Finding Spikes in Time Series

A simple method to deal with spikes in time series is weighted moving average.

Let X_1, X_2, … X_k, … be the values in the univariate time series. In weighted moving average method the moving averages M_k are calculated as,

$$M_k = (1 - \alpha)M_{k-1} + \alpha X_k$$

Where, 'α' denotes a "smoothing constant" which is a number between 0 and 1. This means 'α' would determine how much weight is to be given to the latest value X_k.

Series M represents the local mean value estimated from data up to the present value of the time series. The value of M at time k (M_k) is computed recursively from its own previous value (M_{k-1}).

If a new value of time series is too large as compared to previous values resulting in too far away from the moving average, for example $(X_k - M_k)/M_k >$ some threshold, then we can declare that new observation as an outlier/ spike in the series.