MONTHLY WATER INVENTORY REPORT FOR OHIO

June 1998

http://www.dnr.state.oh.us/odnr/water/pubs/newsltrs/mwirmain.html

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PRECIPITATION during June was noticeably above normal in most areas of the state, but below normal in a few areas in northwestern and northeastern Ohio. The state average was 7.17 inches, 3.21 inches above normal. This ranks as the second wettest June for the state as a whole during the past 116 years. Regional averages ranged from 10.11 inches, 5.97 inches above normal, for the Southeast Region to 4.25 inches, 0.57 inch above normal, for the Northeast Region. This was the wettest June of record for the Southeast, South Central and Southwest regions, the second wettest for the Northeast Hills Region, the third wettest for the Central Region, the seventh wettest for the Central Hills and North Central regions, and the eighth wettest for the West Central Region. Cambridge (Guernsey County) reported the greatest amount of precipitation for the month, 15.40 inches; Belleville Locks and Dam (Meigs County) reported 15.33 inches. Unofficial reports in this general area of the state ranged up to around 22 inches. Toledo Express Airport (Lucas County) reported the least amount of June precipitation, a scant 1.73 inches.

Precipitation during June fell in a typical summer fashion ranging from light showers to intense downpours during dangerous storms and thunderstorms. Light, scattered showers fell during the first week of the month with amounts for the week generally ranging from around 0.25 to 0.5 inch. However, a few isolated, stronger storms crossed through northeastern Ohio and a few areas in southwestern Ohio reported up to nearly 1 inch of precipitation for the week. Much needed rain fell throughout the state during the second and third weeks of the month. Storms were common throughout the June 9-16 period. Daily amounts often exceeded 1 inch especially in the southern half of the state with isolated amounts of up to 3 inches reported at some locations in western and southwestern Ohio. The months most notable storm period began with tornadoes skipping across the southern Lake Erie shore line on June 25-26. Damage was reported in Ottawa and Sandusky counties. The slow-moving front responsible for this storm slowly sagged south and strong storms continued to cross the state along the frontal boundary. Storms pounded the state daily during June 26-30 with the area from north-central down though southeastern Ohio the hardest hit. High winds, extremely intense rain, and several tornadoes accompanied many of these storms. See "Strong Storms Cause Severe Flooding" under Notes and Comments at the end of this report for additional information.

Precipitation for the first half of the 1998 calendar year is above normal throughout the state. The average for the state as a whole is 24.67 inches, 5.07 inches above normal. Regional averages range from 30.23 inches, 8.44 inches above normal, for the South Central Region to 20.47 inches, 2.90 inches above normal, for the Northwest Region (see Precipitation table, departure from normal, past 6 months column). The Ohio Agricultural Statistics Service reports that at the end of June (July 2), soil moisture was estimated as being short or very short in 4 percent of the state, adequate in 53 percent of the state and surplus in 43 percent of the state.

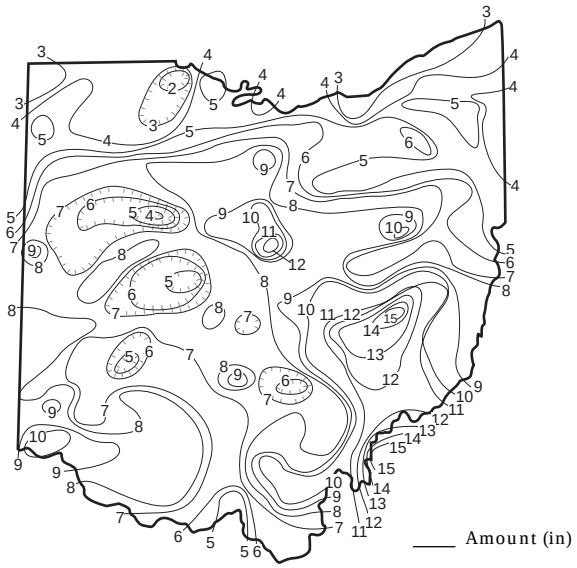
(continued on page 3)

