Hydrologic Conditions in Kansas, Water Year 2020

The U.S. Geological Survey (USGS), in cooperation with Federal, State, and local agencies, maintains a long-term network of hydrologic monitoring stations in Kansas. This network included 219 real-time streamgages, 12 real-time reservoir-level monitoring stations, and 20 groundwater monitoring stations in water year (WY) 2020. A WY is a 12-month period from October 1 to September 30 and is designated by the calendar year in which it ends.

Real-time data are verified by USGS personnel throughout the year with regular measurements of streamflow, lake levels, and groundwater levels. Hydrologic data collected in real time aid in the understanding of, and decisions made involving, water resources of Kansas. Hydrologic conditions are assessed annually by comparing statistical analyses of current and past WY data for the period of record. The monitoring of hydrologic conditions in Kansas can provide critical information to meet several needs including water-resources management, protection of life and property, reservoir operations, agricultural practices, public supply, ecological assessments, and industrial and recreational purposes.

Preceding Conditions and Precipitation

WY 2019 was characterized by greater than normal precipitation across the State (fig. 1*A*; National Oceanic and Atmospheric Administration, 2020). This resulted in normal to much greater than normal runoff and streamflow (fig. 1*B*; U.S. Geological Survey, 2020b). Of the 12 reservoirs monitored by the USGS in Kansas, 10 began WY 2020 with water-level elevations above their full conservation pool.

During WY 2020, some areas of Kansas received greater than normal annual precipitation, and some received less than normal precipitation (fig. 2; National Oceanic and Atmospheric Administration, 2020). All the major drainage basins in the State had areas with greater than normal, less than normal, and normal precipitation (fig. 3). There was however a pattern of predominantly greater than normal precipitation in north-central and northeastern Kansas and less than normal precipitation in extreme western and southeastern Kansas. Despite generally receiving a normal amount of precipitation in WY 2020, drought conditions intensified across much of the State (fig. 4*A* and *B*; National Drought Mitigation Center, 2020).

Characteristically, Kansas is typified by a pronounced gradient of precipitation across the State, and WY 2020 was no different. The westernmost part of the State received 10–20 inches of precipitation, and the easternmost part received 35–50 inches with small areas receiving as much as 50–60 inches (fig. 5; National Oceanic and Atmospheric Administration, 2020).

