Assignment note

1. Study area and dataset

The J-17 index well was drilled in 1913 and is located in the small building at the base of this water tower near the national cemetery at Fort Sam Houston in San Antonio. It is on a major Edwards flowpath and responds quickly to pumpage and recharge, so it has been used for many decades to record changes in the level of the Aquifer in the San Antonio area.

The number of water level elevation in this dataset is simply an indication of relative pressure being exerted on water at the location of the test well, rather than a water depth of the aquifer.

Diagram

Description automatically generated

The graph below illustrates the relationship between J-17 levels and springflows. Most of the water that becomes Comal spring flow moves past the J-17 well on its way toward New Braunfels. So there is a good relationship between the level of the J-17 well and flows at Comal Springs. When the J-17 level increased by about six feet, there was an obvious increase in flows at Comal Springs. In contrast, much of the water discharging at San Marcos Springs originates from recharge in the vicinity of the Springs and does not move past the J-17 well. This is why the relationship between the J-17 well and San Marcos Springs is not as pronounced.

Chart, line chart

Description automatically generated

J-17 data source: <https://www.edwardsaquifer.org/science-maps/aquifer-data/historical-data/>

Datetime: from 1932-11-12 to 2023-03-02

Comal spring data source: <https://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=08168710>

Datetime: from 1932-11-12 to 2023-03-02

San Marcos spring data source:

<https://waterdata.usgs.gov/nwis/dv/?site_no=08170000>

Datetime: from 1956-05-26 to 2023-03-02

2. Decompose function

Decomposing a time series means separating it into its constituent components. A seasonal time series consists of a trend component, a seasonal component and an irregular component. The decompose function can be used to estimate the trend, seasonal and irregular components of this time series.

A non-seasonal time series consists of a trend component and an irregular component. Decomposing the time series involves trying to separate the time series into these components, that is, estimating the trend component and the irregular component.

The SMA() function in the “TTR” R package can be used to smooth time series data using a simple moving average.

can probably be described using an additive model, since the random fluctuations in the data are roughly constant in size over time:

try to estimate the trend component of this time series using a simple moving average of order 10. There still appears to be quite a lot of random fluctuations in the time series

to estimate the trend component more accurately, try smoothing the data with a simple moving average of a higher order. takes a little bit of trial-and-error, to find the right amount of smoothing.

Reference:

[1] <https://www.edwardsaquifer.net/j17.html>

[2] <https://www.statmethods.net/r-tutorial/index.html>

[3] <https://subscription.packtpub.com/book/data/9781801078207/15/ch15lvl1sec96/diagnosing-missing-values-in-r-and-python>

[4] <https://rstudio-pubs-static.s3.amazonaws.com/288218_117e183e74964557a5da4fc5902fc671.html>

[5] <https://a-little-book-of-r-for-time-series.readthedocs.io/en/latest/src/timeseries.html>

[6] <https://www.geeksforgeeks.org/how-to-calculate-cross-correlation-in-r/>

[7] <https://stackoverflow.com/questions/58774705/y-limits-for-ggplot-with-sec-axis>