# GROUND-WATER CONDITIONS IN GEORGIA, 2005

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**Abstract.** The U.S. Geological Survey continuously monitors ground-water levels in a network of wells completed in major aquifers in Georgia. This network includes 19 wells in the surficial aquifer, 20 wells in the upper and lower Brunswick aquifers, 69 wells in the Upper Floridan aquifer, 17 wells in the Lower Floridan aquifer and underlying units, 10 wells in the Claiborne aquifer, 1 well in the Gordon aquifer, 10 wells in the Clayton aquifer, 12 wells in the Cretaceous aquifer system, 2 wells in Paleozoic-rock aquifers, and 11 wells in crystalline-rock aquifers. Data from these 171 wells were evaluated to determine whether mean-annual ground-water levels were within, below, or above the normal range during 2005, based on summary statistics for the period of record. Summaries indicate that water levels in 154 of the 171 wells monitored during 2005 (90 percent) ranged from normal to above normal.

## INTRODUCTION

Monitoring ground-water levels is important for management of water resources. The U.S. Geological Survey (USGS)—in cooperation with State, Federal, and local agencies—collects and disseminates ground-water-level data from a network of wells completed in major aquifers in Georgia (Fig. 1). This paper presents an overview of ground-water levels in selected aquifers in Georgia during 2005 based on continuous water-level measurements obtained from 171 wells. All wells are equipped with electronic data recorders that register at 60-minute intervals and are retrieved bi-monthly. Twenty of the wells are equipped with real-time satellite telemetry that transmits data from every 1 to 4 hours. Telemetered data are displayed on the USGS Georgia Water Science Center Web site at *http://waterdata.usgs.gov/ga/nwis/gw*.

### Method of Study

For each observation well, the median of monthly mean water levels for 2005 was compared to the period-of-record monthly mean water levels to determine if 2005 water levels were either above normal, below normal, or normal. In this paper, the normal range is defined as those monthly mean water-level observations that lie between the 25th and 75th percentiles (first and third quartiles), also known as the interquartile range, for the period of record (Leeth and others, 2003). For comparison purposes, the distribution of monthly mean water level observations is represented graphically with a boxplot (Fig. 2.). The results of comparing the median of monthly mean water levels for 2005 with the period-of-record normal range are graphically depicted on maps (Fig. 1) by an up arrow—2005 monthly mean water levels above period-of-record normal range; a down arrow—2005 monthly mean water levels below period-of-record normal range; or a circle—2005 monthly mean water levels within the period-of-record normal range.

### Occurrence of Ground Water

Contrasting geologic features and landforms of the physiographic provinces in Georgia affect the occurrence of ground water in the State. Surficial aquifers are present in each physiographic province and generally are under water-table (unconfined) conditions. The most productive water-bearing units are in the Coastal Plain in the southern half of the State and include, in order of increasing depth, the surficial and Brunswick aquifer systems (Clarke, 2003); Upper and Lower Floridan aquifers; Claiborne, Gordon, and Clayton aquifers; and Cretaceous aquifer system. In the Piedmont and Blue Ridge Provinces in northern Georgia, ground water occurs in the regolith (referred to as “surficial aquifers”) and in fractures in crystalline bedrock (referred to as “crystalline-rock aquifers”). In the Valley and Ridge and Appalachian Plateau Provinces, ground water occurs largely in secondary openings in folded and faulted sedimentary and metasedimentary rocks (referred to as “Paleozoic-rock aquifers”).

Changes in ground-water levels are caused by changes in aquifer storage—when recharge exceeds discharge, ground-water levels rise, and when discharge exceeds recharge, ground-water levels decline. Recharge varies in response to precipitation and surface-water infiltration to an aquifer. Discharge occurs as natural flow from an aquifer to streams and springs, as evapotranspiration, and as withdrawal from wells. Water levels typically show a cyclic pattern of seasonal fluctuation, with higher water levels in the winter and spring due to greater recharge, and lower water levels in the summer and fall due to less recharge, greater evapotranspiration, and increased pumpage. Ground-water pumpage is the most significant human activity that affects the amount of ground water in storage and rate of discharge from an aquifer (Taylor and Alley, 2001).

