



## **Periodic upward migration model for intermediate-depth earthquakes in Vrancea, Romania**

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Intermediate-depth earthquakes have occurred frequently in Vrancea region of Romania at a depth range of 60-160 km and caused severe damages in Romania and surrounding countries. To understand the regularity of earthquake occurrence and to predict future earthquakes, we analyzed  $M \geq 7.0$  earthquakes during the period of 1500 - 2000 using Romanian earthquake catalogue ROMPLUS. Proposing the periodic upward migration model, in which 1) a front of an active zone migrates upward starting at the deepest part during  $T_Z$  years, and 2) this migration repeats every  $T_P$  years. We assumed that the active period lasts for  $T_1$  years at each depth. One of optimal solutions is as follows:  $T_Z = 75$  years,  $T_P = 100$  years,  $T_1 = 19.5$  years. We tested the model using AIC whether it is better or not than a uniform Poisson model in time and space (depth). We applied the AIC procedure in model selection. The difference in AIC between the two models is 4.22 in the case of  $M \geq 7.3$  earthquakes so that we can conclude that the periodic upward migration model is significantly better model than the Poisson model. Considering that focal depths of historical earthquakes determined by intensity distributions contain larger errors for smaller earthquakes and that earthquakes repeat to occur at the same place, we propose the following regularity for Vrancea intermediate-depth earthquakes: 1) The first M7 earthquake occurs at a deeper segment of the seismic region (140-160 km depth) at the beginning of each century. 2) The second M7 earthquake occurs at a middle segment of the seismic region (110-140 km depth) at the midst of each century. 3) The third M7 earthquake occurs at a shallower segment of the seismic region (80-110 km depth) at the end of each century. 4) The above activity repeats every century. Following the regularity, we

can predict three M7 earthquakes in the 21 century as follows (Year, Lat (N), Lon (E), Z (km), M):

2007.2±6.1, 45.7±0.1, 26.7±0.1, 145±11, 7.34±0.36

2041.1±4.1, 45.8±0.1, 26.9±0.1, 132±16, 7.43±0.27

2082.5±9.2, 45.9±0.1, 26.9±0.1, 104±05, 7.38±0.18

Furthermore, referring to source process of recent larger earthquakes, source process of future earthquakes will be as follows: 1) it is pure thrust with a strike of NE-SW and a dip of one nodal plane is 60-80 degrees toward NW. 2) The rupture is unilateral and propagates from NE to SW. The length of the fault is 30-50 km.