



Fractal analysis of river flow time series: a case study on Shapur river

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Rivers flow plays an important role for irrigation and as a source of potable water. The discharge time series in semi-arid climate are depend on several complex hydrological processes, making it difficult to be studied by traditional statistical tools, especially when it comes to rare floods. Here we use Multi-Fractal Detrended Fluctuation Analysis (MF-DFA) as a robust fractal technique for describing the complicated time series of the Shapur river in Iran with an average discharge of 11 m³/s. the daily discharge time series of two hydrometric stations were considered in this study.

The results indicate that three different scaling regions are observed for discharge time series in both Bushigan and Chiti stations, indicating two crossover times. The first crossover is about 80 days, while the second is estimated to be 360 days, implying seasonal and annual cycles of Shapour River. It should be noted that the river flow time series exhibit non-stationary behavior in the second scaling region on account of scaling exponent higher than 1. The variations of the fluctuation function at different moments represent similar multi-fractal properties at the aforementioned stations. Moreover, the level of multifractality is evaluated using the Holder spectrum diagrams. At both stations, the spectrum curves have right tails, implying that these series are more sensitive to fine structures instead of local fluctuation with large magnitudes. The results can be useful for predicting extreme discharge events.