

## TEMPERATURE OF FLORIDA STREAMS

by  
Warren AndersonPrepared by  
UNITED STATES GEOLOGICAL SURVEY  
in cooperation with the  
BUREAU OF GEOLOGY  
FLORIDA DEPARTMENT OF NATURAL RESOURCESTALLAHASSEE, FLORIDA  
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The temperature of Florida's streams influence to some extent their use for all purposes. Temperatures are an important property of water to consider when planning for municipal, industrial, power generation, and other uses. Temperatures affect the chemical, physical, and biological condition of a stream. The amounts of solids and gases dissolved by a stream depend partly on its temperature and thus temperature influences the suitability of a stream for aquatic life. Further, through its influence on mineral and gas content and on biological activity, temperature affects the taste, odor, and appearance of water. Thus, stream temperatures are of interest in some measure to almost everyone.

Stream temperatures tend to fluctuate daily and seasonally with air temperatures but over a smaller range. Shallow slow-flowing nonshaded streams exhibit a greater daily and seasonal fluctuation in temperature than deeper fast-flowing shaded streams. Ground-water inflow to a stream tends to reduce the range of its temperature fluctuations. The long-term average temperature of a natural stream is normally about the same as the long-term average air temperature in the vicinity of the stream. However, appreciable inflow of geothermally heated water from deep aquifers raises average stream temperatures above average air temperatures at places in Florida. Further, inflow of artificially heated waters such as from power plants, industries, and effluent from cities also increases the maximum and average temperatures of a stream.

Natural warming of streams is primarily by solar radiation (insolation) and secondarily by heat transfer from the air and stream bed. A stream occasionally may be warmed slightly by vapor condensation at its surface. Cooling is largely by radiation augmented by surface evaporation and heat transfer to the air and stream bed.

The long-term average temperature of Florida streams within 4 degrees F is approximated by the zones delineated on the map. The accompanying graphs and the table show how air and water temperatures vary with respect to each other, to time, and to geographic location. In general, the patterns of variation in temperature of Florida streams are similar to and within the range encompassed by the graphs and table. Stream temperatures were obtained at the 140 sites shown on the map, generally between 1956 and 1968 as a part of the hydrologic monitoring network and do not represent an intense study. The data consist of an average of 70 temperature readings collected at 4- to 8-week intervals at 92 sites, daily temperature readings at 43 sites and thermograph records at 5 sites. The periodic and daily temperature readings were taken during daylight hours when water temperatures generally were higher than the average for the day. These data were adjusted to reflect 24-hour averages.

The zones delineated on the map show north-to-south increase in stream temperatures. The position of the lines separating the zones are generalized and were determined by the adjusted long-term average water temperature at the 140 sites. The northwestward bulges of the 68-72 and 72-76 degree zones may be attributed to inflow from the artesian aquifer to streams in these areas. The causes of the slightly warmer water temperatures in the western part of the 72-76 degree bulge are not apparent but they may be associated with several large lakes, at least one of which receives water from the artesian aquifer.

The highest and lowest stream temperatures observed in Florida since 1956 were 100 degrees F for Fishing Creek near Venus (Station 2560) and 34 degrees F for Ochlockonee River near Havana (Station 3290). The Sopchoppy River in northern Florida and Miami Canal in southern Florida were selected to show how water temperatures vary with time, location and air temperatures. The range in observed temperatures of these streams, 40 degrees F to 98 degrees F, encompasses the range in temperature likely to occur elsewhere in the State.

The effect of geographic location on the seasonal variation in stream temperatures is demonstrated by figure 1. Although the seasonal pattern of temperature fluctuation is somewhat similar, the seasonal range in temperatures is greater in northern Florida than in southern Florida with temperatures much lower in the north than in the south in winter and more nearly the same throughout the State in summer. Also, the peak of the average monthly temperature in the south is in September, 3 months later than in the north, even though average monthly maximums coincide in June.

