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Scaling analysis of high-frequency time series of gamma-ray counts

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Gamma radiation is being monitored in a dedicated campaign set-up at the Eastern North Atlantic (ENA) facility located in the Graciosa island (Azores), a fixed site of the Atmospheric Radiation Measurement programme (ARM), established and supported by the Department of Energy (DOE) of the United States of America with the collaboration of the Government of the Autonomous Region of the Azores and University of the Azores. The temporal variability of gamma radiation is mainly determined by the time-varying concentration of radon progeny, which in turn is influenced by meteorological conditions and precipitation scavenging. The resulting time series of high-frequency (1-minute) gamma-ray counts displays therefore a complex temporal structure on multiple time scales, including long-range dependent behavior. This work addresses the scaling properties of the time series of gamma-ray counts from the ENA site (data freely available from the ARM data archive) using both wavelet and model-based methods for the estimation of the scaling exponent. The time series is dominated by sharp peaks associated with events of strong precipitation. The effect of these peaks on the estimation of the scaling exponent, as well as the effect of temporal aggregation (1-minute versus 15-minute aggregated data) is further addressed.