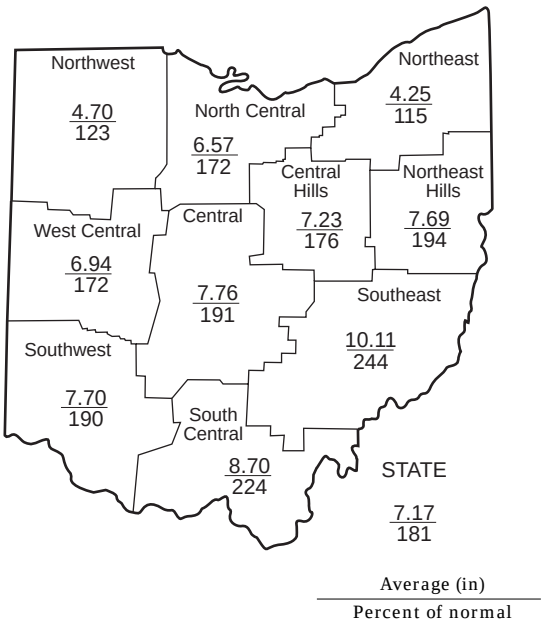
PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.) This Month	Past 3 Mos.	Past 6 Mos.	Past 12 Mos.	Past 24 Mos.	Palmer Drought Severity Index*
Northwest	+0.87	+0.44	+2.90	+5.60	+10.03	+0.9
North Central	+2.75	+2.27	+4.86	+4.99	+13.67	-0.8
Northeast	+0.57	+1.48	+2.07	-0.55	+10.23	-2.2
West Central	+2.90	+4.21	+4.03	+1.61	+5.54	+1.8
Central	+3.70	+5.49	+4.47	+5.08	+7.09	+0.9
Central Hills	+3.12	+3.59	+3.42	+1.48	+6.70	+0.2
Northeast Hills	+3.73	+5.05	+5.12	+2.92	+7.24	-1.1
Southwest	+3.65	+8.59	+6.83	+2.82	+7.66	+2.2
South Central	+4.82	+7.73	+8.44	+6.16	+10.52	+2.5
Southeast	+5.97	+7.46	+8.44	+9.26	+12.37	+3.1
State	+3.21	+4.63	+5.07	+3.94	+9.11	

*Above +4 = Extreme Moist Spell
3.0 To 3.9 = Very Moist Spell
2.0 To 2.9 = Unusual Moist Spell
1.0 To 1.9 = Moist Spell
0.5 To 0.9 = Incipient Moist Spell
0.4 To-0.4 = Near Normal
-0.5 To -0.9 = Incipient Drought
-1.0 To -1.9 = Mild Drought
-2.0 To -2.9 = Moderate Drought
-3.0 To -3.9 = Severe Drought
Below -4.0 = Extreme Drought

PRECIPITATION JUNE





MEAN STREAM DISCHARGE

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	95	37	123	96	79
Great Miami River at Hamilton	3,630	8,901	382	172	129	112
Huron River at Milan	371	602	348	165	160	152
Killbuck Creek at Killbuck	464	478	182	107	88	82
Little Beaver Creek near East Liverpool	496	460	147	124	124	108
Maumee River at Waterville	6,330	5,019	221	109	137	140
Muskingum River at McConnelsville	7,422	9,556	161	121	111	105
Scioto River near Prospect	567	598	225	109	102	97
Scioto River at Higby	5,131	8,355	239	151	117	129
Stillwater River at Pleasant Hill	503	1,213	453	150	111	94

STREAMFLOW during June was noticeably above normal in all drainage basins except those in extreme northeastern Ohio where it was below normal. June flows for the southern two-thirds of the state were high enough to be considered excessive. Generally, flows for the month declined seasonally from those flows recorded during May, but flows in north-central, northwestern and southwestern Ohio were greater than last month's flows. The monthly flows for several of the gauging stations used in this report ranked in the top five to ten greatest for June, but preliminary data indicates that no new record-high monthly flows were established.

