Okla.	22.41	13.76	3.51	10.25	22.78	4.22	1.08	3.15
68	07250000	Lee Creek near Van Buren, Ark.	22.41	12.72	3.31	9.42	22.78	3.95	1.03	2.92
69	07251500	Frog Bayou at Rudy, Ark.	23.11	12.87	3.20	9.66	23.33	3.09	0.77	2.32
70	07252000	Mulberry River near Mulberry, Ark.	24.11	15.27	4.61	10.66	23.78	4.17	1.26	2.91
71	07256500	Spadra Creek at Clarksville, Ark.	24.41	13.35	3.57	9.79	22.72	3.20	0.85	2.34
72	07257000	Big Piney Creek near Dover, Ark.	25.38	16.50	4.85	11.65	23.21	3.90	1.15	2.75
73	07257006	Big Piney Creek at Highway 164 near Dover, Ark.	25.23	16.83	4.81	12.02	22.82	4.37	1.25	3.12
74	07257500	Illinois Bayou near Scottsville, Ark.	24.62	17.02	4.15	12.87	22.57	3.63	0.89	2.74
75	07258500	Petit Jean River near Booneville, Ark.	23.43	10.61	1.68	8.93	22.17	2.70	0.43	2.28
76	07260000	Dutch Creek at Waltreak, Ark.	25.26	12.61	2.38	10.23	22.84	3.22	0.61	2.61
77	07260500	Petit Jean River at Danville, Ark.	25.91	10.30	3.20	7.10	23.25	3.43	1.07	2.36
78	07261000	Cadron Creek near Guy, Ark.	26.38	17.61	5.28	12.33	23.18	4.13	1.24	2.89
79	07261500	Fourche LaFave River Near Gravelly, Ark.	26.28	13.99	3.13	10.85	23.72	3.85	0.86	2.99
80	07263000	South Fourche LaFave River near Hollis, Ark.	26.39	14.57	2.30	12.27	23.32	3.57	0.56	3.01
81	07264000	Bayou Meto near Lonoke, Ark.	27.14	15.73	4.41	11.33	21.24	3.61	1.01	2.60
82	07280000	Tallahatchie River near Lambert, Miss.	31.16	14.43	8.74	5.68	22.81	5.17	3.13	2.04
83	07287000	Yazoo River at Greenwood, Miss.	31.19	12.47	10.10	2.37	22.70	7.68	6.22	1.46
84	07288500	Big Sunflower River at Sunflower, Miss.	31.46	14.25	5.37	8.88	22.85	4.89	1.84	3.04
85	07290000	Big Black River near Bovina, Miss.	31.67	15.60	6.15	9.45	22.65	3.07	1.21	1.86
86	07337900	Glover River near Glover, Okla.	25.79	14.99	2.61	12.38	24.22	5.85	1.02	4.83
87	07338500	Little River below Lukfata Creek, near Idabel, Okla.	25.97	14.26	3.77	10.50	23.47	5.86	1.55	4.31
88	07339000	Mountain Fork near Eagletown, Okla.	26.50	15.88	3.62	12.26	24.13	8.16	1.86	6.30
89	07339500	Rolling Fork near DeQueen, Ark.	27.74	16.12	3.00	13.12	23.99	5.06	0.94	4.12
90	07340000	Little River near Horatio, Ark.	27.33	14.47	4.43	10.04	23.54	6.18	1.89	4.29
91	07340300	Cossatot River near Vandervoort, Ark.	29.16	20.11	5.09	15.02	26.58	8.18	2.07	6.11
92	07340500	Cossatot River near DeQueen, Ark.	27.77	17.76	3.96	13.80	23.96	5.00	1.12	3.89
93	07341000	Saline River near Dierks, Ark.	28.04	16.32	3.46	12.86	24.53	4.53	0.96	3.57

Table 2. Estimated precipitation and runoff values for selected continuous-record streamflow-gaging stations within Arkansas and surrounding States.—Continued

[mi², square miles; in., inches; GW, groundwater; note: precipitation values derived from PRISM data]

