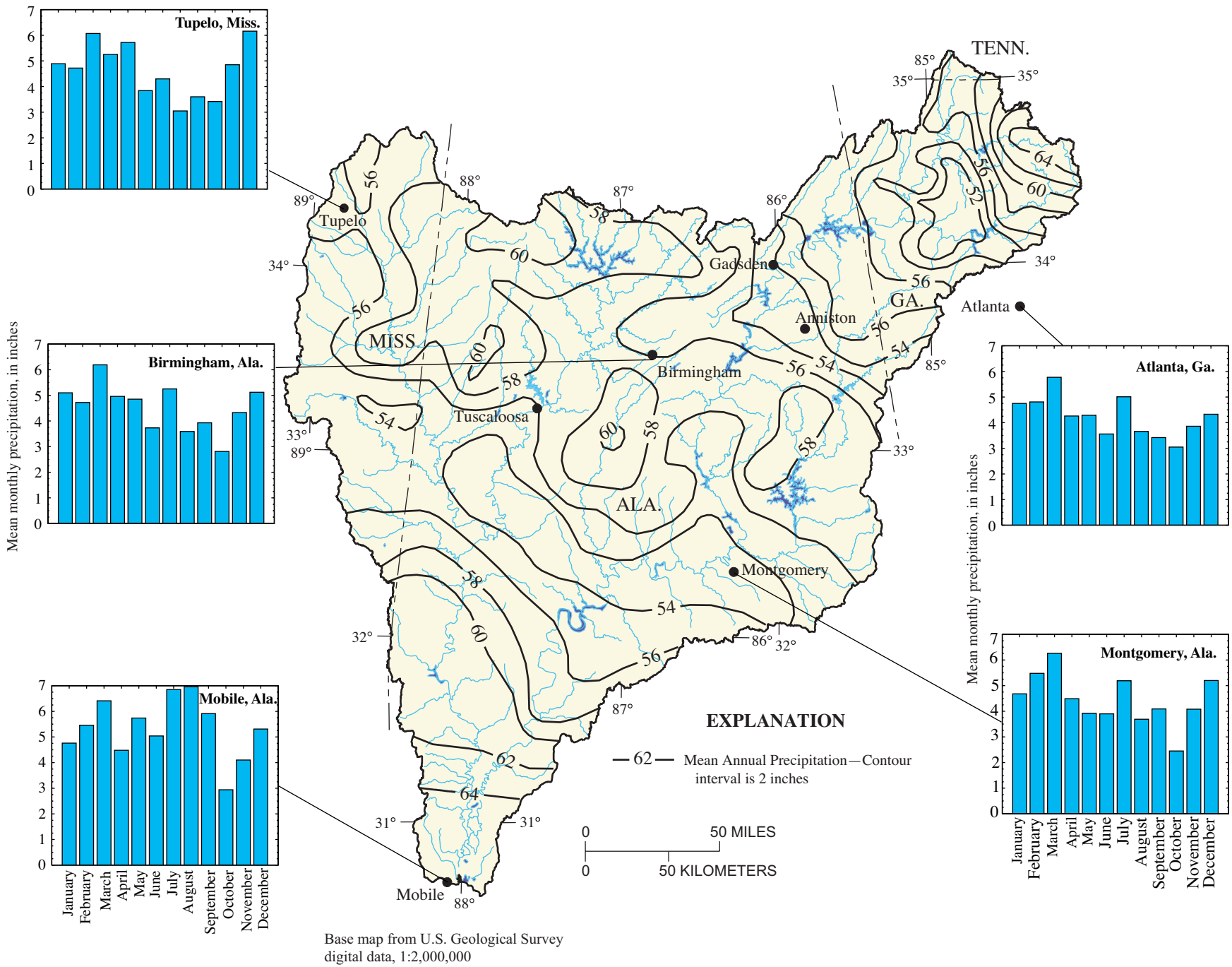



**Figure 6.** Mean annual precipitation for the Mobile River Basin and mean monthly precipitation for selected sites, 1961-90. (Source: Precipitation contours modified from National Oceanic and Atmospheric Administration, 1998.)