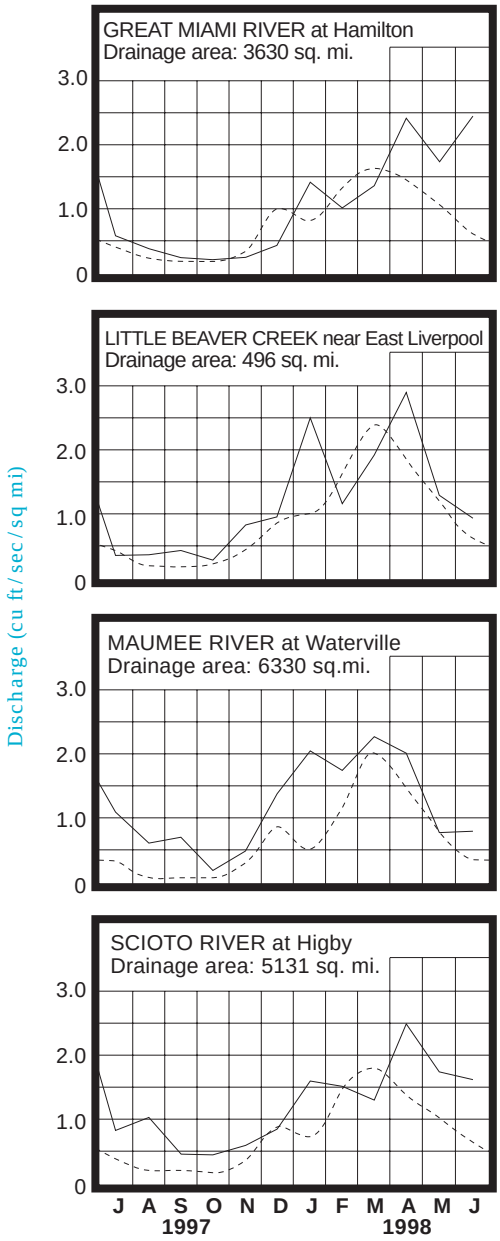
Flows at the beginning of the month were below normal in many areas of the state, but slightly above normal in a few drainage basins in southwestern and northeastern Ohio. Lowest flows for June in all basins occurred sometime during the first ten days of the month with most occurring on June 8 or 9. Flows increased statewide following heavier precipitation that fell during June 10-16. Drainage basins in western and northern Ohio recorded their greatest June flows following these storms. A series of storms during June 26-30 dumped extremely heavy precipitation from north-central down through portions of central and on into southeastern Ohio. Very serious flash-floods occurred in many watersheds. Streams and rivers in the Muskingum and Hocking river basins as well as streams that drain directly into the Ohio River had the greatest flooding. A few of those streams include Duck Creek, Wills Creek, and Steep Run. Twenty one counties have been declared disaster areas as a result of this flooding. See "Strong Storms Cause Severe Flooding" under Notes and Comments at the end of this report for more information. Flows at the end of the month remained noticeably above normal in most areas of the state, but were below normal in northwestern and northeastern Ohio.

RESERVOIR STORAGE for water supply during June increased in both the Mahoning and Scioto river basins. Storage remained at above-normal seasonal levels in both basins.

Reservoir storage at the end of June in the Mahoning basin index reservoirs was 99 percent of rated capacity for water supply compared with 98 percent for last month and 99 percent for June 1997. Month-end storage in the Scioto basin index reservoirs was 105 percent of rated capacity for water supply compared with 101 percent for last month and 102 percent for June 1997. Surface-water supplies continue to remain adequate throughout the state.

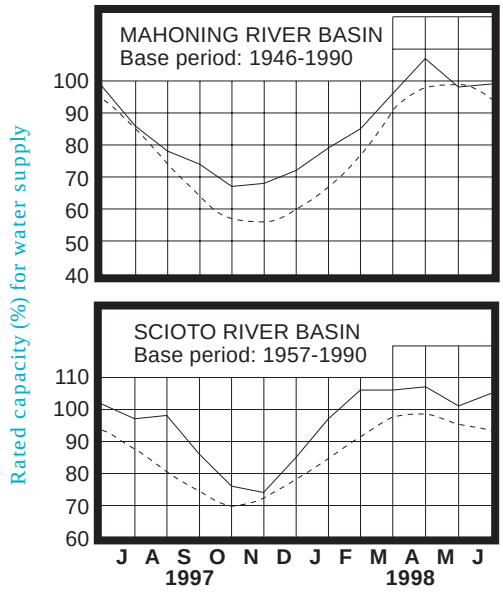
As a result of the heavy precipitation during the last week of the month, reserve storage in many flood control and recreational reservoirs in the Muskingum, Hocking and Scioto river basins was being utilized at the end of June. Levels in some reservoirs in eastern Ohio reached notably high levels. Many smaller dams had flow through their emergency spillway. Although a few dams received some damage, no failures were reported.

