

THE PERFORMANCE OF THE STATIONS OF THE ROMANIAN SEISMIC NETWORK IN MONITORING THE LOCAL SEISMIC ACTIVITY



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SUMMARY

The seismic survey of the territory of Romania is mainly performed by the national seismic network operated by the National Institute for Earth Physics of Bucharest. After successive developments and upgrades, the network consists at present of 121 permanent stations equipped with high quality digital instruments - 102 real time and 19 off-line stations - which cover the whole territory of the country.

The goal of this study is to evaluate the individual contribution of the real time seismic stations to the monitoring of the intermediate depth seismicity of the Vrancea region, the seismogenic zone which controls the seismic hazard at regional scale.

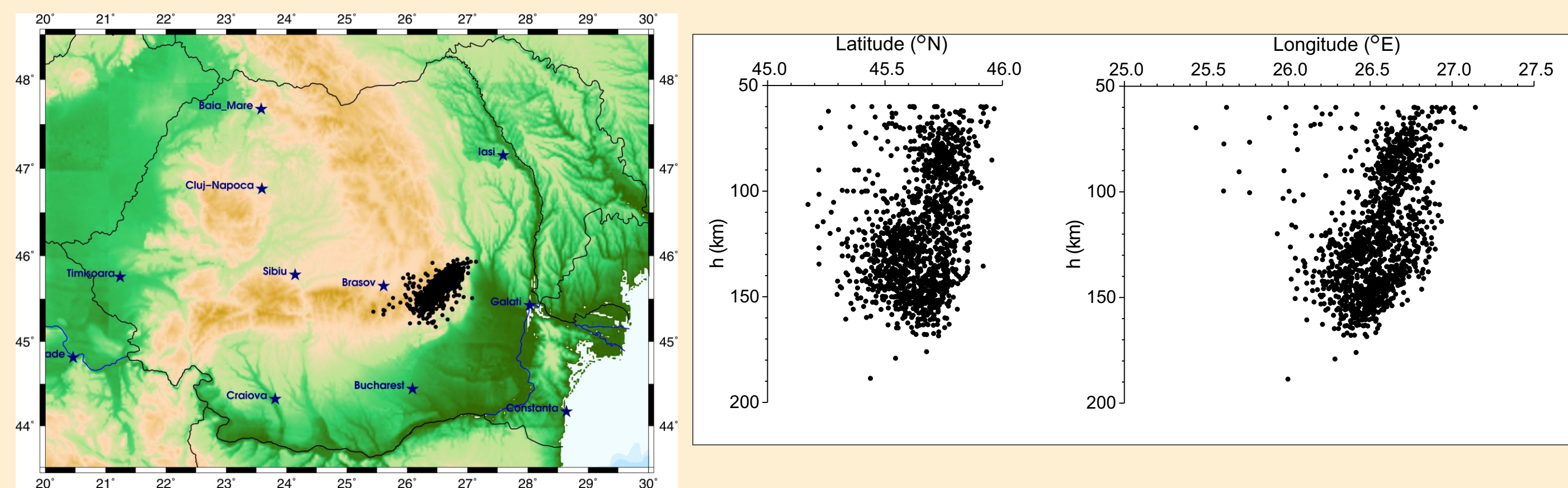
The performance of each station is estimated by taking into consideration the fraction of events that are localized using the station records, compared to the total number of events of the catalogue, which occurred during the time of station operation.

In the evaluation of the individual station effectiveness, the essential elements are: the location of the site with respect to the Vrancea subcrustal source zone, and the recovery rate of reliable data - P- and S-wave arrival times.