**Table 1.** Summary of climatic data for cooperative weather stations in the Mobile River Basin, 1961-90

[$^{o}$F, degree Fahrenheit; Data from National Oceanic and Atmospheric Administration, 1998]

| National Weather Service cooperative station | | Mean annual temperature ($^{o}$F) | Mean annual precipitation (inches) |
|---|---|---|---|
| Location | Number | | |
| Birmingham Municipal Airport Birmingham, Alabama. | 010831 | 61.8 | 54.6 |
| Montgomery Dannelly Airport Montgomery, Alabama. | 015550 | 64.9 | 53.4 |
| Mobile Regional Airport Mobile, Alabama. | 015478 | 67.5 | 64.0 |
| Tupelo Lemons Airport Tupelo, Mississippi. | 229003 | 61.7 | 55.9 |
| Atlanta Hartsfield Airport Atlanta, Georgia. | 090451 | 61.3 | 50.8 |

Mean annual temperatures for the Mobile River Basin ranged from 56 $^{o}$F in the northeastern part of the basin to 68 $^{o}$F near the coast for the period of 1961 to 1990 (fig. 7). Mean monthly temperature data were obtained for the five National Weather Service cooperative stations. The lowest mean monthly temperature was in January for all five sites and ranged from 39.9 $^{o}$F in Tupelo to 49.9 $^{o}$F in Mobile. The highest mean monthly temperature was in July for all five sites and ranged from 78.8 $^{o}$F in Atlanta to 82.3 $^{o}$F in Mobile, near the coast.

## Hydrology

The Mobile River Basin has abundant water resources. The streams and rivers provide water for many uses, and ground water is available from numerous aquifers throughout the basin. Flow in the two major rivers, the Alabama and Tombigbee Rivers, is generally regulated by upstream reservoirs, flood-control and navigational locks, and dams and hydroelectric plants.

### Surface Water

The Mobile River Basin comprises seven major rivers. The Mobile River is formed by the confluence of two of these major rivers (fig. 8) near Mount Vernon, Ala. (fig. 1)—the Tombigbee River to the west, which has headwaters in northeastern Mississippi, and the Alabama River to the east, which has headwaters in northwestern Georgia and the southeastern corner of Tennessee. These two river basins can be further divided into seven subbasins. The Black Warrior River is a major tributary to the Tombigbee River with the confluence near Demopolis, Ala. The Alabama River is formed by the confluence of the Coosa and Tallapoosa Rivers near Montgomery, Ala.; and the Cahaba River, also a major tributary, joins the Alabama River downstream from Selma, Ala. Downstream from the confluence of the Tombigbee and Alabama Rivers, the Mobile River has formed a deltaic plain across which flow several distributaries that drain into Mobile Bay and, subsequently, into the Gulf of Mexico (fig. 2). The Mobile River system has been estimated to contribute approximately 95 percent of the freshwater inflow to Mobile Bay (Loyacano and Smith, 1979).

#### Streamflow Characteristics

The total average annual surface-water discharge from the Mobile River Basin is estimated to be about 62,100 ft$^3$/s (U.S. Army Corps of Engineers, written commun., 1974). Approximately 47 percent of this discharge is contributed from the Tombigbee River and 52 percent from the Alabama River. Mean annual discharge data from 1923 to 1999 (fig. 9) was calulated by using available discharge data from USGS streamgaging stations. About 2,800 ft$^3$/s (8 percent) of the Alabama River's discharge comes from the Cahaba River, 7,300 ft$^3$/s (22 percent) from the Tallapoosa River, and about 16,400 ft$^3$/s (49 percent) from the Coosa River. The Black Warrior River is the