MEAN STREAM DISCHARGE



Base period for all streams: 1961-1990

RESERVOIR STORAGE FOR WATER SUPPLY



Normal – – – – Current ———

GROUND WATER levels during June declined in most aquifers. A few exceptions occurred in some shallow sand and gravel aquifers were levels showed some net improvement during the month. Generally, declines during the month were less than those usually observed.

Ground water levels in all aquifers were declining at the beginning of the month. Levels in consolidated aquifers continued to slowly decline through the end of the month or stabilized after the middle of the month. Levels in many unconsolidated aquifers showed some improvement after the middle of the month and then were rather stable through the end of the month. Notable exceptions occurred in many shallow sand and gravel aquifers in central and eastern Ohio were levels rose sharply just prior to the end of the month.

Although current levels are lower than they were a year ago in many aquifers, ground water supplies continue to remain in good condition throughout the state. Levels are near or above normal in most areas of Ohio, but are below normal in some aquifers in the eastern half of the state. The above normal precipitation during June in this area could eliminate a large portion of this deficit.

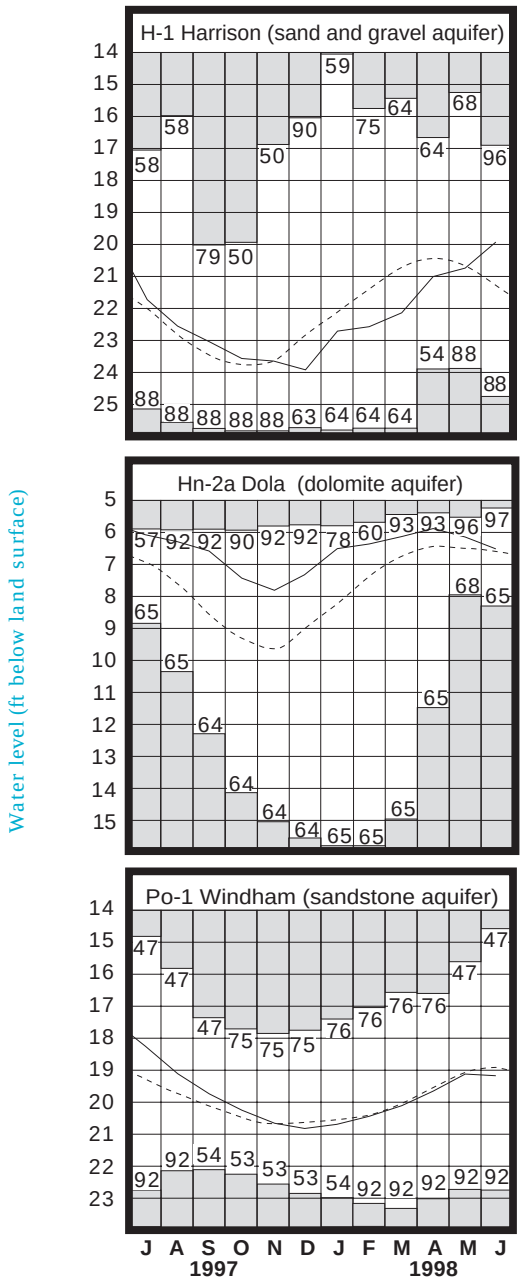
LAKE ERIE level declined during June. The mean level was 573.49 feet (IGLD-1985) which is 0.30 foot below last month's mean level and 1.67 feet above normal. This month's level is 0.76 foot lower than the June 1997 level and 4.29 feet above Low Water Datum.