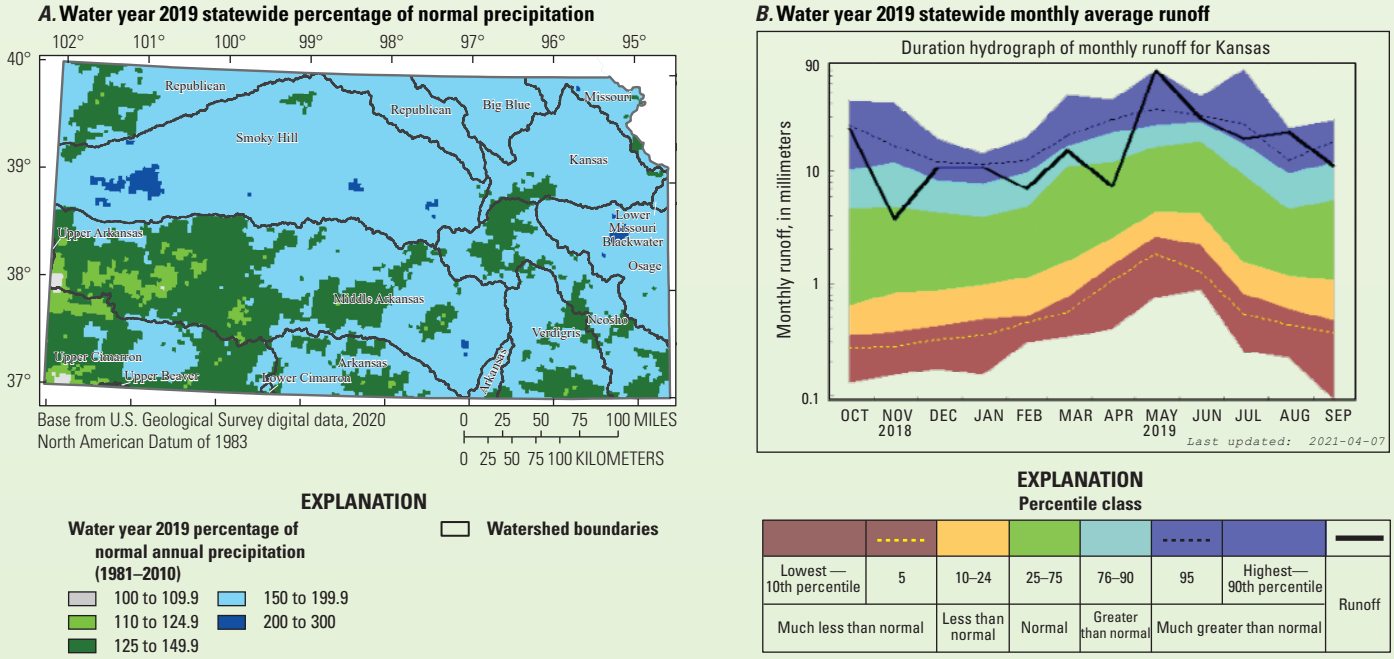


Figure 1. Water year 2019 precipitation in Kansas. *A*, water year 2019 statewide percentage of normal precipitation (1981–2010; National Oceanic and Atmospheric Administration, 2020); *B*, statewide monthly average runoff for Kansas during water year 2019 (U.S. Geological Survey, 2020b).

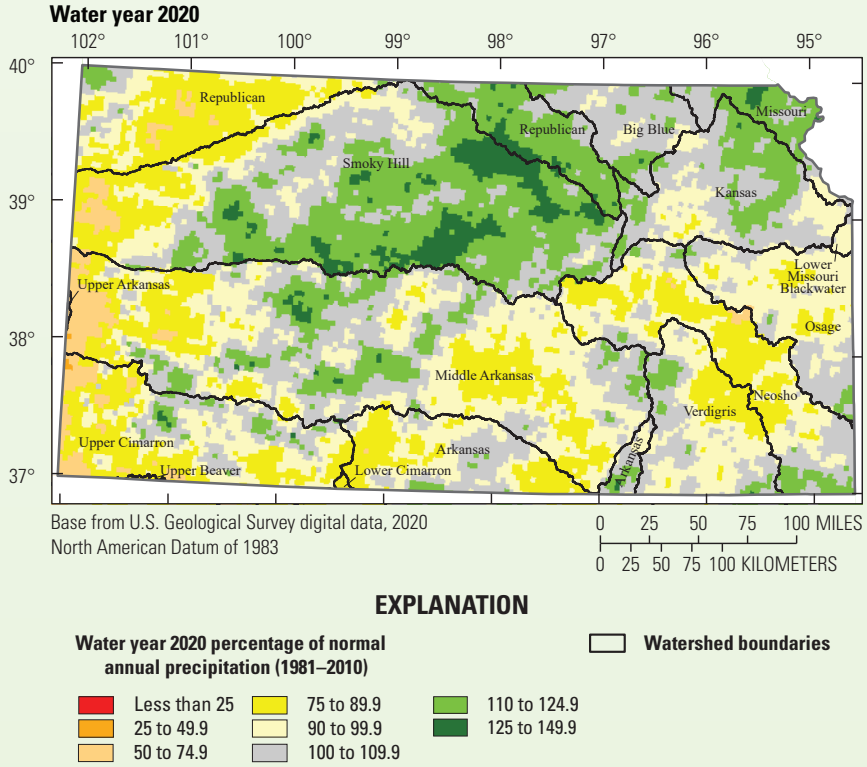


Figure 2. Comparison of water year 2020 statewide percentage of normal precipitation (1981–2010; National Oceanic and Atmospheric Administration, 2020).

