Time Series Analysis

Basics of Time Series Analysis

Nicoleta Serban, Ph.D.
Professor
Stewart School of Industrial and Systems Engineering

The Concept of Stationarity: Data Example

Georgia Tech

About This Lesson

Data Example: Temperature in Atlanta, Georgia

Data: Average monthly temperature records starting in 1879 until 2016.

- Available from the iWearherNet.com
- The Weather Bureau (now the National Weather Service) began keeping weather records for Atlanta 138 years, 8 months and 19 days ago on October 1, 1878.
- Provided in Fahrenheit degrees

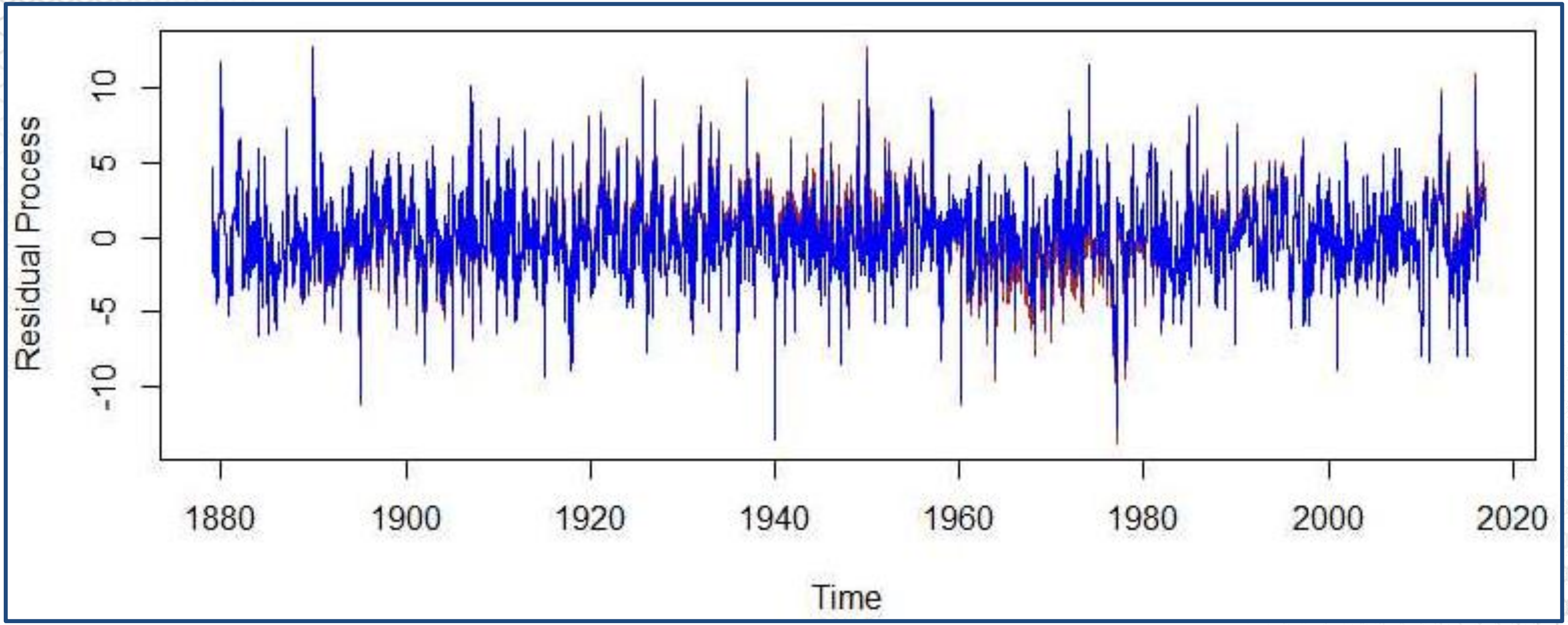
Is there seasonality and trend in temperature in Atlanta?
Is the residual process after removing seasonality and trend stationary?

Georgia Tech

Time Series Analysis: General Approach

1. Plot the series and check for:
   a. trend
   b. a seasonal component
   c. any apparent sharp changes in behavior
   d. any outlying observations
2. Remove trend and seasonal components to get stationary residuals.
3. Choose a model to fit the residual process.
4. Forecasting can be carried out by forecasting residuals and then inverting the transformations carried out in Step 2.2.

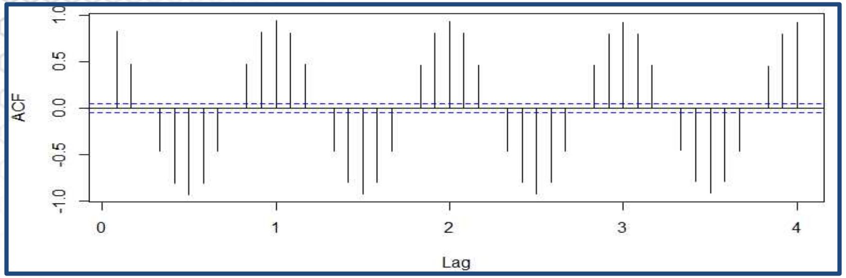
Residual Process



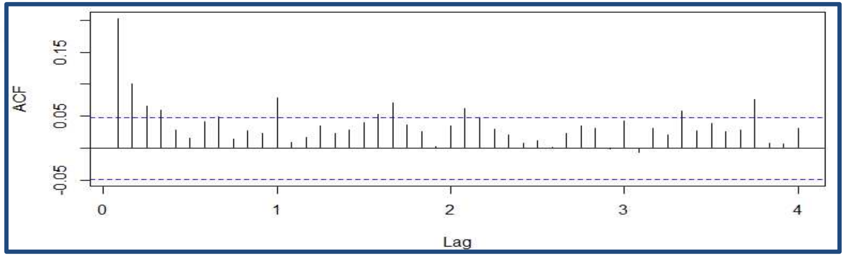
Sample Autocorrelation

```
## ACF for the temperature time series
acf(temp,lag.max=12*4,main="")
## ACF for the residual process
acf(dif.fit.lm,lag.max=12*4,main="")
acf(dif.fit.gam,lag.max=12*4,main="")
```

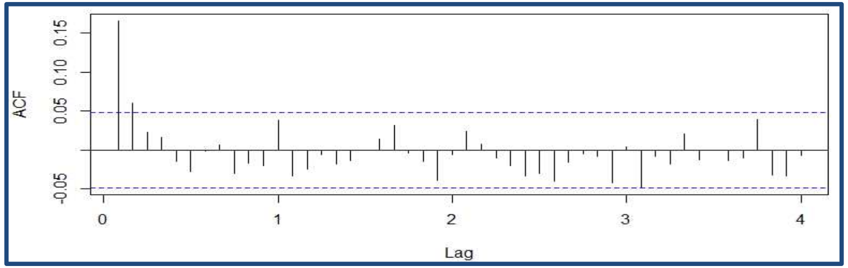
Sample Autocorrelation Plots



There is a clear seasonality pattern; trend cannot be identified since it is slowly changing over years



No seasonality pattern but some cyclical pattern mirroring the seasonal periodicity



No seasonality pattern; the residual process shows some stationarity

Summary