Statistical Methods for Long Term Memory Processes covers the diverse statistical methods and applications for data with long-range dependence. Presenting material that previously appeared only in journals, the author provides a concise and effective overview of probabilistic foundations, statistical methods, and applications. The material emphasizes basic principles and practical applications and provides an integrated perspective of both theory and practice. This book explores data sets from a wide range of disciplines, such as hydrology, climatology, telecommunications engineering, and high-precision physical measurement. The data sets are conveniently compiled in the index, and this allows readers to view statistical approaches in a practical context. Statistical Methods for Long Term Memory Processes also supplies S-PLUS programs for the major methods discussed. This feature allows the practitioner to apply long memory processes in daily data analysis. For newcomers to the area, the first three chapters provide the basic knowledge necessary for understanding the remainder of the material. To promote selective reading, the author presents the chapters independently. Combining essential methodologies with real-life applications, this outstanding volume is an indispensable reference for statisticians and scientists who analyze data with long-range dependence.

The author has prepared an extremely accessible treatment for the time series analysis of long-range dependent processes. The book can serve as a wonderful introduction to the topic for novices, as well as a valuable desktop reference for practitioners.

The author does a very good job of keeping the prerequisites from mathematics and statistics to the bare minimum. On the mathematics side,
you'll need to solid understanding of undergraduate calculus, including infinite series and sequences. I recommend Apostle's two volume set Calculus, Vol. 1 and Calculus, Vol. 2. Elementary probability and statistics are required, and Rao's Linear Statistical Inference and Its Application is a nice introduction. Finally, you'll need some exposure to the ARIMA analysis of time series. Try Brockwell & Davis Introduction to Time Series and Forecasting.

In the first chapter, Beran provides a wonderfully intuitive introduction in which he asks the reader to consider what happens to time-honored statistical techniques for estimating mean & variance by sample mean and sample variance in the case the usually IID (independent, identically distributed) assumption is no longer valid. This leads quite naturally into a discussion of the autocorrelation function for stationary processes, which is at the core of the investigation. The chapter concludes with a number of real-world examples of long-range dependent time series. Note that the author uses the term "long-memory" to be synonymous with long-range dependence. This is not necessarily a widely adopted practice, so take care when reading other authors. The Nile river data set is introduced at the end of the chapter, and this data will be referenced repeatedly throughout the remainder of the book.

Chapter 2 introduces the formal definition of long-range dependence in terms of the rate of decay of the autocorrelation function of a stationary time series (or equivalently via asymptotic properties of the spectral density function). Next, self-similar processes are introduced, with the most well-known of these being fractional Brownian motion. The chapter concludes with a discussion of the fractional ARIMA model, which is emphasized in the remainder of the text.

Chapter 3 is a short chapter which records the limit theorems needed for the asymptotic distribution of maximum likelihood estimators found later in the text. The results are stated and motivated, and the author provides copious literature references if the reader is interested in tracking down the mathematical proofs of these results.

Chapter 4 begins study of statistical inference for long-range dependent processes, and this starts with the Hurst R/S statistic. This discussion is reinforced with the use of the Nile river data, together with chart plots for a number of sample statistics.

Maximum likelihood estimation of the Hurst parameter H in fractional ARIMA models begins in Chapter 5 with a focus on time-domain techniques, although analysis of spectral density plays an important role. The exact Gaussian MLE and Whittle's approximate MLE are introduced and asymptotic normality of the estimators is established via use of the limit theorems of Chapter 3.
The emphasis shifts to spectral density and frequency domain in chapter 6 by considering techniques based on periodogram analysis. The fractional EXP model is introduced and considered as an alternative to the fARIMA model studied so far.

Up to this point, the main object of study has been stationary Gaussian processes. Chapter 7 provides a glimpse of some techniques used to non-stationary processes, or non-Gaussian stationary processes. This is an active area of research and the treatment here is provided to give the reader an appreciation of these issues, rather than a comprehensive review of the state-the-art.

Chapter 8 is principally concerned with estimating the mean and standard deviation for non-centered processes, as well the problem of predicting future mean values.

The question of performing linear regression on dependent variable with long-range dependent explanatory variables and long-range dependent innovations is discussed in Chapter 9. This is a must read chapter for econometricians and anyone working with economic time series data.

The next two chapters are brief, and touch on topics such as goodness-of-fit tests, simulation and fractional GARMA processes. In the final chapter, the author includes SPLUS programs along with data sets (including the Nile River data).

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