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# Exploring Dynamic Evolution and Fluctuation Characteristics of Air Traffic Flow Volume Time Series : A Single Waypoint Case

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## HIGHLIGHTS:

- We use visibility graph and horizontal visibility graph to analyze the time series.
- Fluctuation patterns are extracted based on sequential motif.
- We find fluctuation pattern transition loops in the dynamic evolution.
- Fluctuation characteristics are differentiated based on communities.

## Abstract

Understanding the dynamic evolution and fluctuation characteristics of air traffic flow volume time series is the basis for designing effective air traffic flow management measures and controlling strategy. The research on optimization and control of air traffic flow management is fruitful. However, there is little research on dynamic evolution and fluctuation characteristics of air traffic flow volume time series. With the incorporation of complex networks theory into the time series analysis, we get complex networks description of air traffic flow volume time series in about 24 hour length, correlate the visibility lines and air traffic flow volume fluctuations, extract the fluctuation patterns, differentiate the fluctuation characteristics to explore the fluctuation patterns distribution. We find that there are significant fluctuation patterns and the transition loops between these fluctuation patterns in the time series. The distribution of fluctuation patterns is not even. The minimal difference is 0.0588, and the maximal difference is 0.7199. The work in our paper maybe helpful for scholars and engineers in understanding the intrinsic nature of air traffic and in development of intelligent assistant decision making systems for air traffic management.

*Keywords:*

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