



Variation of the b-value Might Not Be a Ubiquitous Precursor for Mega Earthquakes as Revealed from Variation Dynamics of the Seismicity Network

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Noticeable variations of the b-value of some regional seismic activity as precursors to sizeable earthquakes have been documented and debated amid much speculation. We examine seismicity around the Taiwan region, during the period of 1994-2008, within the framework of network interactions of successive events. Various power laws in the spatial and temporal relations are verified. We envisage a scenario wherein repeated ruptures and healing of the crust compete to cross purposes to reveal variation dynamics of the network topology. We examine the monthly statistics of connection degrees, times and distances, and find each of the noted variations is consequential, aftershock perturbations rather than being adequately envisioned as precursors. That is, after catastrophic events, the topology of the earthquake network becomes dominated by considerably busier, richer and concentrated connections. It then takes years for the system to gradually cool down to normal background levels, through certain healing processes. With the noted variation dynamics, there is no evidence of precursors in the variation of the generalized b-value of the examined power laws. Furthermore, earlier sand pile model experiment shows that gradual increases of the probability of random long range connections imposed upon a reference network with nearest neighbor interacting topology (without any Long Range Connection; LRC) will induce systematical variation of the b-value. A Long Range Connection Sandpile (LRCS) model has thus been proposed (Chen et al., 2008) to provide rationale for the variation of the b-value as a potential precursor. However, instead of the anticipated increases of LRCs after catastrophic events and the reduction of LRCs prior to a major event, we observe in the transient variation of the network of successive events that the topology tend to become obviously busier, more concentrated after a major event rather than being characterized by increasing the LRCs; and there are no noticeable, robust signature such as the obvious reduction of LRCs that can be envisioned as a precursor.