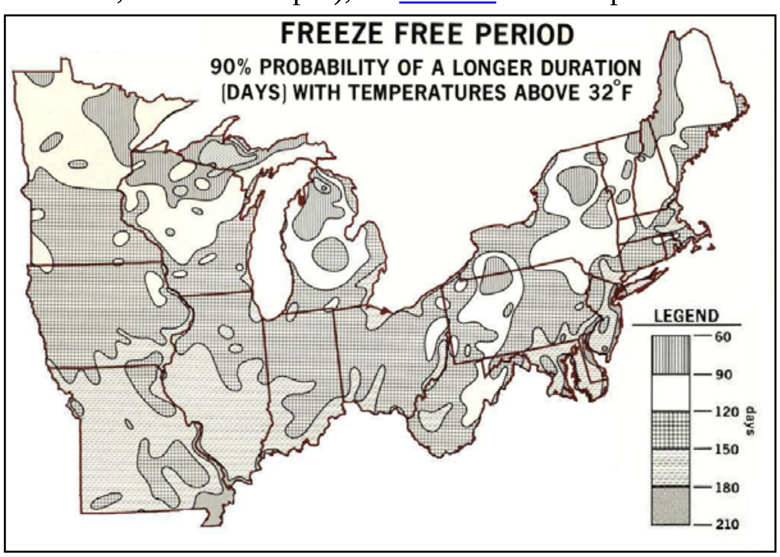
How Can You Use Meteorological Data in Watershed Management?

The National Climate Data Center (NCDC) maintains and manages the world's largest archive of weather data. It contains data as old as 150 years. The NCDC has local daily meteorological data for roughly 8,000 weather stations. Types of data available from these stations are: temperature-max, min, and average; precipitation-rainfall and snowfall; heating and cooling degree days; atmospheric pressure; and wind speed. Some stations have hourly meteorological data, and annual summaries are available for each station.

Albany, NY Airport Automated Surface Observation Station, NCDC

The NCDC also produces many types of maps such as the probability of when spring and fall freezes will occur, number of days above freezing, heavy rainfall frequency, extreme weather, as well as over 700 normal climate maps, even the probability of a white Christmas. The NCDC data provides the opportunity to understand cause and effect linkages, seasonal patterns, and cycles through the year. By gathering local meteorological data from a nearby weather station, a watershed manager can come to better understand the natural environment and seasonal cycles of their watershed.

To locate and download daily meteorological data (precipitation, mean daily temperature, snowfall, and snow depth), the NCDC website provides an easy to follow interface by either finding a station by location, state, county, lat/long, name, zip code or by using an interactive map to search a geographical location. On the home page of the NCDC begin the process under **Data and Products** using the **Find a Station** or **Search by Map** link.