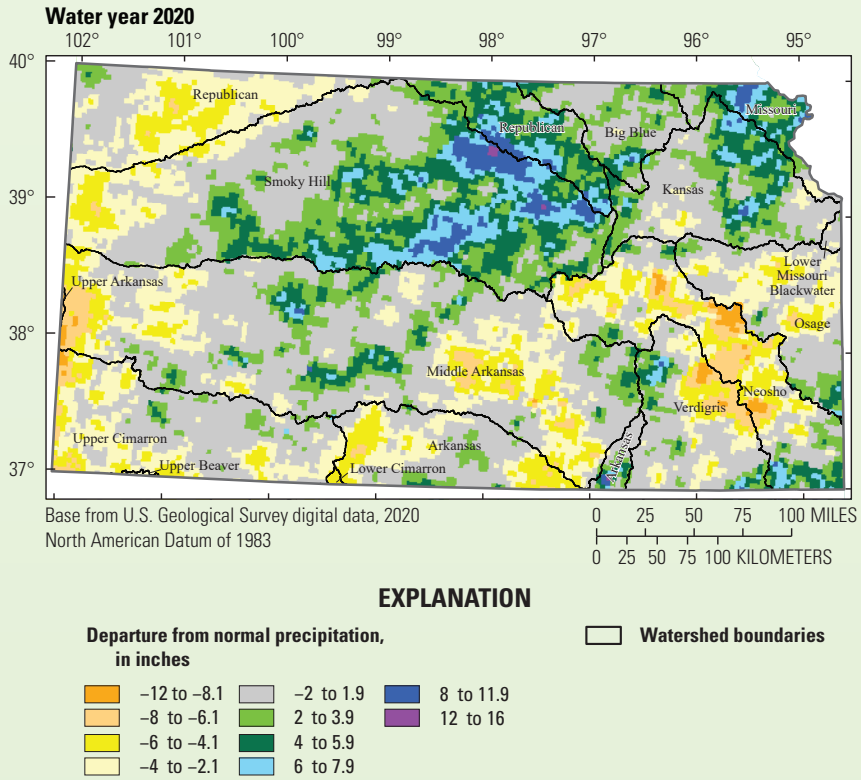


Figure 3. Observed statewide departure from normal precipitation, in inches (1981–2010; National Oceanic and Atmospheric Administration, 2020), for water year 2020.

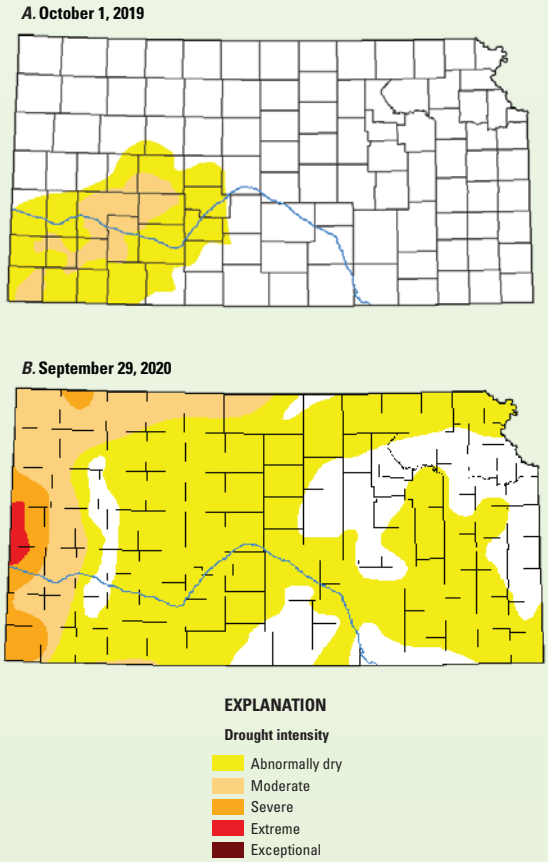


Figure 4. Comparison of drought conditions in Kansas (National Drought Mitigation Center, 2020). *A*, at the beginning of water year 2020; *B*, at the end of water year 2020.