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from: Last Month	Change in feet from: Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	15.05	-1.14	-1.96	+1.25
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.99	+0.38	-0.15	+0.38
Fr-10	Columbus, Franklin Co.	Gravel	42.10	+0.95	-0.52	-0.64
H-1	Harrison, Hamilton Co.	Gravel	19.94	+1.36	+0.80	-0.15
Hn-2a	Dola, Hardin Co.	Dolomite	6.52	+0.11	-0.36	-0.75
Po-1	Windham, Portage Co.	Sandstone	19.19	-0.27	-0.06	-1.71
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.51	-1.62	-0.52	-1.60

GROUND-WATER LEVELS



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990

Record high and low, year of occurrence

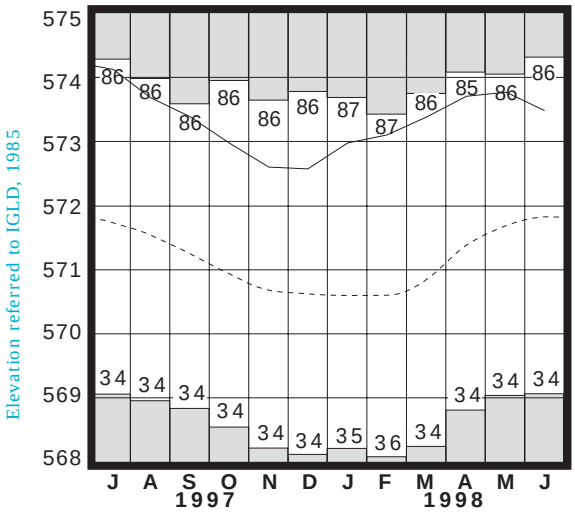
SUMMARY

Precipitation was noticeably above normal throughout most of Ohio with the average of 7.17 inches ranking as the second wettest June during the past 116 years. This was the wettest June of record across the southern one-third of the state. Streamflow was noticeably above normal in all drainage basins except those in extreme northeastern Ohio. A series of storms during June 26-30 resulted in severe flooding from north-central down through southeastern Ohio. Streams and rivers in the Muskingum and Hocking river basins as well as streams in southeastern Ohio that drain directly into the Ohio River were impacted the greatest. Reservoir storage increased and was at above-normal seasonal levels. Ground-water supplies showed seasonal declines but were improving at the end of the month. Lake Erie level started its seasonal decline by falling 0.30 foot but remained above the long-term June average by 1.67 feet.

(continued from front page)

Precipitation for the 1998 water year is above normal throughout the state. The state average is 31.01 inches, 3.84 inches above normal. Regional averages range from 36.75 inches, 6.99 inches above normal, for the South Central Region to 26.26 inches, 1.66 inches above normal, for the Northwest Region.

LAKE ERIE LEVELS at Fairport



Base period: 1900-1991

Record high and low, year of occurrence

Normal – – – – Current ———

NOTES AND COMMENTS

STRONG STORMS CAUSE SEVERE FLOODING

Many areas of Ohio were rocked with strong thunderstorms during June 25-30. The storms were associated with a slow moving frontal boundary that slowly sagged its way through the state. High winds, extremely heavy rainfall, and tornadoes were associated with many of the storms. To compound the problems, several of these storms struck at night. Flooding was widespread across eastern and southeastern Ohio and locally severe in central and north-central Ohio. Tragically, the loss of 11 lives has been attributed to these storms. Unofficial reports of daily rainfall amounts ranged up to 9 inches following many of these storms. Unofficial cumulative precipitation amounts for the period ranged up to around 22 inches. As a result of the storm's damage from winds, tornadoes, and flooding, 23 Ohio counties have been declared disaster areas. Those counties are: Athens, Belmont, Coshocton, Franklin, Guernsey, Harrison, Holmes, Jackson, Jefferson, Knox, Meigs, Monroe, Morgan, Morrow, Muskingum, Noble, Ottawa, Perry, Pickaway, Richland, Sandusky, Tuscarawas, and Washington.

