M10b Modeling of Solar Soft X-ray Flux Variations

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Many authors have discussed the distribution function of flare like events and time series analysis of flux variations in order to investigate the statistical properties of solar flares. It has been well known that flares are distributed in number as power laws of their energy output, $(dN/dE) \propto E^{-\alpha}$. However, the power-law index α is not well determined and is measured to lie widely in the range $1.6 \sim 2.9$ (Kashyap et al. 2002 and references therein). The theoretical approach assuming the RTV scaling law requires $\alpha \approx 1.5$ (e.g. Aschwanden and Parnell 2002). The precise value of α is important because if the slope is steep enough ($\alpha > 2$), then the bulk of energy lies in the smallest events and the possibility of coronal heating by Parker's nanoflare model can survive (Hudson 1991).

We perform Monte Carlo simulations to reconstruct observational light curves of GOES soft X-ray flux. Assuming that the flare light curve follows the exponential decay, we use the decay timescale τ as a parameter, i.e. large τ for long duration events, small τ for impulsive events. We first assume a uniform τ for simplicity, and then discuss the cases of mixed τs. The parameter dependencies to light curves are checked using the probability distribution functions of flux. In order to obtain the optimal values for the parameters and these confidence range, we use maximum likelihood estimation. We also discuss the relation between the energy budget and frequency distribution of flares.