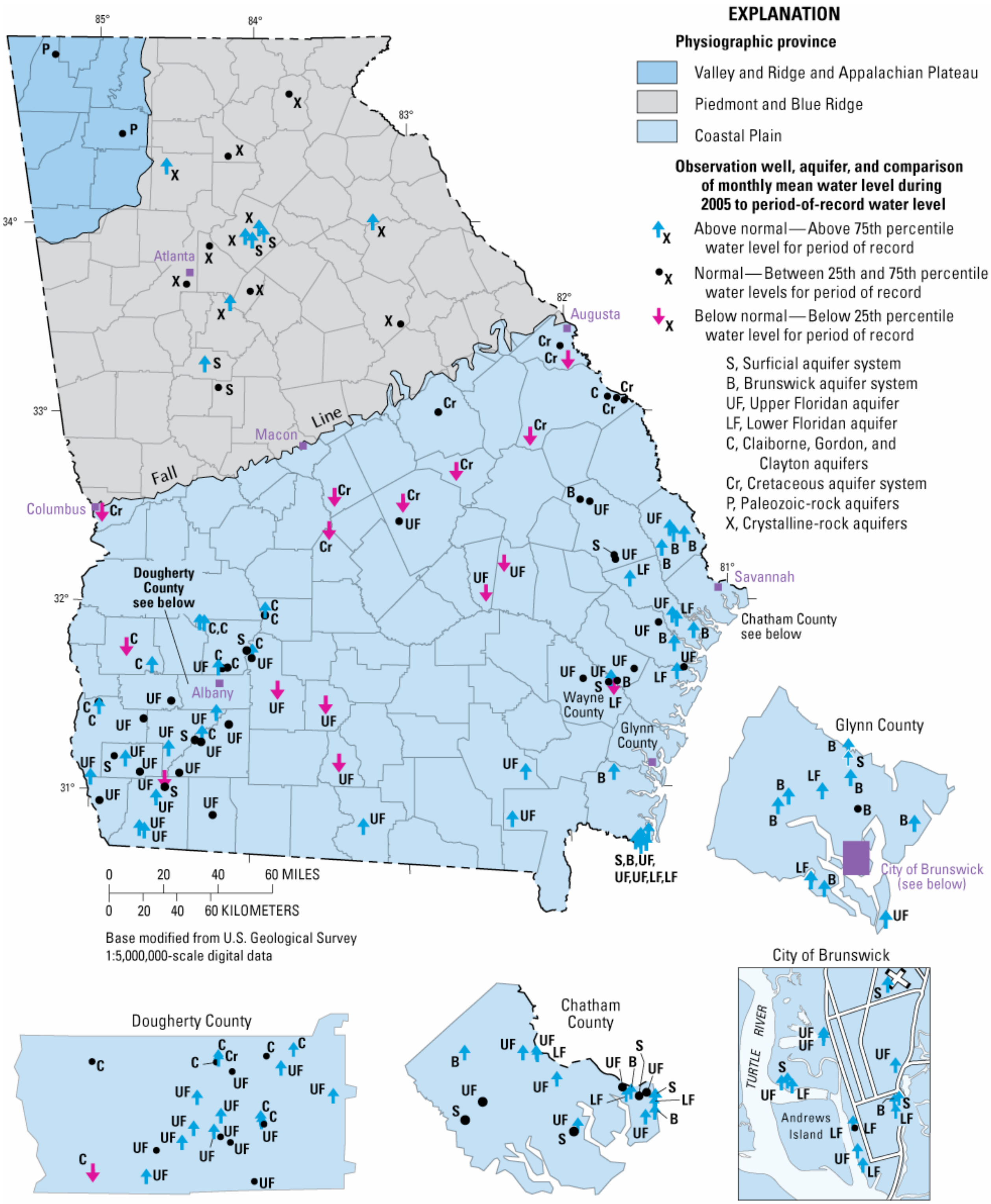


**Figure 1. Physiographic provinces, observation wells, and aquifer; and comparison of monthly mean water level during 2005 to period-of-record water level.**

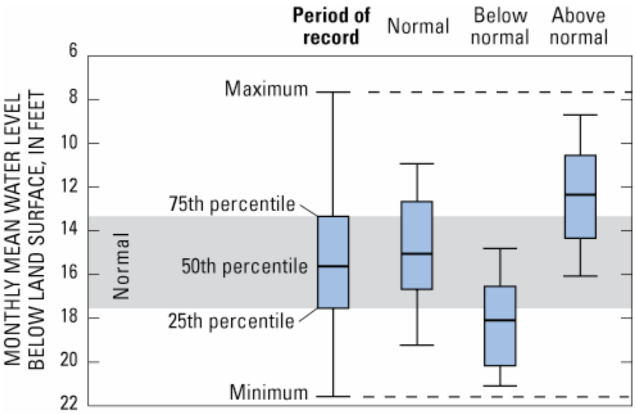


**Figure 2. Boxplot showing normal, below normal, and above normal water-level range and maximum and minimum water level.**

## GROUND-WATER LEVELS, 2005

During early 2005, ground-water levels in all aquifers monitored in Georgia continued to rise. The rise began about mid-2002, after a prolonged decline as a result of drought. During 2005, ground-water levels in the statewide network were either normal or above normal in 90 percent of the wells, and below normal in 10 percent of the wells (Table 1). Water levels in the northern half of the State were either normal or above normal during 2005, as were most of the water levels in the southern half of the State (89 percent of the wells). Variations in water levels between these areas reflect differences in the proximity of a well to aquifer recharge areas, differences in ground-water pumpage and the areal coverage of the monitoring network.