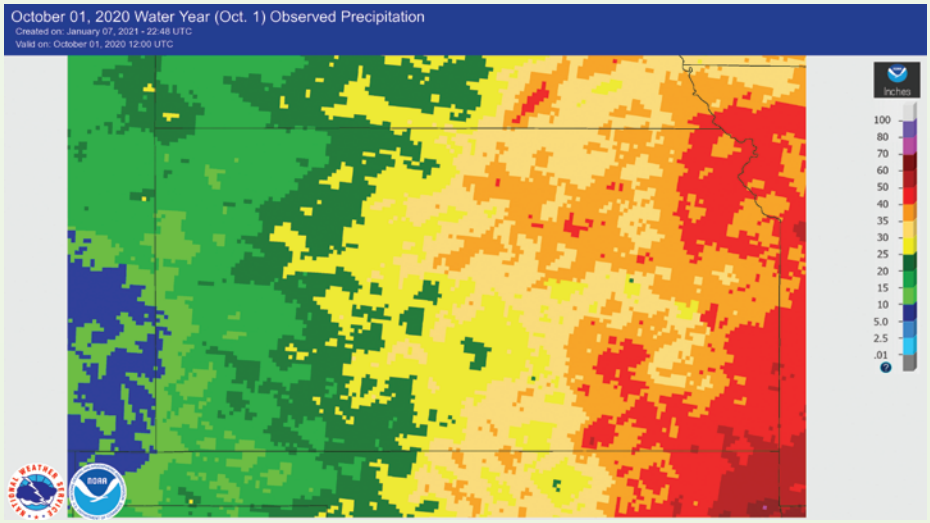


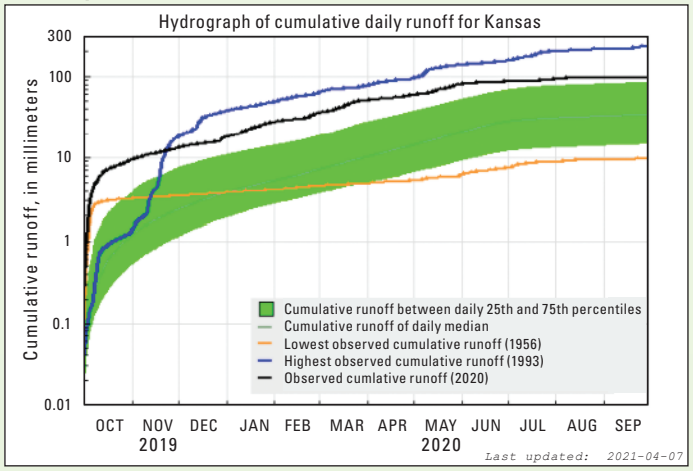
Figure 5. Observed statewide precipitation, in inches (1981–2010; National Oceanic and Atmospheric Administration, 2020), water year 2020.

Drainage Basin Runoff and Streamflow Conditions

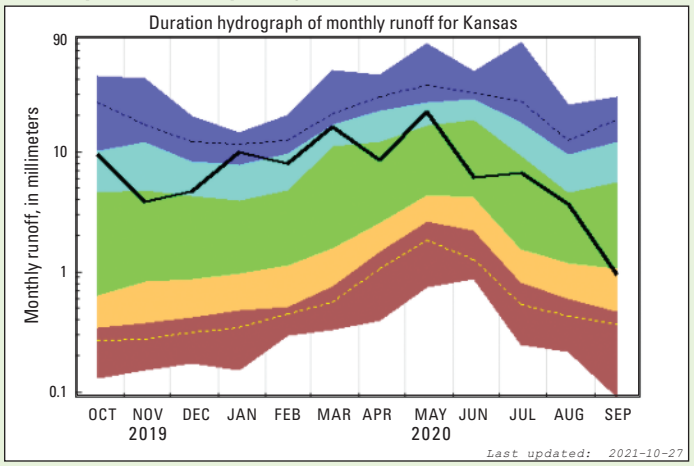
Estimated runoff (flow per unit area) based on available streamflow data at gaged locations can be used to characterize streamflow over large areas such as drainage basins or States (Brakebill and others, 2011). In WY 2020, Kansas was characterized by normal to much greater than normal runoff (fig. 6*A* and *B*; U.S. Geological Survey, 2020b). WY 2020 began with statewide runoff much greater than the normal level, but by summer, runoff was in the normal range, approaching slightly less than the normal level in September (fig. 6*B*; U.S. Geological Survey, 2020b). The less than normal runoff condition corresponds to the mostly less than normal precipitation across most of the State from May to the end of the WY (fig. 7*A*–*J*). This condition resulted in increased drought conditions across much of the State by the end of September 2020, in comparison with drought conditions at the beginning of the WY (fig. 4*A*; National Drought Mitigation Center, 2020).