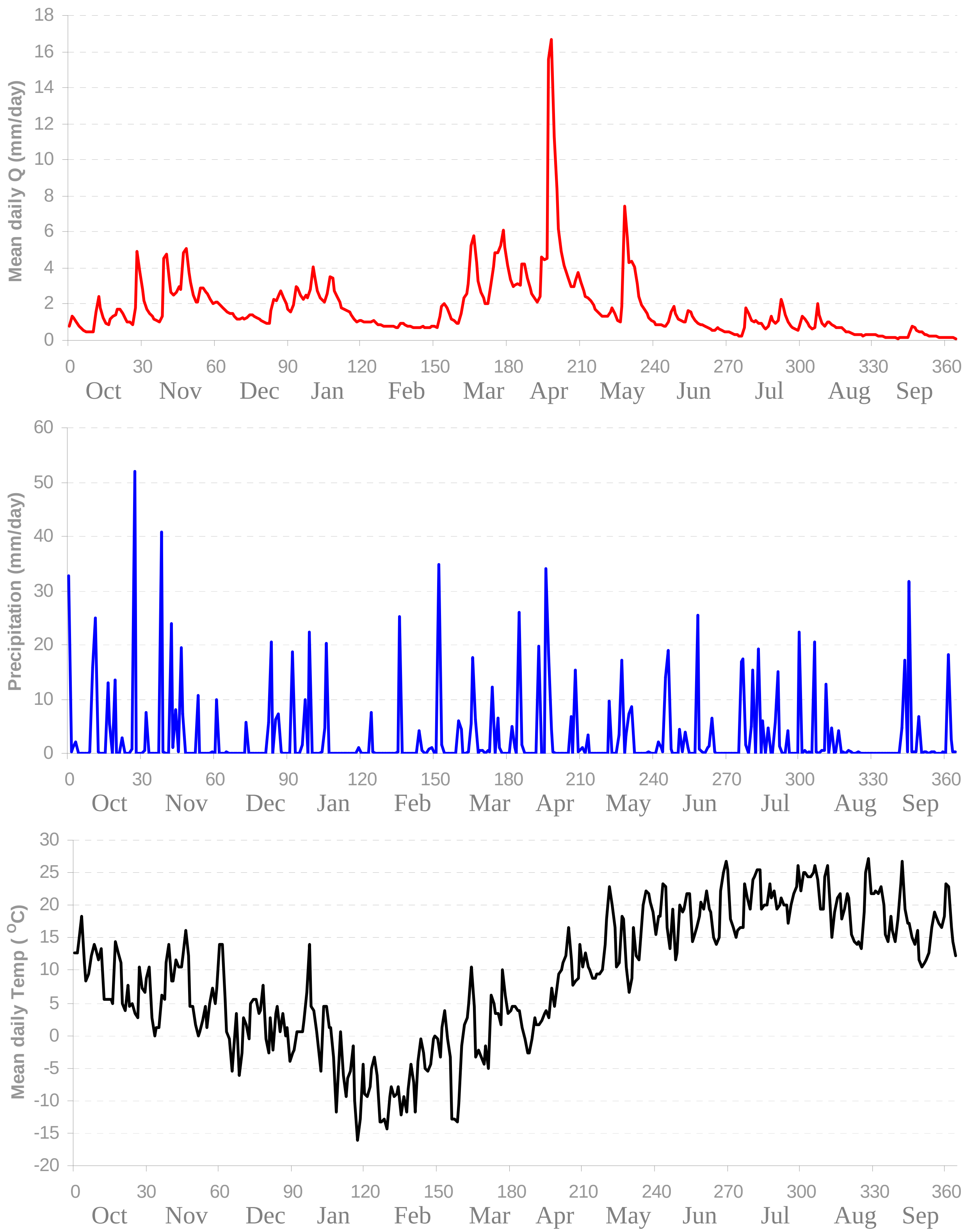


Figure 1. Streamflow, precipitation, and temperature from October 2006 to September 2007. Precipitation and temperature data from the Orange, MA (airport) NOAA meteorological station; streamflow data from the USGS gage station on the east branch of the Swift River Hardwick, MA.

The precipitation and temperature data in Figure 1 were downloaded from the National Climate Data Center. Streamflow data was obtained from the USGS Real-time Water Data website. The precipitation and temperature graphs were generated by clipping and pasting the associated data into an Excel spreadsheet and converting the data from inches to millimeters and ^{O}F to ^{O}C respectively. The streamflow hydrograph was produced similarly as in the FAQ “How Do You Use Streamflow Data for Watershed Management?”.

In comparing and contrasting the graphs in Figure 1 several patterns present themselves. As the mean daily temperatures start to rise above freezing in April, causing the melting of the snow pack, the streamflow, Q, has its highest peak of the year. Even the large rainfall event in October was not able to exceed this characteristic annual event. The streamflow graph shows low levels of flow during the summer months even with significant precipitation events. This is the time of peak growth for many plants and high rates of evapotranspiration (ET). The streamflow graph also shows the efficient conversion of rain and snow to streamflow in the colder months due to low amounts of ET. The seasonal variation of ET, which is governed by the mean daily temperatures, accounts significantly for the differences in seasonal streamflow response to a precipitation event. Soil properties, vegetative cover, and land use, also affect streamflow. Note, peaks in streamflow occurred one to two days after the associated rainfall event due to watershed characteristics such as slope, hydraulic roughness, wetlands, etc., that combine to influence the travel time of water through the watershed. The above graphs can enlighten the watershed manager on the interconnections of temperature, streamflow and precipitation and how they play a major role in shaping the many cycles and interactions in the natural environment.

For Further Reading

de La Crétaz, A.L., and P. K. Barten. 2007. Land Use Effects on Streamflow and Water Quality in the Northern United States. CRC Press, Boca Raton, FL, USA.

Web Resources

National Climate Data Center
http://www.ncdc.noaa.gov/oa/ncdc.html

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