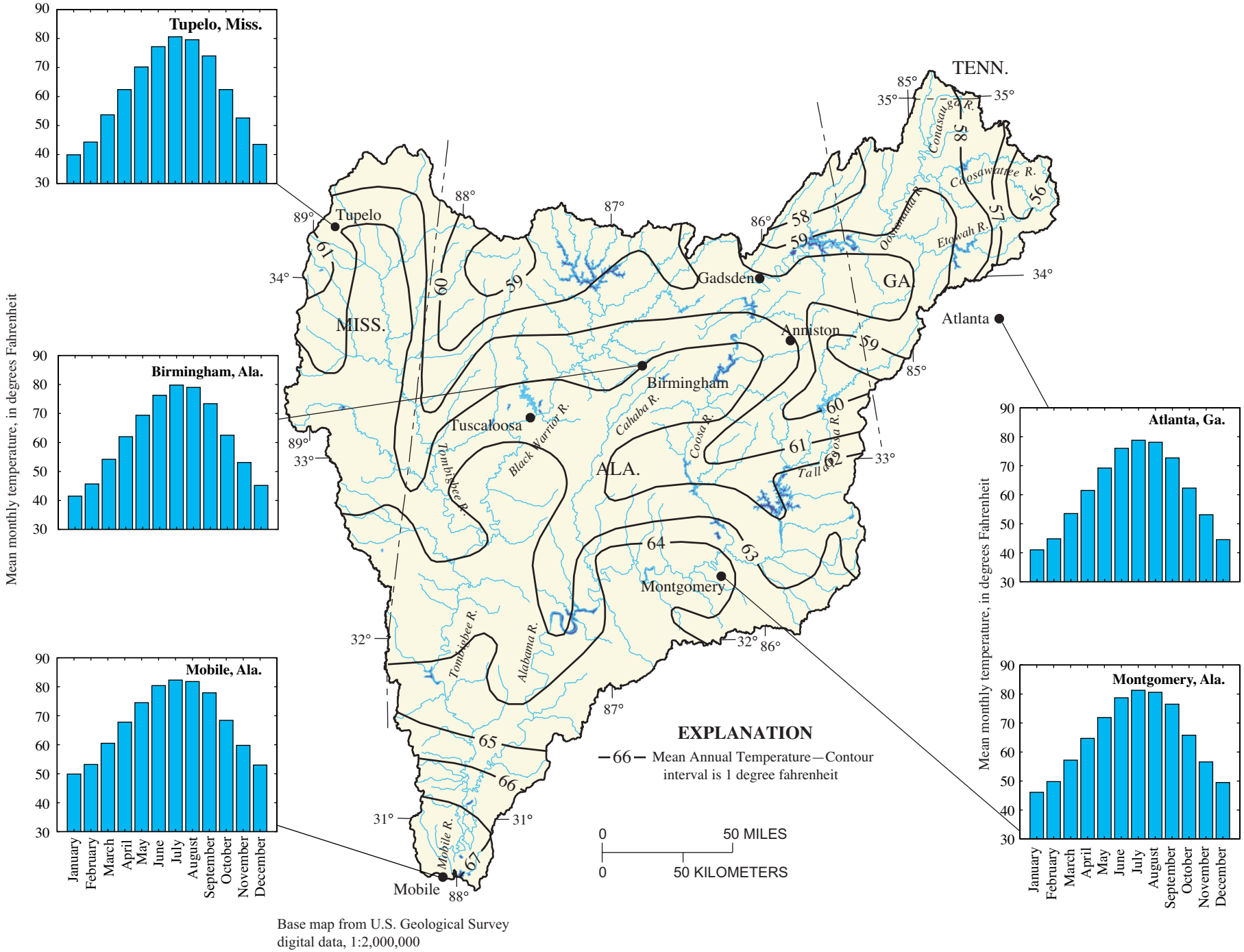
