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A detailed study of the Pernik (Bulgaria) seismic sequence of 2012

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A detailed study of the Pernik (Bulgaria) seismic sequence of 2012
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The spatial and temporal clustering of aftershocks is the dominant non-random element of seismicity, so that when aftershocks are removed, the remaining activity can be modelled (as first approximation) as a Poisson process. The properties of aftershock sequences (distinct cluster, for example; even aftershocks can have aftershocks) allow time-dependent prediction of aftershock probabilities. Consideration of recent earthquake sequences suggests that aftershocks to large earthquakes although they are still, by definition, smaller events, can be very damaging and should be addressed in emergence planning scenarios. Because of the factors such as location and radiation pattern and the cumulative nature of building damage, aftershocks can cause more damage than the main shock.
An earthquake of moment magnitude 5.6 hit Sofia seismic zone, on May 22nd, 2012. The earthquake occurred in the vicinity of Pernik city, at about 25 km south west of the city of Sofia (the capital of Bulgaria). The event was followed by intensive activity.
The active area is situated in the central part of western Bulgaria. That is the most populated (more than 1.2 mil. inhabitants), industrial and cultural region of Bulgaria. Seismicity in the zone is related to the marginal neotectonic faults of Sofia graben. The boundaries of the graben are represented by SE-NW fault system with expressive neotectonic activity. This zone is characterized by shallow earthquakes. The strongest known event in the region is the 1858 quake with intensity I0=9-10 MSK. The 1858 earthquake caused heavy destruction in the city of Sofia and the appearance of thermal spring.
It is worth mentioning that the seismic sequence of May 2912 occurred in an area characterized by a long quiescence (of 95 years) for moderate events. Moreover, a reduced number of small earthquakes has also been registered in the recent past.
The manifold purpose of this study is first to study spatial and temporal distribution of aftershocks than to analyze wave forms and to determine individual focal mechanisms of the largest shocks. Additionally, a joint hypocenter determination and composite focal mechanism of a large number of small aftershocks were carried out. Finally, the current state of stress in the considered region, obtained on the base of aftershock focal mechanisms, was compared with horizontal crustal movement inferred from GPS measurement.