**Table 1. Percentage of water levels in the normal to above normal range and below the normal range, by aquifer or aquifer system, and geographic region, Georgia, 2005.**

| Aquifer/system | Water levels normal or above normal | | Water levels below normal | | Total number of wells |
|---|---|---|---|---|---|
| | Number of wells | Percent of total | Number of wells | Percent of total | |
| | By aquifer or aquifer system | | | | |
| Surficial aquifer system | 18 | 95 | 1 | 5 | 19 |
| Brunswick aquifer system | 20 | 100 | 0 | 0 | 20 |
| Upper Floridan aquifer | 63 | 91 | 6 | 9 | 69 |
| Lower Floridan aquifer | 16 | 94 | 1 | 6 | 17 |
| Claiborne and Gordon aquifers | 11 | 100 | 0 | 0 | 11 |
| Clayton aquifer | 8 | 80 | 2 | 20 | 10 |
| Cretaceous aquifer system | 5 | 42 | 7 | 58 | 12 |
| Paleozoic-rock aquifer | 2 | 100 | 0 | 0 | 2 |
| Crystalline-rock aquifer | 11 | 100 | 0 | 0 | 11 |
| **Total** | **154** | **90** | **17** | **10** | **171** |
| | By geographic region | | | | |
| North of Fall Line | 17 | 100 | 0 | 0 | 17 |
| South of Fall Line | 137 | 89 | 17 | 11 | 154 |

The Upper Floridan aquifer is confined throughout most of its extent (Fig. 1), except where it either crops out or is near land surface and in areas of karst topography in parts of southwestern and south-central Georgia. During 2005, 63 of the 69 wells monitored in the Upper Floridan aquifer ranged mostly from normal to above normal (91 percent). Below normal water levels were observed near pumping areas in the southwestern, south-central, east-central, and northern coastal parts of the State. In most parts of coastal Georgia, water levels in the Upper Floridan aquifer were either normal or above normal, except in areas where agricultural pumpage is prevalent. Water is confined and influenced mostly by pumpage in the Lower Floridan aquifer and underlying units in coastal Georgia. Water levels were either within or above the normal range in 16 of the 17 wells monitored during 2005. With the water level below normal in the well in Wayne County.

The Claiborne and Gordon aquifers in southwestern and east-central Georgia can be either confined or unconfined. During 2005, water levels were normal or above normal in the wells in these aquifers. Water is confined and influenced mostly by pumping in the Clayton aquifer in southwestern Georgia. Water levels in the Clayton aquifer were normal or above normal in 8 of the 10 wells. Where the water level was below normal is a reflection of the effects of agricultural pumping from this aquifer.

In the Cretaceous aquifer system, ground water is mostly confined but can be unconfined in stream valleys. Water levels were below the normal range in 7 of 12 wells during 2005, reflecting declines related to ground-water pumpage. This declining condition (with most water levels below normal) is in contrast to all of the other aquifers monitored in the State.

Water in the surficial aquifer system typically is in contact with the atmosphere (referred to as either an unconfined or water-table aquifer), but locally may be under pressure exerted by overlying strata (referred to as a confined aquifer). Where unconfined, water levels change quickly in response to recharge and discharge. Consequently, hydrographs from these wells show a strong relation to climate. Water levels in 18 of the 19 wells in the surficial aquifer system were above or within the normal range during 2005, indicating good recovery from the effects of drought. Water in the Brunswick aquifer system is confined. During 2005, water levels in all 20 wells in the Brunswick aquifer system ranged from normal to above normal range.

Water occurs under confined conditions in the Paleozoic-rock aquifers of northwestern Georgia. Water levels in the two wells were in the normal range during 2005. In the crystalline-rock aquifers of the Piedmont and Blue Ridge Provinces, water is present in discontinuous joints and fractures and may be either confined or unconfined. Crystalline-rock aquifers typically have local extent and can be highly affected by localized water use and climate. Water levels, in the crystalline rock aquifers of the Piedmont and Blue Ridge, were either above or within the normal range during 2005.

## LITERATURE CITED

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