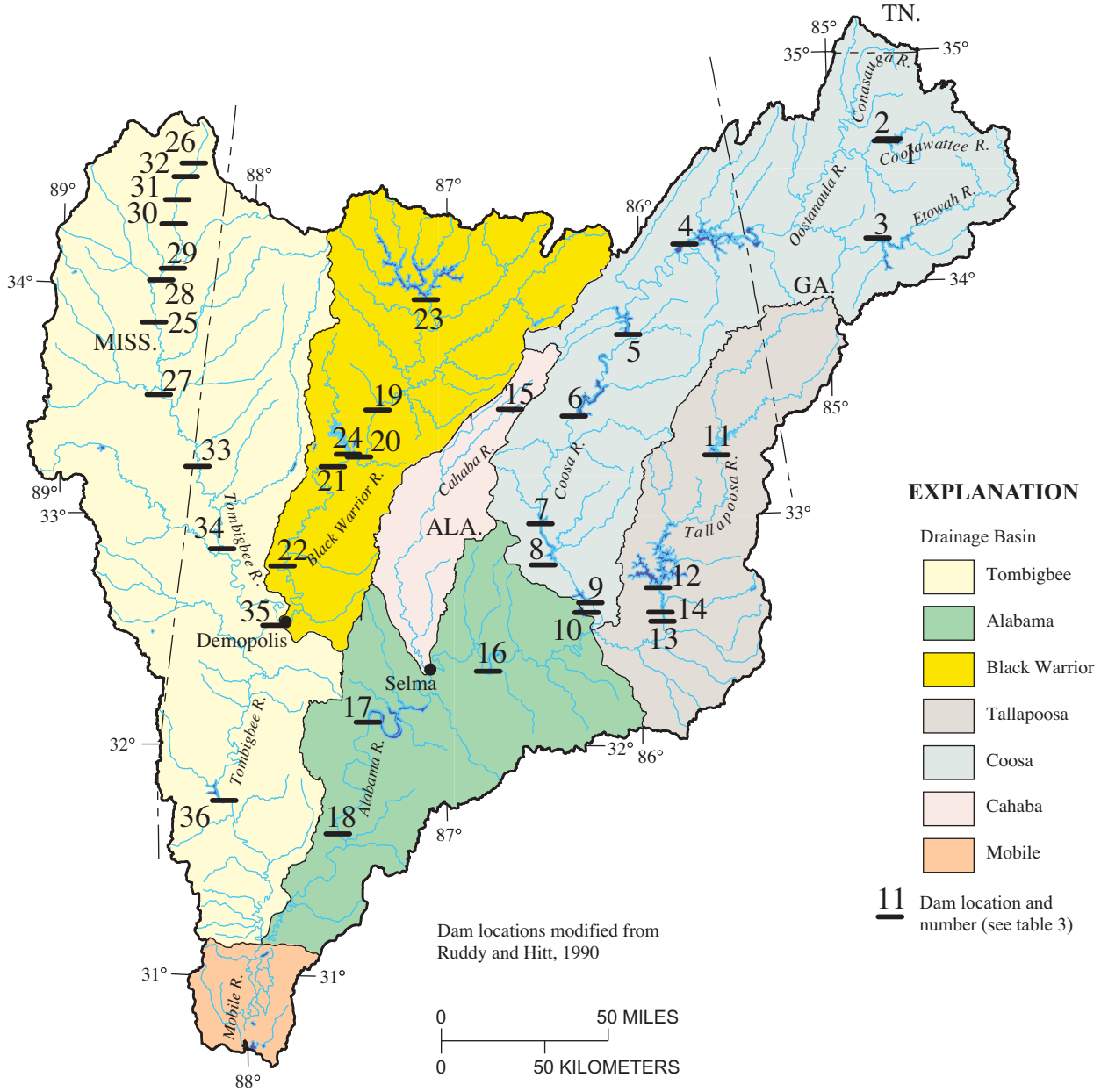



