The Dynamics of Sandpile Model and Its Application to Earthquakes YUNFAN GONG, Weill Med. College of Cornell Univ. — Just from the simple yet widespread power laws, it seems unlikely to differentiate self-organized criticality (SOC) from other mechanisms proposed for power-law relationships. Here we report SOC phenomenon in a sandpile model driven by chaos. We characterize SOC by analyzing times series from the system. Surprisingly, we find that the microscopic dynamics of the complex sandpile system can be best approximated by a very simple one-order autoregressive (AR) model. Meanwhile, the AR model can well reproduce almost all power-law behaviors of the sandpile model, suggesting a similar dynamics between the complex sandpile system and the simple one-order AR model. Next, real earthquake time series including Harvard catalog and source time functions (STFs) are analyzed along the same lines. The one-order linear dynamics fitted from the STFs is in excellent agreement with that of the sandpile model, whereas the optimal two-order dynamics fitted from the STFs is a false mode and should be rejected. Our results support that earthquakes can be considered as a SOC process and suggest that they may be governed by sandpile models with high order (≥ 2) dynamics.

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