Map number	Station number	Station name	Mean wet season				Mean dry season			
			Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)	Precip-itation (in.)	Total runoff (in.)	GW runoff (in.)	Surface runoff (in.)
94	07341200	Saline River near Lockesburg, Ark.	27.49	15.36	4.30	11.06	23.79	5.07	1.42	3.65
95	07342500	South Sulphur River near Cooper, Tex.	22.68	7.31	0.75	6.56	21.10	2.21	0.23	1.99
96	07343500	White Oak Creek near Talco, Tex.	23.34	9.80	0.79	9.01	21.57	4.22	0.34	3.88
97	07346000	Big Cypress Bayou near Jefferson, Tex.	25.20	7.34	3.28	4.06	21.27	2.70	1.21	1.49
98	07346070	Little Cypress Bayou near Jefferson, Tex.	25.35	8.42	3.62	4.80	21.51	2.05	0.88	1.17
99	07348700	Bayou Dorcheat near Springhill, La.	27.27	11.01	3.20	7.80	22.75	2.36	0.69	1.68
100	07349500	Bodcau Bayou near Sarepta, La.	27.30	11.23	5.10	6.13	22.74	2.53	1.15	1.38
101	07356000	Ouachita River near Mount Ida, Ark.	28.12	16.90	4.61	12.29	25.02	5.99	1.64	4.36
102	07356500	South Fork Ouachita River at Mount Ida, Ark.	29.29	15.99	3.36	12.63	25.90	3.94	0.83	3.12
103	07359610	Caddo River near Caddo Gap, Ark.	30.07	18.21	6.23	11.98	26.16	8.51	2.91	5.60
104	07359800	Caddo River near Alpine, Ark.	29.76	18.01	4.67	13.35	26.20	3.99	1.03	2.96
105	07360000	Ouachita River at Arkadelphia, Ark.	28.64	13.47	4.96	8.52	24.41	6.35	2.34	4.01
106	07361000	Little Missouri River near Murfreesboro, Ark.	28.61	13.60	2.87	10.73	24.74	8.14	1.72	6.42
107	07361500	Antoine River at Antoine, Ark.	27.95	16.41	3.53	12.88	24.22	4.77	1.02	3.74
108	07361600	Little Missouri River near Boughton, Ark.	28.17	13.69	3.52	10.17	23.79	4.87	1.25	3.62
109	07362000	Ouachita River at Camden, Ark.	28.10	14.27	5.95	8.32	23.53	5.29	2.21	3.09
110	07362100	Smackover Creek near Smackover, Ark.	28.29	11.54	2.89	8.66	22.94	3.16	0.79	2.37
111	07362500	Moro Creek near Fordyce, Ark.	29.51	12.30	2.12	10.19	22.95	2.22	0.38	1.84
112	07363000	Saline River at Benton, Ark.	27.96	15.17	3.61	11.56	24.84	4.11	0.98	3.13
113	07363200	Saline River near Sheridan, Ark.	29.06	14.77	4.43	10.34	23.04	4.24	1.27	2.97
114	07363300	Hurricane Creek near Sheridan, Ark.	28.94	13.09	3.19	9.90	23.07	2.15	0.53	1.63
115	07363400	Hurricane Creek below Sheridan, Ark.	28.93	13.29	2.80	10.48	22.76	3.25	0.68	2.56
116	07363500	Saline River near Rye, Ark.	29.99	14.00	5.10	8.91	23.15	2.65	0.97	1.69
117	07364133	Bayou Bartholomew at Garrett Bridge, Ark.	29.14	14.04	4.98	9.06	21.71	3.89	1.38	2.51
118	07364150	Bayou Bartholomew near McGehee, Ark.	30.01	12.77	5.84	6.93	21.63	3.15	1.44	1.71
119	07364200	Bayou Bartholomew near Jones, La.	30.82	12.55	8.41	4.14	22.88	3.16	2.12	1.04
120	07364300	Chemin-A-Haut Bayou near Beekman, La.	30.95	12.36	1.87	10.49	23.35	2.35	0.35	1.99
121	07364700	Bayou De Loutre near Laran, La.	29.95	13.14	3.82	9.32	23.24	4.59	1.34	3.25
122	07365800	Cornie Bayou near Three Creeks, La.	28.87	10.66	2.26	8.40	23.36	2.67	0.57	2.10
123	07366200	Little Corney Bayou near Lillie, La.	29.95	10.58	2.58	8.00	23.33	2.70	0.66	2.04

Table 3. Annual and seasonal statistics for precipitation and runoff by physiographic sections in Arkansas, 1951–2011.

