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Stochastic differential equations applied to the study of geophysical and financial time series

Maria C. Mariani*, Osei K. Tweneboah†

Abstract

This work is devoted to the study of modeling geophysical and financial time series. We propose a stochastic differential equation arising from the superposition of independent Ornstein-Uhlenbeck processes driven by a $\Gamma(a, b)$ process. Superposition of independent $\Gamma(a, b)$ Ornstein-Uhlenbeck processes offers analytic flexibility and provides a class of continuous time processes capable of exhibiting long memory behavior. The stochastic differential equation is applied to geophysics and finance by fitting the superposed $\Gamma(a, b)$ Ornstein-Uhlenbeck model to typical geophysical and financial time series.

Keywords: stochastic differential equations; Ornstein-Uhlenbeck processes; geophysical time series; financial time series

1 Introduction

Estimating future seismic hazards of a region constitutes an important study many scholars have shown a renewed interest in the past few decades. A good estimation of the seismic hazard in a region requires the prediction of time, location and magnitude of future seismic events. As the knowledge of the geophysical mechanisms that drive seismic events has increased, so have the corresponding mathematical model representations. There has been a

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