**Figure 7.** Mean annual temperature for the Mobile River Basin and mean monthly temperature for selected stations, 1961-90. (Source: Temperature data modified from National Oceanic and Atmospheric Administration, 1998.)




Base map from U.S. Geological Survey digital data, 1:2,000,000

**Figure 8.** Major river systems and dam locations in the Mobile River Basin.

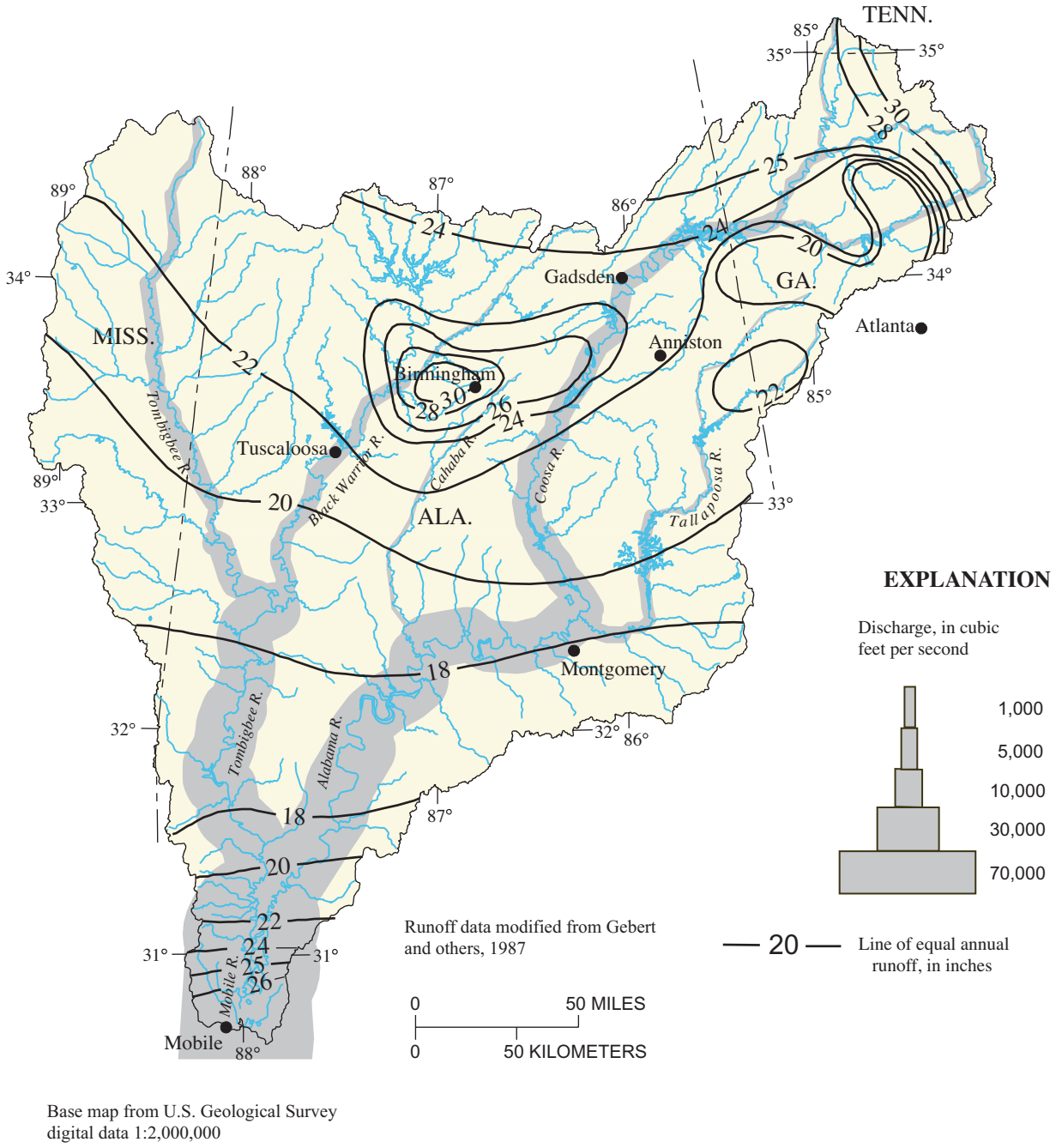



**Figure 9.** Mean annual runoff (1961-90) and mean annual discharge (1923-99) for the Mobile River Basin.

major contributor to the Tombigbee River, providing about 33 percent of the mean annual flow (9,900 $ft^3/s$).