[Units, inches; Min, minimum; Max, maximum; Std dev, standard deviation; Wet season: December, January, February, March, April, May; Dry season: June, July, August, September, October, November]

Season	Statewide				Springfield-Salem Plateaus				Boston Mountains				Arkansas Valley			
	Min	Max	Mean	Std dev	Min	Max	Mean	Std dev	Min	Max	Mean	Std dev	Min	Max	Mean	Std dev
								Precipitation								
Annual	42.9	64.7	49.8	3.0	43.0	50.4	45.5	1.4	44.1	56.3	49.2	2.4	42.9	58.2	48.2	2.1
Wet season	20.6	34.1	26.9	2.4	20.6	26.4	23.2	1.6	21.8	28.3	25.1	1.6	21.4	29.7	25.3	1.7
Dry season	19.7	31.2	22.9	1.5	21.0	25.4	22.3	0.7	21.2	28.1	24.1	1.1	21.4	28.4	22.9	0.7
								Total runoff								
Annual	12.3	27.1	17.8	2.5	12.3	19.1	15.0	1.4	14.6	23.5	19.4	2.2	14.0	22.2	18.4	2.4
Wet season	10.3	15.9	13.2	1.3	10.3	13.9	11.7	1.1	10.7	14.5	12.9	1.1	10.9	15.7	13.5	1.2
Dry season	3.3	5.7	4.3	0.5	4.0	4.7	4.3	0.2	3.7	4.5	4.1	0.2	3.6	4.6	4.1	0.2
								Groundwater runoff								
Annual	3.6	10.2	6.1	1.5	4.8	10.2	6.8	1.3	4.2	7.9	5.4	0.6	3.7	8.3	5.2	1.2
Wet season	2.7	7.0	4.5	1.0	3.4	7.0	4.7	0.9	3.2	5.3	4.1	0.4	2.8	5.6	4.0	0.7
Dry season	0.8	3.1	1.6	0.5	1.3	3.1	2.0	0.5	1.0	2.5	1.3	0.3	0.8	2.5	1.2	0.4
								Surface runoff								
Annual	5.0	19.1	11.4	2.4	5.5	12.3	9.3	1.8	7.9	15.9	11.6	1.2	7.7	14.9	12.3	1.8
Wet season	2.4	14.5	8.8	2.6	2.4	10.0	5.7	1.7	4.7	14.0	10.8	1.7	4.1	12.9	10.3	1.7
Dry season	1.7	4.6	2.7	0.5	1.7	2.9	2.4	0.3	2.2	2.9	2.7	0.1	2.1	3.2	2.8	0.2

Season	Ouachita Mountains				Mississippi Alluvial Plain				West Gulf Coastal Plain			
	Min	Max	Mean	Std dev	Min	Max	Mean	Std dev	Min	Max	Mean	Std dev
							Precipitation					
Annual	42.3	64.7	53.0	3.2	46.1	55.2	49.9	1.8	47.5	54.3	51.4	1.4
Wet season	22.9	34.1	28.1	1.7	25.4	31.3	28.3	1.4	24.6	30.6	28.1	1.1
Dry season	21.7	31.2	24.9	1.7	19.7	23.9	21.6	0.6	21.3	25.0	23.3	0.6
							Total runoff					
Annual	14.6	27.1	20.4	2.6	14.7	22.0	17.5	1.5	12.7	23.2	17.2	2.1
Wet season	12.6	15.9	14.8	0.5	10.8	13.9	12.6	0.8	12.7	15.7	14.0	0.8
Dry season	3.6	5.6	4.6	0.5	3.3	5.1	4.3	0.4	3.4	5.7	4.4	0.7
							Groundwater runoff					
Annual	3.6	7.1	4.9	0.6	5.1	10.0	7.5	1.1	4.2	5.9	5.0	0.3
Wet season	2.7	5.1	3.7	0.4	3.9	7.0	5.6	0.7	3.2	4.6	3.8	0.2
Dry season	0.9	1.9	1.2	0.2	1.0	3.0	2.0	0.4	0.9	1.5	1.2	0.1
							Surface runoff					
Annual	10.3	19.1	14.5	1.1	5.0	12.4	9.4	1.2	10.5	17.0	13.1	1.5
Wet season	8.1	14.5	11.7	1.1	2.9	13.4	7.5	2.0	6.0	13.6	9.5	1.2
Dry season	2.4	4.6	3.4	0.4	1.8	2.7	2.3	0.2	2.2	4.5	3.1	0.6

Table 4. Mean annual and monthly precipitation and runoff by physiographic sections in Arkansas, 1951–2011.