Streamflow conditions across the State ranged from extremely low to extremely high percentiles during WY 2020 (fig. 8; U.S. Geological Survey, 2020b). The southwestern part of the State remained at less than normal to much less than normal through the entirety of the WY. In the rest of the State, a wide range of streamflow conditions was observed.

A. **Water year 2020 cumulative runoff**



B. **Water year 2020 monthly average runoff**



EXPLANATION

Percentile class

Lowest — 10th percentile	5	10–24	25–75	76–90	95	Highest— 90th percentile	Runoff
Much less than normal		Less than normal	Normal	Greater than normal	Much greater than normal		

Figure 6. Statewide runoff for Kansas during water year 2020 (U.S. Geological Survey, 2020b). *A*, cumulative runoff; *B*, monthly average runoff.

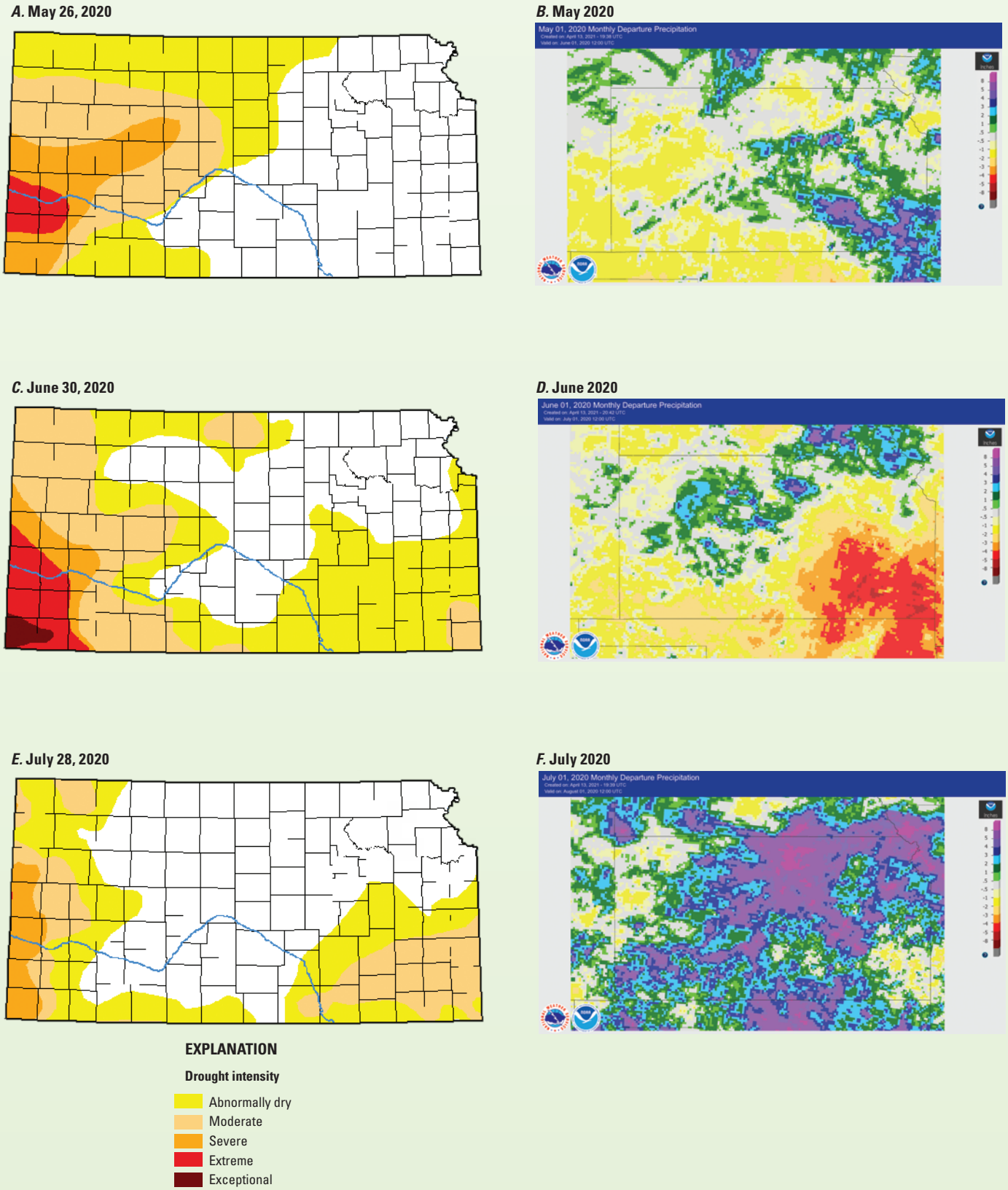
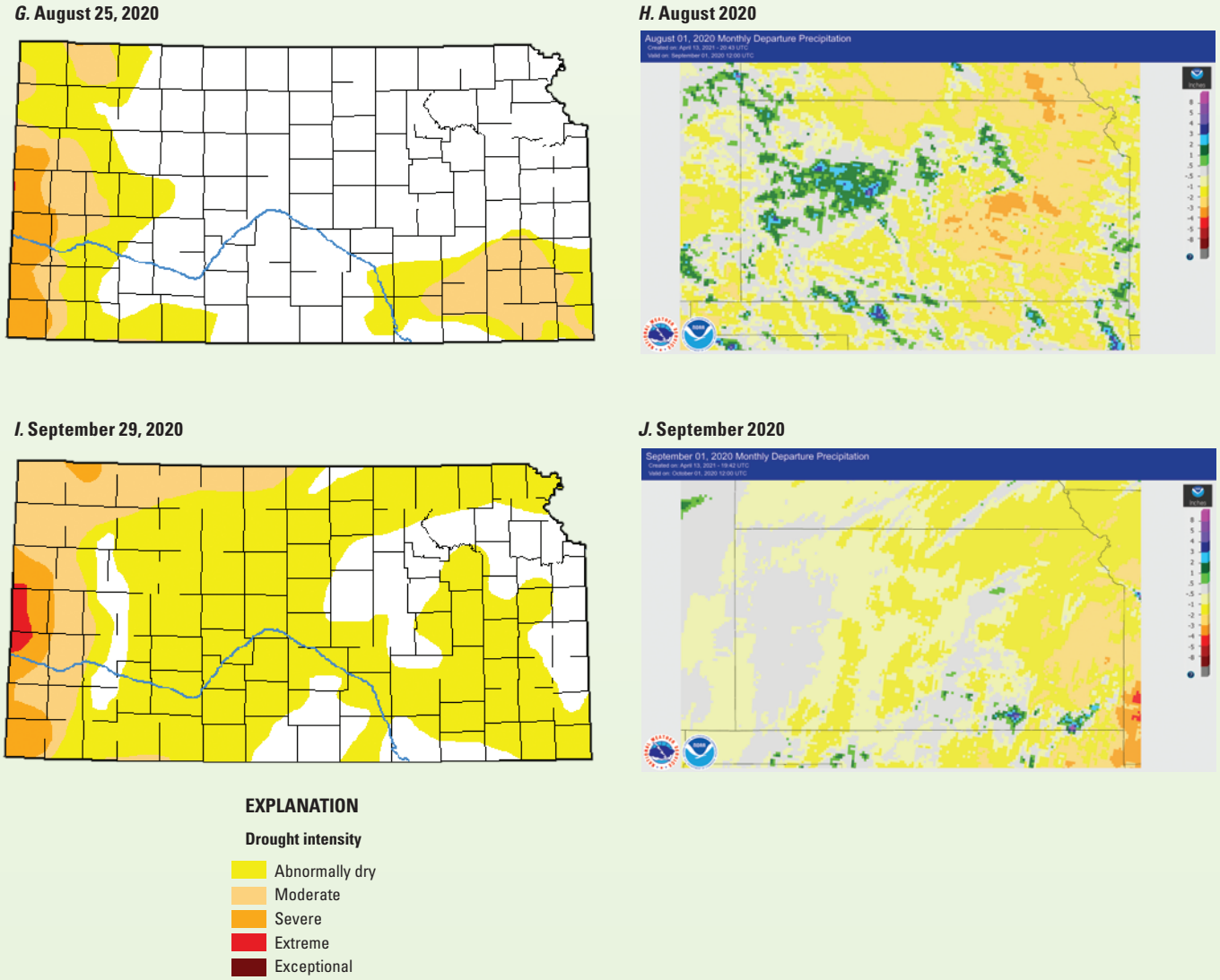


