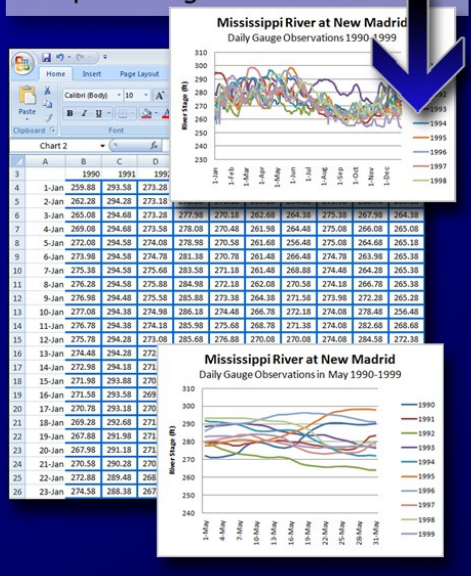
MDC Resource Science

Science Notes

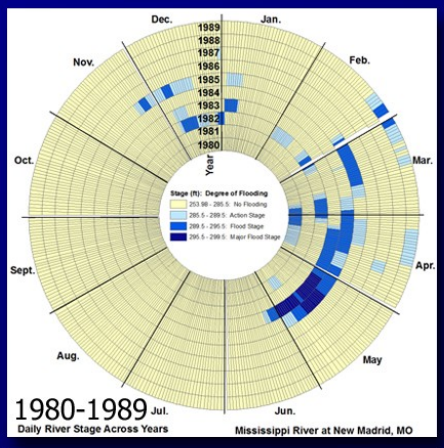
Ring Maps: A Useful Way to Visualize Temporal Data, River Gauge Example

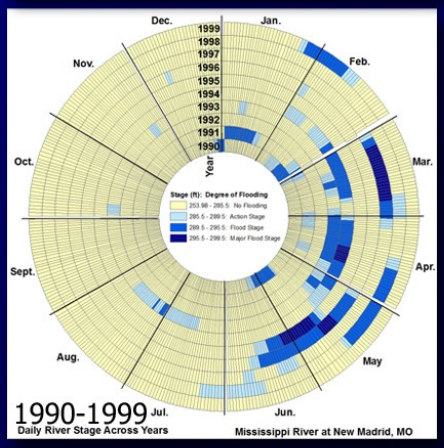
Line graphs typically are used to visualize large continuous datasets. Daily river stage data are particularly difficult to read and interpret using this method.

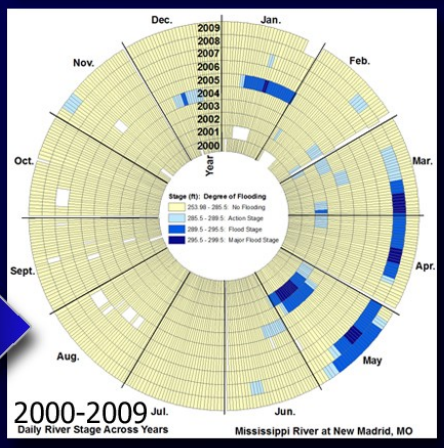


Using a GIS, one can input the same data to create a ring map. This method allows for a clearer visualization of temporal trends and especially to decipher flood timing, duration, and magnitude.

Daily stage data, 1980-2009
Mississippi River at New Madrid gauge







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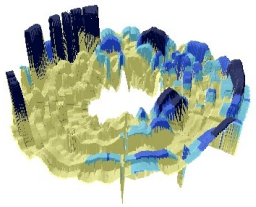

By Frank A. Nelson

SUMMARY

River gauge data are used by scientists and managers to interpret flood cycles, duration, magnitude, and frequency. It provides valuable information that is helpful for management decisions. Although gauge stations frequently occur along rivers and streams, the amount of data and consistency of long-term datasets vary. Fortunately, much of the data can be found on the web and is easily downloaded. However, using the data or putting them into a format that is easy to interpret is more challenging. Here I present a method to visualize gauge data such that trends are apparent without having to greatly manipulate the data to improve their interpretation.