[Units, inches; ← Driest inches Wettest →]

Physiographic section	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Precipitation												
Statewide	3.5	3.7	4.7	5.0	5.2	3.8	3.7	3.0	3.8	3.8	4.7	4.5
Springfield-Salem Plateau	2.7	3.0	4.3	4.6	5.0	3.9	3.5	3.1	4.0	3.5	4.5	3.6
Boston Mountains	2.7	3.1	4.4	4.7	5.4	4.0	3.5	3.2	4.2	3.8	4.4	5.0
Arkansas Valley	3.0	3.3	4.7	4.8	5.4	3.8	3.5	3.1	4.0	3.9	4.6	3.7
Ouachita Mountains	3.4	3.6	4.9	5.1	5.7	4.2	3.9	3.0	4.2	4.3	4.8	4.1
Mississippi Alluvial Plain	4.0	4.2	4.9	5.1	5.1	3.5	3.7	2.9	3.5	3.5	4.7	4.6
West Gulf Coastal Plain	4.0	4.2	4.8	5.0	5.3	4.0	3.9	2.9	3.8	4.1	4.8	4.9
Total runoff												
Statewide	1.9	2.0	2.6	2.6	2.3	1.0	0.6	0.4	0.5	0.6	1.2	1.8
Springfield-Salem Plateau	1.3	1.7	2.4	2.5	2.2	1.0	0.6	0.4	0.5	0.6	1.2	1.5
Boston Mountains	1.8	1.8	2.7	2.8	2.4	1.0	0.5	0.3	0.4	0.6	1.3	1.8
Arkansas Valley	1.8	2.0	2.8	2.8	2.4	0.9	0.5	0.3	0.4	0.6	1.3	1.6
Ouachita Mountains	2.1	2.2	3.0	2.8	2.7	1.1	0.6	0.3	0.5	0.7	1.5	1.8
Mississippi Alluvial Plain	2.1	2.0	2.4	2.3	2.1	1.0	0.7	0.5	0.5	0.6	1.0	2.1
West Gulf Coastal Plain	1.9	2.2	2.8	2.6	2.4	1.1	0.6	0.4	0.5	0.6	1.2	2.0
Groundwater runoff												
Statewide	0.6	0.7	0.9	0.9	0.8	0.4	0.2	0.2	0.2	0.2	0.4	0.6
Springfield-Salem Plateau	0.6	0.7	1.0	1.0	0.9	0.4	0.3	0.2	0.3	0.3	0.5	0.6
Boston Mountains	0.5	0.6	0.9	0.9	0.8	0.3	0.2	0.1	0.1	0.2	0.4	0.8
Arkansas Valley	0.5	0.6	0.8	0.8	0.7	0.3	0.2	0.1	0.1	0.2	0.4	0.5
Ouachita Mountains	0.5	0.6	0.8	0.7	0.7	0.3	0.2	0.1	0.1	0.2	0.4	0.5
Mississippi Alluvial Plain	0.9	0.9	1.1	1.0	0.9	0.5	0.3	0.3	0.2	0.3	0.4	0.6
West Gulf Coastal Plain	0.6	0.6	0.7	0.7	0.7	0.3	0.2	0.1	0.1	0.2	0.3	0.6
Surface runoff												
Statewide	1.2	1.3	1.8	1.7	1.5	0.6	0.4	0.2	0.3	0.4	0.8	1.2
Springfield-Salem Plateau	0.9	1.0	1.2	1.5	1.1	0.5	0.3	0.2	0.3	0.3	0.7	0.9
Boston Mountains	1.1	1.3	2.3	1.9	1.9	0.7	0.3	0.2	0.3	0.4	0.9	1.1
Arkansas Valley	1.2	1.4	2.1	2.0	1.8	0.6	0.3	0.2	0.3	0.4	0.9	1.1
Ouachita Mountains	1.5	1.6	2.4	2.1	2.1	0.8	0.4	0.2	0.4	0.5	1.1	1.3
Mississippi Alluvial Plain	1.1	1.1	1.4	1.3	1.2	0.5	0.3	0.3	0.3	0.3	0.6	1.6
West Gulf Coastal Plain	1.4	1.6	1.9	1.9	1.6	0.8	0.4	0.3	0.3	0.4	0.9	1.5

Table 5. Percentage of mean annual precipitation and runoff by month for physiographic sections in Arkansas, 1951–2011.