Six streamgaging stations were selected to be representative of streamflow characteristics in the different physiographic settings in the Mobile River Basin (fig. 10). Variations in streamflow were determined by analyzing discharge data collected from the six streamgaging stations. Streamflow varies seasonally in response to precipitation and evapotranspiration. The mean daily discharge shows a consistent trend across the basin with the highest median discharge occurring in February and the lowest median occurring during the summer months. Maximum mean daily discharges for the six sites occurred from January through March. Flow duration curves for the six sites were normalized for the contributing drainage areas to eliminate the effect of the different basin sizes (fig. 11). The shapes of the curves reflect the underlying soil type and geologic characteristics typical of the different physiographies in the basin. For instance, Catoma Creek in the Black Prairie Belt district has a lower base flow and tends to go dry more frequently than streams in other areas of the Mobile River Basin. Mulberry Creek in the Fall Line Hills district and the Cahaba River in the Valley and Ridge Physiographic Province have higher base flows than streams in other areas of the Mobile River Basin.

#### Mean Annual Runoff

Runoff is the water that drains from the land surface into stream or river channels after precipitation. Runoff is influenced by precipitation amounts, topography, geology, soil moisture, and other factors. Mean annual runoff per square mile of basin, which is computed by dividing the mean annual volume of water leaving the basin (measured as streamflow at a gaging station) by the area of that basin, is commonly used to compare runoff characteristics between basins.

Mean annual runoff within the Mobile River Basin (Gebert and others, 1987) ranges from 18 in/yr in the Montgomery area to 30 in/yr in the Birmingham area and in the Blue Ridge Mountains (fig. 9). The mean annual runoff increases in the southern part of the basin reflecting increased annual precipitation from the proximity of this area to the Gulf of Mexico. The mean annual runoff in the Birmingham area is influenced partly by the amount of urbanization and subsequent increase in impermeable area. The higher mean annual runoff in the northeastern corner of the study unit is the result of greater precipitation and steeper slopes in the Blue Ridge Mountains, which are underlain by less permeable rocks than other parts of the basin.

### Ground Water

The numerous aquifers in the Mobile River Basin range in composition from unconsolidated sand to hard, fractured crystalline rocks. These aquifers, grouped into four major aquifers or aquifer systems on the basis of the different rock types and ground-water flow systems, are the Southeastern Coastal Plain aquifer system, Valley and Ridge aquifers, the Appalachian Plateaus aquifers, and Piedmont and Blue Ridge aquifers (fig. 12, table 2) (U.S. Geological Survey, 1998). In general, ground-water flow in all of the aquifers in the Mobile River Basin is south-southwest towards the Gulf of Mexico.

#### Southeastern Coastal Plain Aquifer System

The Southeastern Coastal Plain aquifer system includes four regional aquifers (fig. 12; table 2) and three intervening regional confining units. Rocks forming these confining units are exposed at the land surface as a series of curved bands (Miller, 1990). The regional aquifers are composed mostly of sand with minor gravel and limestone beds that locally may contain clay beds. The regional confining units are primarily clay, silt, or chalk, but locally may contain sand beds. Each of the four regional aquifers that compose the Southeastern Coastal Plain aquifer system includes several smaller aquifers. Even though the regional aquifers contain clayey confining units that locally can subdivide the regional aquifers, the overall water-yielding characteristics of the regional aquifers are similar throughout their extent.

Recharge enters the Southeastern Coastal Plain aquifer system primarily from precipitation in outcrop areas of the aquifers. After reaching the water table, most of this water moves laterally and either discharges to small streams, evaporates, or is transpired by plants. In areas where the aquifer is unconfined, water moves downward generally along short flowpaths, and then horizontally towards discharge areas. A small percentage of ground water moves into confined parts of the aquifer where most of the movement is horizontal and downdip of the aquifers, along generally long flowpaths, until the water approaches discharge points, where its movement again becomes predominantly vertical to discharge to shallower aquifers or surface-water bodies (Miller, 1990). Near the

