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On the surprising robustness of the surplus run length ratio formula, and its application to extreme bursts in time series from natural complex systems — •Nicholas Watkins[1,2,3,4], Sandra Chapman[1,2,5], and Philip Hush[2] — [1]MPIPKS, Dresden, Germany — [2]CFSA, Physics, University of Warwick, Coventry, UK — [3]MCT, Open University, Milton Keynes, UK — [4]CATS, LSE, London, UK — [5]Maths and Statistics, UIT, Tromso, Norway

"Bursts", events that begin when a time series exceeds a threshold u, and end when it drops below it, have been widely studied in models of intermittent dynamical systems such as SOC and turbulence, and in natural datasets. Analytical approaches to bursts are needed which permit handling time dependence and heavy tailed amplitudes, and make contact with mature mathematics such as the theory of random fields and level crossings. We will discuss one such technique, which we call the surplus run length ratio [SRLR] formula, which states that the expectation value of the time T_u between successive up and downcrossings of a threshold u by values of stationary time series from a stochastic process $X(t)$ is the empirical survival function of X divided by the time rate of upcrossings at that level [Volkonskii, 1960; Cramér and Leadbetter,1967; Lawrance and Kottegoda, 1977]. We show that the SRLR formula applies surprisingly widely in highly skewed (log-normal), heavy tailed (α-stable) and long range dependent (fractional Gaussian) cases, among others. We demonstrate its utility on a non-Gaussian, correlated, natural example which has been previously studied using bursts, the auroral electrojet AE ionospheric index.

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