Objective: Use a ring map for long-term river gauge datasets to visualize the inter- and intra-annual timing, duration, magnitude, and frequency of floods.

A line graph is typically used to plot river gauge data. We typically look at the data spread over the course of a year to examine the seasonality of flooding. When multiple years are combined, trends among and with-in years are difficult to see or interpret because of the overlapping lines (Figure 1).

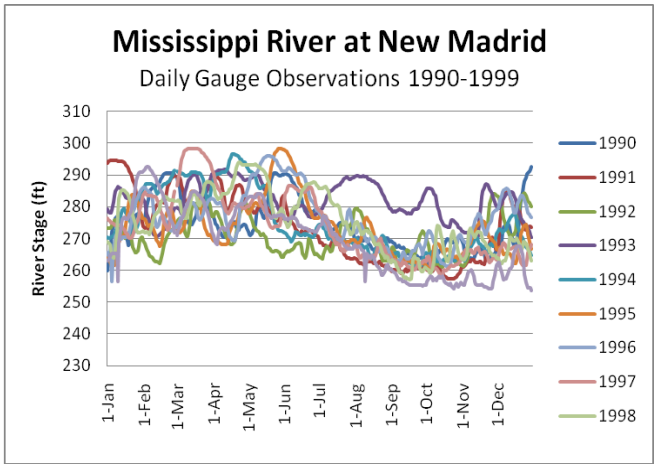

Figure 1. Daily river stage data from the New Madrid, Missouri gauge along the Lower Mississippi River, 1990-1999. The graph is messy and trends unclear.

Geospatial software programmers and users are increasingly combining temporal and spatial data for more meaningful interpretation of trends. Ring maps were developed specifically to manage and interpret large, continuous and non-continuous datasets such that patterns and trends can more easily be visualized.

Thirty years of river stage data (10 years at a time) from the New Madrid, Missouri gauge were used to graphically display the timing, duration, and magnitude of floods at that location (see cover). To do this, I utilized ArcMap and Microsoft Excel software. First, I created a shapefile to serve as our ring map framework. Next, I downloaded the gauge data and formatted them to match the shapefile format. Next, I joined the tabular data to the ring map shapefile. Finally, I adjusted the symbology so the stage information displayed across a graduated color gradient. The data and symbology were classified by the following categories: no flooding, action stage, flood stage, and major flood stage.

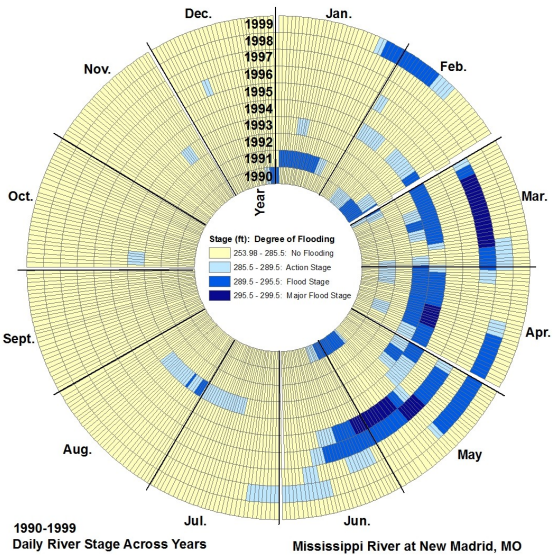

Figure 2. The ringmap shows the same river gauge information (New Madrid gauge, Mississippi River, 1990-1999) as the line graph, but the timing, duration, and magnitude of flooding are easier to observe within and across years.

Using GIS with tabular data in a ring map format is an easy way to visualize complex long-term data sets such as those generated by river gauges. This is a useful tool for biologists to have in their management toolbox.

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