

<TIMES>

The Application of Seasonal Autoregressive Fractionally Integrated Moving Average (SARFIMA) in Forecasting of River Streamflow

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Abstract: Time series modeling can be used in various fields including hydrology. River streamflow is one of the hydrological parameters which is not only affected by seasonal factors but also often identified to possess *long memory* pattern. In this paper, a modeling using *Seasonal Autoregressive Fractionally Integrated Moving Average (SARFIMA)* will be applied. The data used is historical data of Cimanuk river streamflow which is the result of 20-year documentation in monthly interval. SARFIMA model is then compared with ARFIMA. The analysis is done to comprehend how SARFIMA model is able to model seasonal factors and *long memory* pattern which is shown by the data of Cimanuk river streamflow. The result of the analysis shows that SARFIMA model is not suitable for this data based on MSE and MAPE value.

Key words: Sarfima, seasonal factors, MAPE.

INTRODUCTION

River streamflow is a hydrological parameter which is extremely important in water resource engineering and management. River streamflow in Indonesia, just like the other tropical areas, is affected by two seasonal factors; rainy season and dry season. The fluctuation of streamflow occurs all the time, the peak of streamflow occurs in rainy season and its lowest occurs in dry season. The documentation of river streamflow is done in particular intervals according to the needs, which is in hourly, daily, weekly, monthly and yearly intervals. A series of historical data of river streamflow as the result of the documentation is the hydrological time series actual data.

River streamflow is predicted to not only be affected by seasonal factors but also to possess dependent nature of *long memory*, that is two observations, long separated by different periods, but still have high correlation. This can be detected through the pattern of autocorrelation function (ACF) ρ_k in lag k falls hyperbolically. Meanwhile, stationer time series data is declared to possess dependent nature of *short memory* if the pattern of the autocorrelation function (ACF) ρ_k in lag k falls exponentially.

The phenomenon of *Long Memory* in time series data was first introduced by Hurst (1951). Afterwards, Ganger and Joyeux (1980), and Hosking (1981) developed *Autoregressive Fractionally Integrated Moving Average (ARFIMA)* model to model the time series data comprising *long memory*. ARFIMA model fills up the weakness of ARIMA model that can only explain time series data of *short memory* with a round numbers differentiator parameter (d). ARFIMA model is a model able to explain time series data of *short memory* and *long memory* with real number differentiator parameter (d).

The modeling of time series for river streamflow data in Indonesia have been done a couple of times, among them Mulyana (2007) modelled time series data of Cikapundung river using ARIMA