The first signs of what was the beginning of the disastrous events yet to unfold began with tornadoes skipping across the southern Lake Erie shoreline on June 25-26. Damage was reported in Ottawa and Sandusky counties. Storms continued to develop along the frontal boundary as it slowly sagged south. The first in a series of storms that produced flooding rains began late on June 26 and continued into the morning hours of June 27. This storm dumped from 2 to 6 inches of rain from Crawford and Morrow counties, down through Knox and Muskingum counties, and then on into Morgan and Washington counties. The next day, storms pounded the region again settling in an area from Knox County east to Tuscarawas County and south to Washington and Meigs counties with 2 to more than 6 inches of rain falling. Guernsey and Athens counties were especially hard hit as were portions of Morgan, Noble and Perry counties. Storms during June 28-29 were not quite as widespread, but from 2 to more than 6 inches of rain fell in portions of Franklin, Madison and Pickaway counties and also again in Guernsey County. Locally heavy rain of 2 to 4 inches fell throughout the Hocking River valley and also in a few north-central Ohio locations. The storms finally began to leave the state after June 30 but not before a few more storms crossed through northern Ohio. Cumulative amounts of precipitation from all of these storms for the eastern half of the state ranged from 2 inches to at least 10 inches.

Flash-flooding occurred in many streams in the Muskingum and Hocking river basins and in streams that drain directly into the Ohio River. Duck Creek, Wills Creek, and Steep Run are a few of those streams especially hard hit. Generally, these flood peaks were not record levels in the larger drainage basins, but may very well be the floods of record in some of the smaller watersheds. At the time of this reports preparation, hydrologists are still collecting and analyzing data.

NEW PUBLICATIONS

The Division of Water and the U. S. Geological Survey announce the availability of the following new publication:

Analysis of the Streamflow-Gaging Station Network in Ohio for Effectiveness in Providing Regional Streamflow Information

(U. S. Geological Survey Water-Resources Investigations Report 98-4043)

by David E. Straub

This report, prepared cooperatively with the Ohio Department of Natural Resources (ODNR) Division of Water, presents the results of an analysis of Ohio's streamflow-gaging network for providing regional streamflow information. This analysis involved application of the principles of generalized least squares regression between streamflow and climate and basin characteristics. All active and discontinued gaging stations with five of more years of unregulated streamflow data were used to develop regression equations for three flow characteristics: the instantaneous peak flow with a 100-year recurrence interval, the mean annual flow, and the 7-day, 10-year low flow. The network was evaluated for the current (1996) condition and for 5- and 20-year planning horizons.

The analysis involved the use of the regression equations in combination with location, period of record, and cost of operation for each site. It provides a quantitative measure of the importance of each gaging station by ranking each site according to the potential cost-weighted reduction of the mean square error of the regression equations. A combined rank was also computed based on the average of the individual ranks of the three flow characteristics.

The analysis found that the predictive ability of the regression equations developed from the gaging station network could be improved for all three flow characteristics with the collection of additional streamflow data. The addition of new stations in the network would result in an even greater improvement. The report suggests that additional data collected at stations with less than 11 years of record and with drainage areas smaller than 200 square miles contributed the largest cost-weighted reduction to the average sampling-error variance of the regional estimating equations. The results of the network analysis can be used to prioritize the continued operation of active gaging stations or the reactivation of discontinued gaging stations if the objective is to maximize the regional streamflow information content in the network. However, since streamflow gaging stations are rarely operated for the exclusive purpose to provide regional information and are usually operated for many reasons, several other factors need to be considered in decisions concerning the continued operation of an existing gaging station or the addition of a new station.

A limited number of this new publication is available from either the U. S. Geological Survey, Water Resources Division, 975 West Third Avenue, Columbus, Ohio 43212-3192, phone (614) 469-5553 or the ODNR Division of Water, 1939 Fountain Square, Building E-1, Columbus, Ohio 43224-1336, phone (614) 265-6739.

ACKNOWLEDGMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:
- *U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Conservancy District: U.S. Army Corps of Engineers, Muskingum Area.*

Streamflow and reservoir storage data:
- *U.S. Geological Survey, Water Resources Division.*

Lake Erie level data:
- *U.S. Army Corps of Engineers, Detroit District.*

Palmer Drought Severity Index:
- *U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.*

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