(77-240417-B) **Complexity-Entropy Analysis and Stochastic Modelling of Atmospheric aerosols**

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Long atmospheric time series, like those collected at NOAA/GML, provide an opportunity to apply sophisticated statistical methods to assess atmospheric processes. One such method that has been demonstrated to distinguish the impact of stochastic and chaotic processes on the time series is Complexity-Entropy (CH) analysis [1,2]. In CH analysis, estimates of complexity and entropy are obtained from the amplitude permutations in the data time series and plotted in the CH-plane. The location of the time series in the CH-plane provides information on the type of system the time series is obtained from. It will be shown that continuous-time systems should be associated with curves in the CH-plane rather than points and the sampling time parameterizes these curves. Different types of systems will follow different curves in the CH-plane. Here we show where a known stochastic model (e.g., fractional Brownian motion (FBM)), and chaotic models (e.g., the Lorenz model and the Filtered Poisson Process (FPP) [3,4]) lie in the CH plane. CH analysis allows us to optimize the type of model to choose when analyzing real world time series. Time series of aerosol number concentration from NOAA's NFAN network are used as an example. Figure 1 shows that each year of data from each station follows the FBM line in the CH-plane, demonstrating the clear stochastic nature of the aerosol data. Additionally, remote sites like SPO and MLO exhibit less complexity than more anthropogenically-influenced sites like BND and BOS. Thistype of analysis can help identify a stochastic differential equation (SDE) to model the data,as has been done for sea surface temperature [5].

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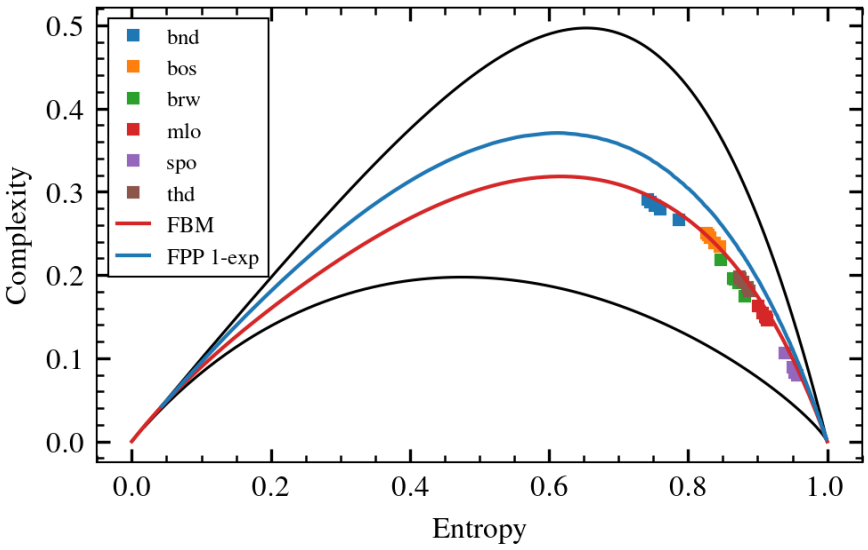

Figure 1. Complexity-Entropy analysis of aerosol number concentration for six NFAN stations. Each symbol represents one year of 1 min frequency aerosol data. The FPP model with one-sided exponential pulse shape is indicated by the blue line and the FBM model by the red line.