Figure 7. Comparison of drought conditions in Kansas (National Drought Mitigation Center, 2020) and observed statewide departure from normal precipitation, in inches (1981–2010; National Oceanic and Atmospheric Administration, 2020). *A*, at the end of May 2020; *B*, the month of May 2020; *C*, at the end of June 2020; *D*, the month of June 2020; *E*, at the end of July 2020; *F*, the month of July 2020; *G*, at the end of August 2020; *H*, the month of August 2020; *I*, at the end of September 2020; *J*, the month of September 2020.



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Reservoirs

The USGS monitors the water level and contents of 12 reservoirs in Kansas. Some of these reservoirs began WY 2020 more than 100 percent above their conservation pools because of the greater than normal precipitation received during WY 2019. These reservoirs (and their real-time monitoring stations) included Milford Lake (06857050), Kanopolis Lake (06865000), Tuttle Creek Lake (06886900), Perry Lake (06890898), Clinton Lake (06891478), and Pomona Lake (06912490) (fig. 9; U.S. Geological Survey, 2020a). Additional reservoirs above their conservation pool at the beginning of the WY, but at less than 120 percent of their conservation pool, were Wilson Lake (06868100), Melvern Lake (06910997), and Hillsdale Lake (06914995). The remaining reservoirs, Cedar Bluff (06861500), HorseThief (07140885), and Cheney (07144790), began the WY with less than 100 percent of their conservation pool full.

Except for Milford Lake, Tuttle Creek Lake, Perry Lake, and Hillsdale Lake, reservoir storage was below the conservation pool at the eight reservoirs by the end of WY 2020. Four of the reservoirs with larger storage capacity (Milford Lake, Tuttle Creek Lake, Perry Lake, and Clinton Lake) ended the WY, still above a 100-percent full conservation pool, with greater than 40 percent less than the volume with which they began the WY. Only HorseThief Reservoir indicated an increase in storage at the end of the WY compared to the beginning.

Cedar Bluff Reservoir indicated lower storage conditions from the other 11 reservoirs monitored by the USGS. Cedar Bluff has little inflow, which results in relying heavily on precipitation. As a result, Cedar Bluff has minimal outflow, except during heavy precipitation conditions; thus, this reservoir is not as sensitive to storage changes as the other 11 reservoirs monitored.