[Units, percent; ← Smallest percentage Largest →]

Physiographic section	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Precipitation												
Statewide	7.1	7.6	9.6	10.0	10.6	7.7	7.5	6.0	7.7	7.7	9.4	9.1
Springfield-Salem Plateau	5.9	6.6	9.4	10.0	11.0	8.5	7.6	6.9	8.8	7.6	9.8	7.8
Boston Mountains	5.6	6.5	9.1	9.8	11.1	8.3	7.2	6.5	8.6	7.9	9.1	10.3
Arkansas Valley	6.4	7.0	9.8	10.0	11.2	8.1	7.4	6.5	8.3	8.1	9.6	7.7
Ouachita Mountains	6.6	7.1	9.6	10.0	11.2	8.1	7.7	5.8	8.1	8.3	9.3	8.1
Mississippi Alluvial Plain	8.1	8.4	9.9	10.4	10.2	7.0	7.4	5.8	7.0	7.0	9.5	9.2
West Gulf Coastal Plain	7.8	8.1	9.4	9.7	10.2	7.7	7.5	5.6	7.4	8.0	9.2	9.5
Total runoff												
Statewide	10.7	11.4	15.0	14.6	13.2	5.7	3.4	2.3	2.8	3.5	6.8	10.5
Springfield-Salem Plateau	8.0	10.5	15.2	15.9	13.7	6.3	4.0	2.7	3.3	3.8	7.4	9.4
Boston Mountains	10.1	10.5	15.4	16.2	13.8	5.4	3.0	1.7	2.6	3.4	7.5	10.5
Arkansas Valley	10.5	11.3	16.1	15.9	13.9	5.3	2.8	1.7	2.5	3.4	7.5	9.0
Ouachita Mountains	10.7	11.4	15.7	14.7	14.0	5.5	3.0	1.7	2.6	3.7	7.7	9.4
Mississippi Alluvial Plain	12.0	11.4	14.0	13.3	12.0	5.7	3.9	3.1	3.1	3.2	5.9	12.4
West Gulf Coastal Plain	10.5	12.2	15.1	14.2	13.2	5.9	3.2	2.0	2.5	3.5	6.5	11.2
Groundwater runoff												
Statewide	10.5	11.3	14.7	14.2	13.0	6.1	4.0	2.9	3.0	3.6	6.6	10.2
Springfield-Salem Plateau	8.8	9.8	14.2	15.3	13.4	6.7	4.6	3.3	3.8	4.1	7.3	8.8
Boston Mountains	8.6	10.2	14.9	15.5	13.1	5.7	3.4	2.1	2.5	3.4	7.1	13.6
Arkansas Valley	10.0	11.4	15.7	15.4	13.5	5.7	3.4	2.2	2.6	3.5	7.2	9.5
Ouachita Mountains	10.2	11.3	15.2	14.1	13.5	5.6	3.1	1.9	2.7	3.8	7.6	11.0
Mississippi Alluvial Plain	11.9	12.1	14.7	13.7	12.8	6.4	4.6	3.7	3.3	3.4	5.9	7.5
West Gulf Coastal Plain	11.0	12.2	14.7	14.0	12.9	6.1	3.4	2.2	2.5	3.5	6.5	11.0
Surface runoff												
Statewide	10.4	11.5	15.5	14.7	13.3	5.5	3.1	2.1	2.7	3.4	7.0	10.7
Springfield-Salem Plateau	9.7	11.1	13.5	16.9	12.5	5.7	3.7	2.5	3.0	3.6	7.9	9.9
Boston Mountains	8.7	10.3	18.7	15.8	15.6	5.4	2.6	1.3	2.4	3.3	7.1	8.7
Arkansas Valley	9.6	11.2	17.3	15.8	14.7	5.2	2.6	1.7	2.4	3.4	7.4	8.7
Ouachita Mountains	10.1	11.4	16.6	14.7	14.3	5.4	2.9	1.7	2.6	3.7	7.6	8.8
Mississippi Alluvial Plain	10.8	11.3	14.2	12.8	11.9	5.2	3.4	2.7	2.9	3.0	5.8	15.9
West Gulf Coastal Plain	11.1	12.3	14.4	14.5	12.5	5.9	3.2	2.1	2.4	3.4	6.9	11.3

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