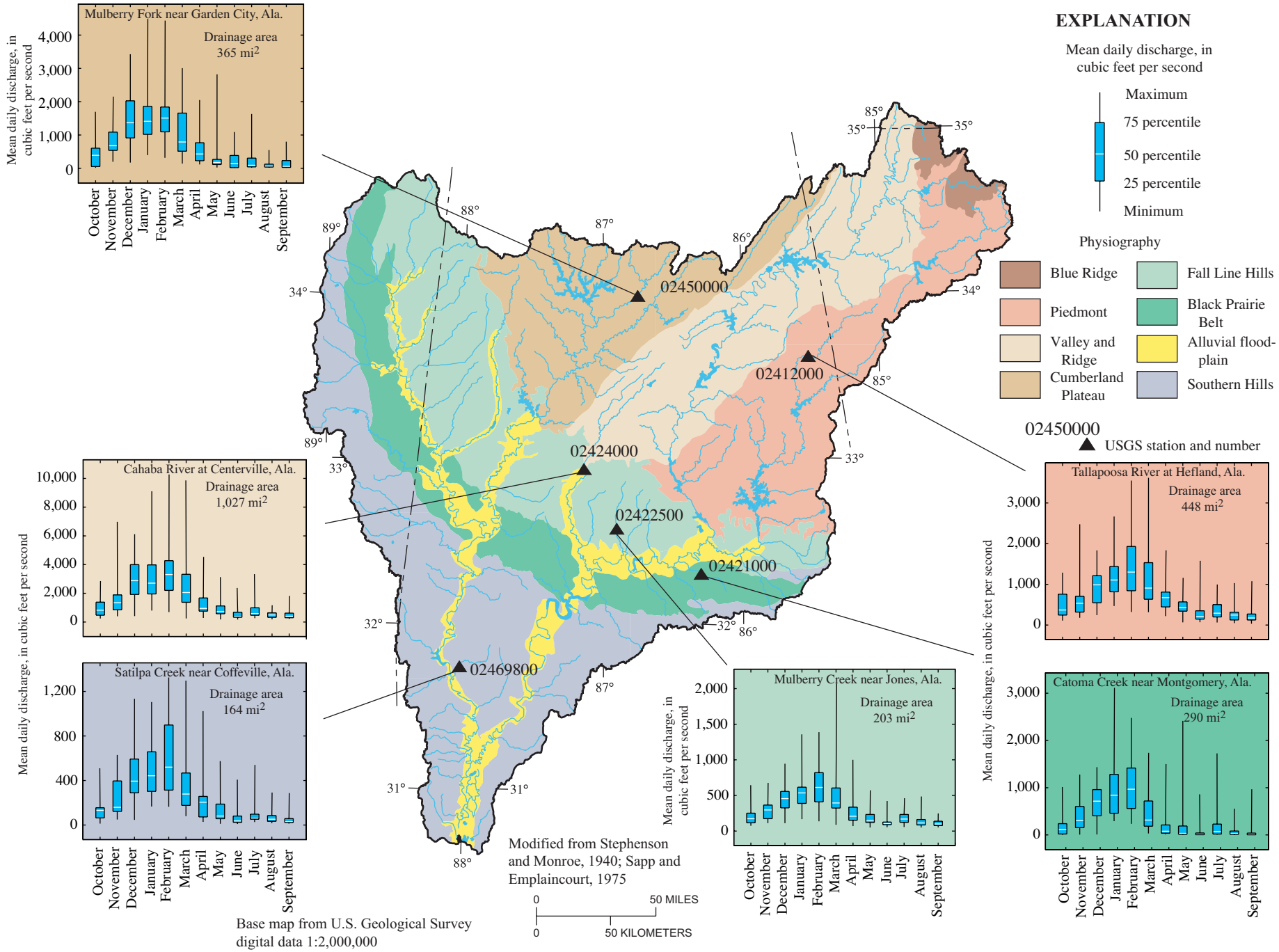
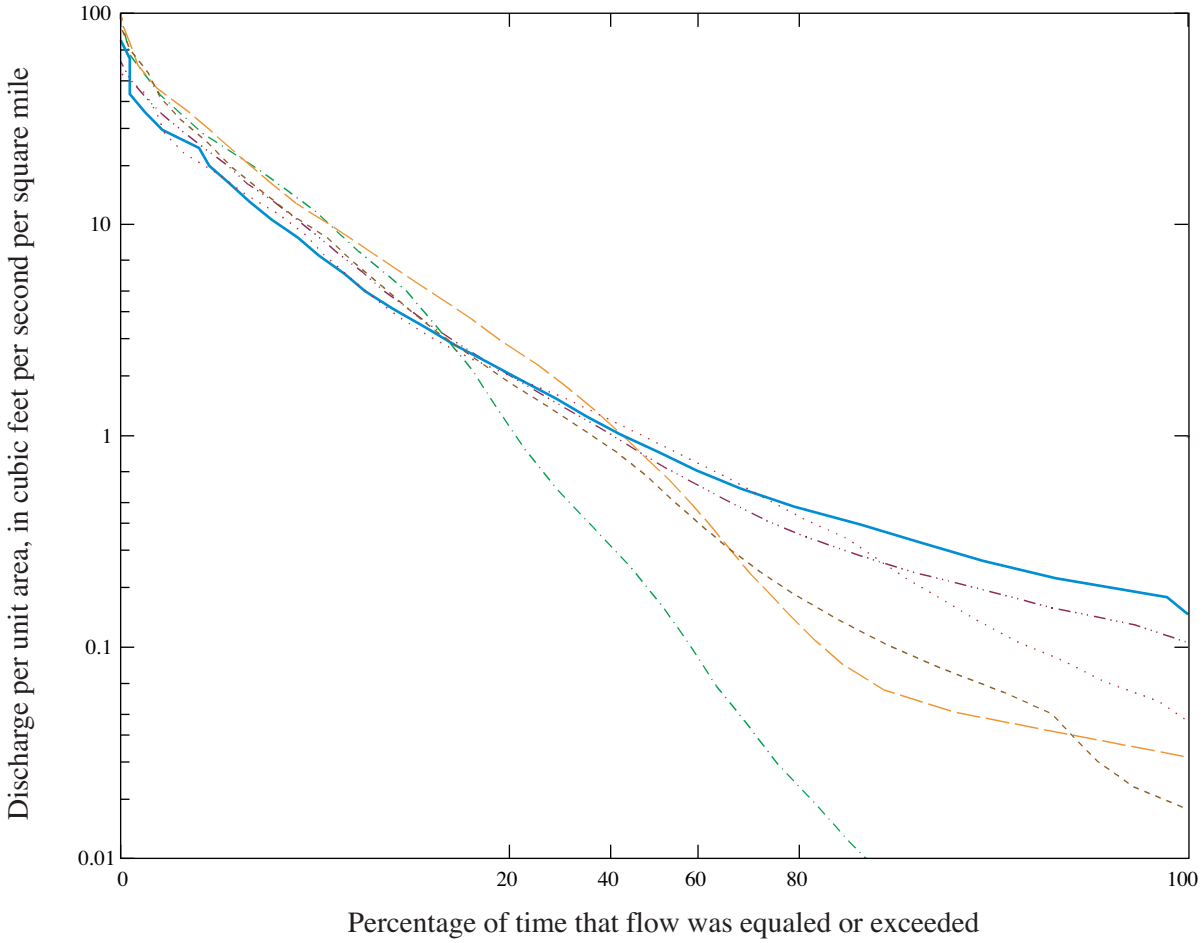



**Figure 10.** Locations and box plots of mean daily discharges for selected streamgaging stations for duration analysis representing the different physiographies in the Mobile River Basin.




**EXPLANATION**

| Line type | Station number | Stream | Physiography | Drainage area ($mi^2$) |
|---|---|---|---|---|
| | 02424000 | Cahaba River | Valley and Ridge | 1027 |
| | 02421000 | Catoma Creek | Black Prairie Belt | 290 |
| | 02450000 | Mulberry Fork | Cumberland Plateau | 365 |
| | 02422500 | Mulberry Creek | Fall Line Hills | 203 |
| | 02469800 | Satilpa Creek | Southern Hills | 164 |
| | 02412000 | Tallapoosa River | Piedmont | 448 |

**Figure 11.** Duration curves for selected streamgaging stations representing the different physiographies in the Mobile River Basin.