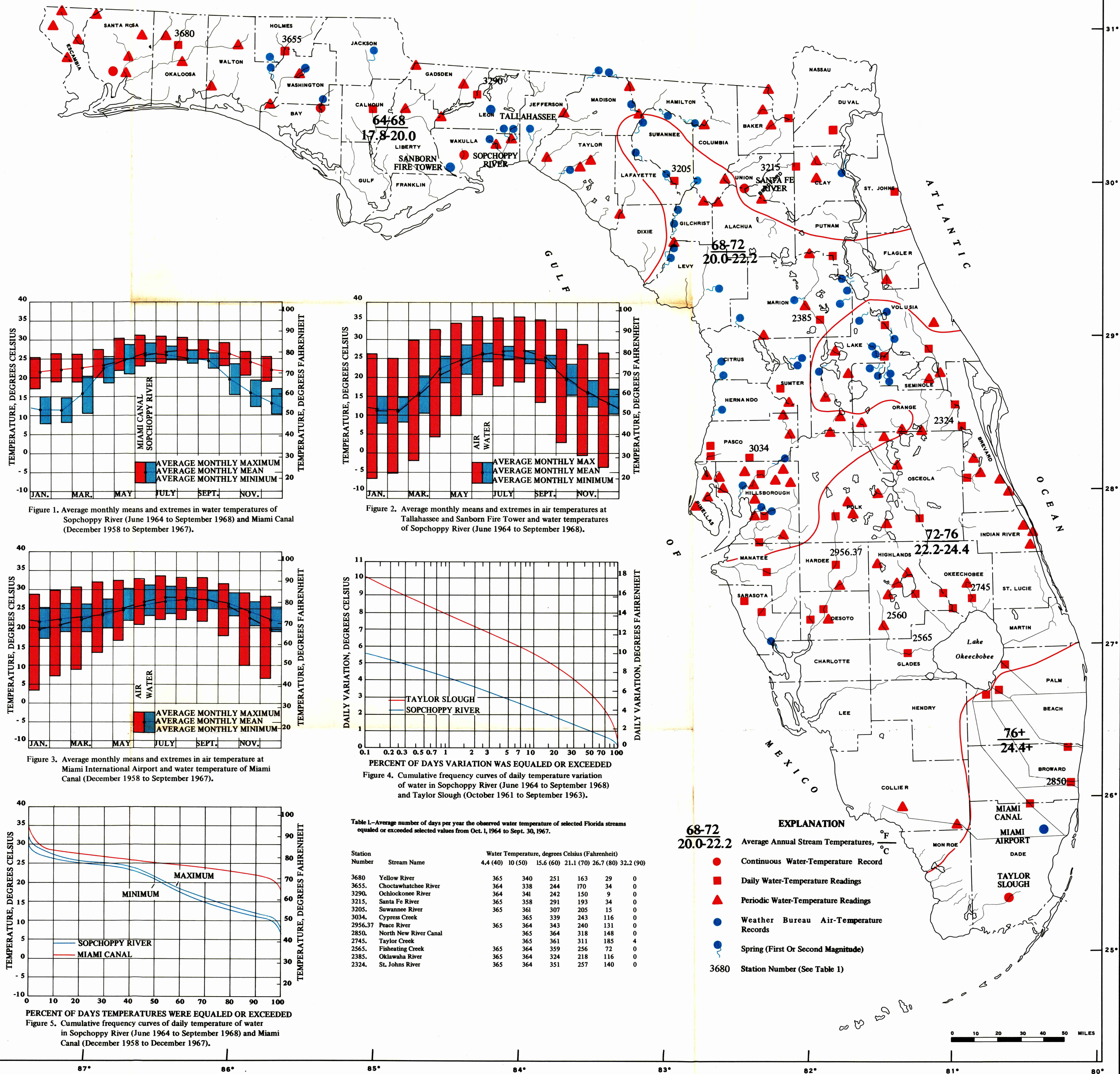
Streams that derive a significant part of their flow from deep aquifers do not conform to this seasonal pattern. Instead, such streams exhibit more stable temperatures and are lower in summer and higher in winter than those of adjacent streams unaffected by aquifer inflow. The location of many of the first and second magnitude springs that influence the temperatures of some Florida streams, especially when their flow constitutes a major part of the stream discharge, are shown on the map.

The variations in air temperatures and stream temperatures in northern and southern Florida are compared in figures 2 and 3. Although the range in air temperature fluctuations is much greater than that in water temperature fluctuations, the monthly average temperatures of the air and streams differ little in either northern or southern Florida. The average difference between the mean monthly maximum and the mean monthly minimum air temperatures is about 50 percent greater in northern Florida than in southern Florida. This indicates the secondary importance of heat transfer between a stream and the air.

The percentage of days that the diurnal range in water temperature of Sopchoppy River and Taylor Slough equals or exceeds a specific number of degrees is shown by figure 4. A curve prepared for Santa Fe River so closely resembles the curve for Sopchoppy River that it is not shown on figure 4. The two curves on figure 4 also show that the diurnal water temperature is more stable in north Florida than in south Florida. The distribution of diurnal temperature variations of most Florida streams will probably fall within the limit defined by the two curves on figure 4 except for those fed by springs. Also, though not indicated by figure 4, the number of days during which no change in water temperature occurred ranged from 25 percent of the days of the record for Sopchoppy River to 16 percent for Santa Fe River and only 2 percent for Taylor Slough.

The percentage of days that temperatures are likely to be equaled or exceeded in northern and southern Florida are shown in figure 5. The average water temperature for a day for the Miami Canal is not to be slightly less than the observed daily temperatures indicated by the Miami Canal curve because daytime temperatures average slightly higher than the average for the day. The curves for the Sopchoppy River show the percent of days the daily maximum and minimum water temperatures are likely to be equaled or exceeded. Additional data on temperature duration characteristics of Florida streams are given in table 1 for 12 streams distributed throughout the State. This table shows the average number of days per year that selected water temperatures were equaled or exceeded, October 1, 1964 to September 30, 1967.

## REFERENCE

U.S. Weather Bureau,  
Climatological Data, Florida: Monthly summaries, 1959-68, v. 63-72,  
nos. 1-12.

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