

# Stationary and non-stationary timeseries data

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The concept of stationary and non-stationary is important about each process variable timeseries data, as it directly influences the choice of data analysis method. The concept was a bit vague for me when encountered, so I decided to write this document for better understanding of it. Let's first take a look at definitions:

**Definition 1:** a timeseries is said to be *stationary* if the statistical properties of it remain constant as new samples are gathered.

Figure 1 shows an example of a stationary datastream.

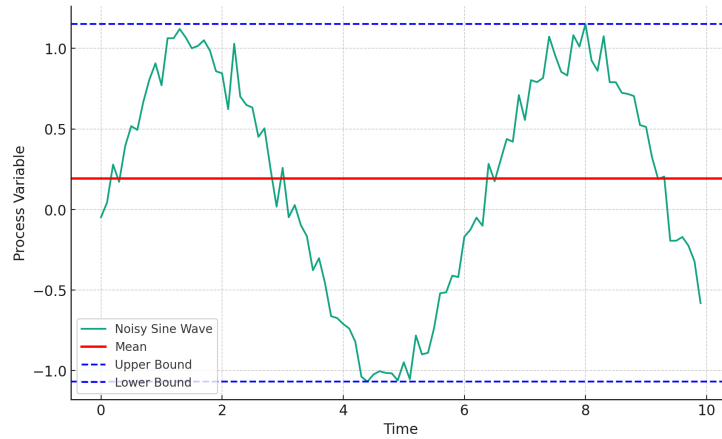


Figure 1: Stationary datastream with constant mean, variance and covariance

Generally, it is very ideal to have a stationary datastream in a real process. That's when the properties are within a range, and they are assumed to be constant, we say we have a *quasi-stationary* datastream. Converging and diverging

patterns of data are non-stationary, since variance changes even though the mean remains constant. Figure 3 shows an example of a stationary datastream.

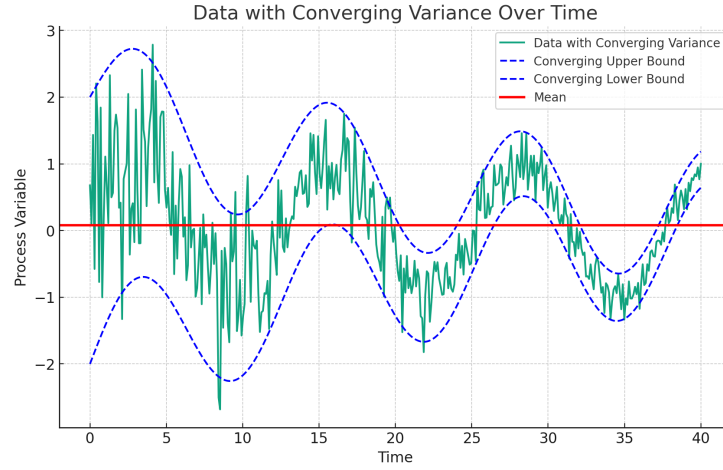


Figure 2: Non-stationary converging datastream with constant mean and decreasing variance

Another case is when, mean increases(or decreases), but variance is constant.

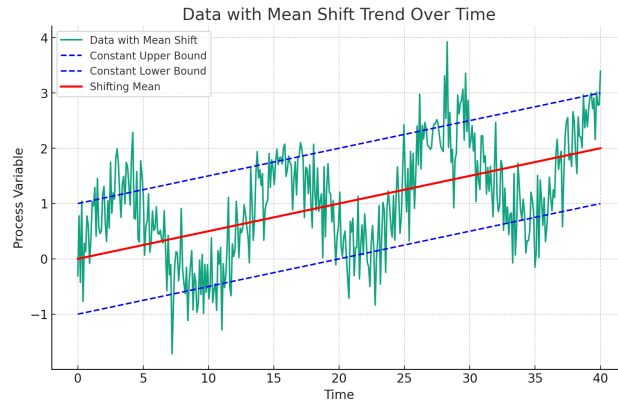


Figure 3: Non-stationary datastream with increase of mean and constant variance