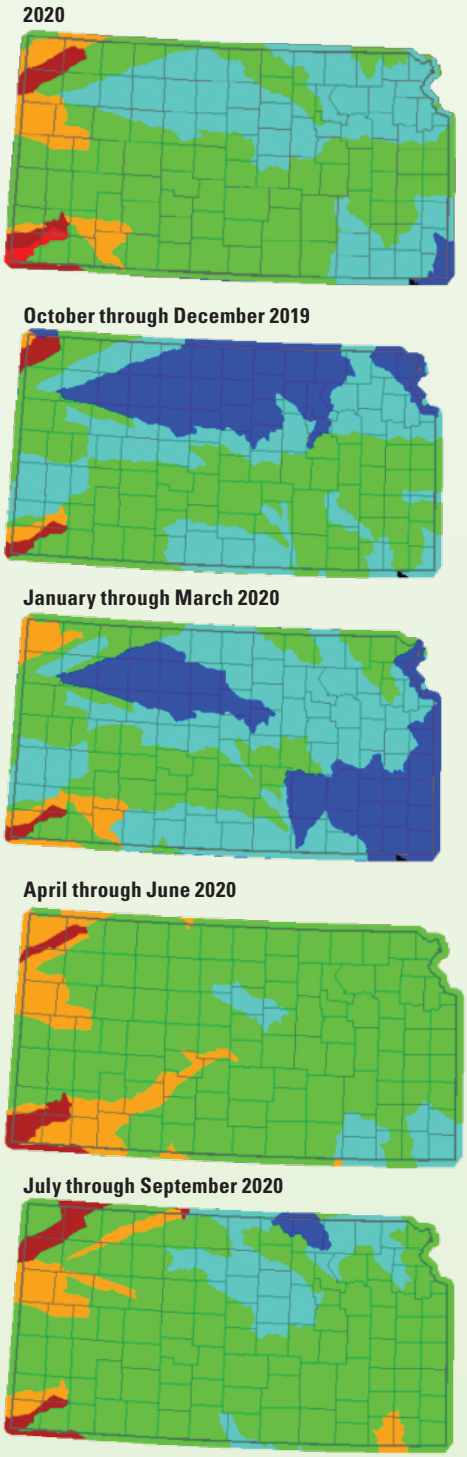

Figure 8. Comparison of monthly streamflow conditions across Kansas throughout water year 2020 (U.S. Geological Survey, 2020b).

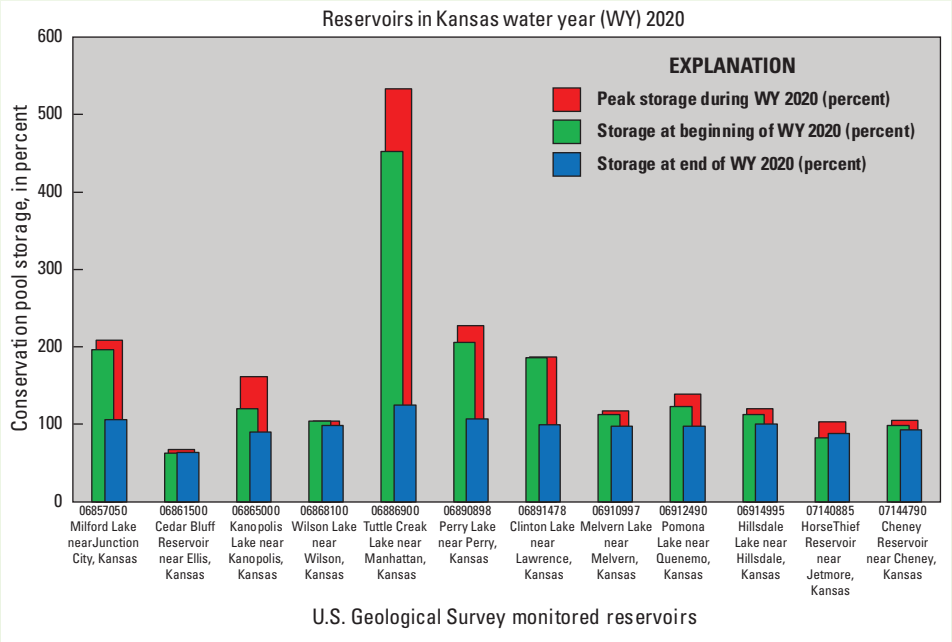

Figure 9. Contents of reservoirs in Kansas monitored by the U.S. Geological Survey in water year 2020 (U.S. Geological Survey, 2020a).

Summary

At the beginning of water year (WY) 2020, streamflow in Kansas was generally greater than normal in response to greater than normal precipitation in WY 2019. By the end of WY 2020, streamflow was generally at normal levels throughout the State, in response to a year with near normal precipitation.

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Publishing support provided by the Rolla Publishing Service Center

ISSN 2327-6916 (print)
ISSN 2327-6932 (online)
https://doi.org/10.3133/fs20213045