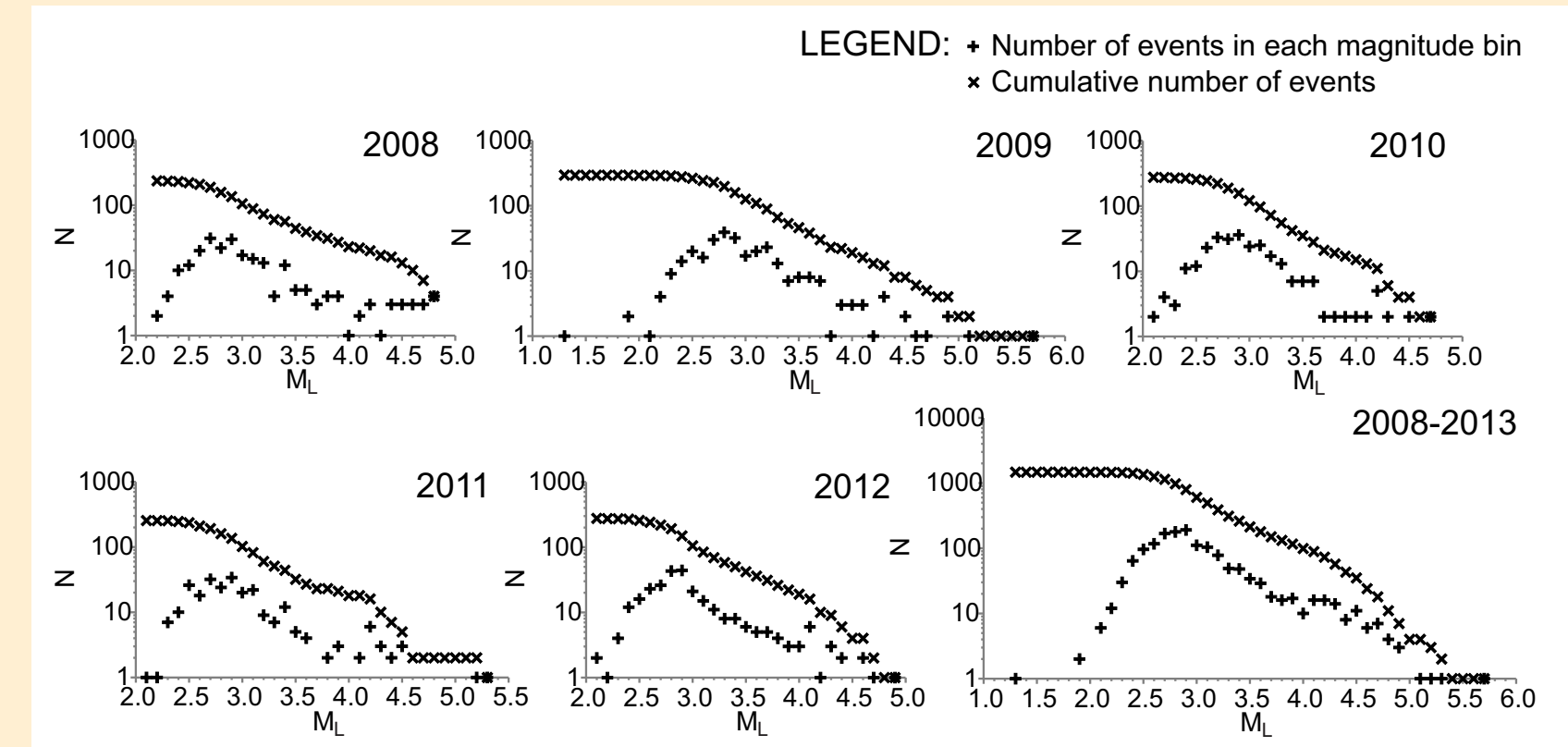
DATA

We investigate the contribution of the on-line stations in operation at January 1, 2013, to the localization of the undercrustal seismic events which occurred during the period January 1, 2008 - June 1, 2013.

1468 earthquakes with depth > 60 km and local magnitude M_L > 1.3 were located at the bend of the Eastern Carpathians during the study time interval. The strongest shock had local magnitude 5.7.



Seismicity space distribution:
left - location of epicenters;
right - depth distribution of foci,
along N-S and E-W directions.



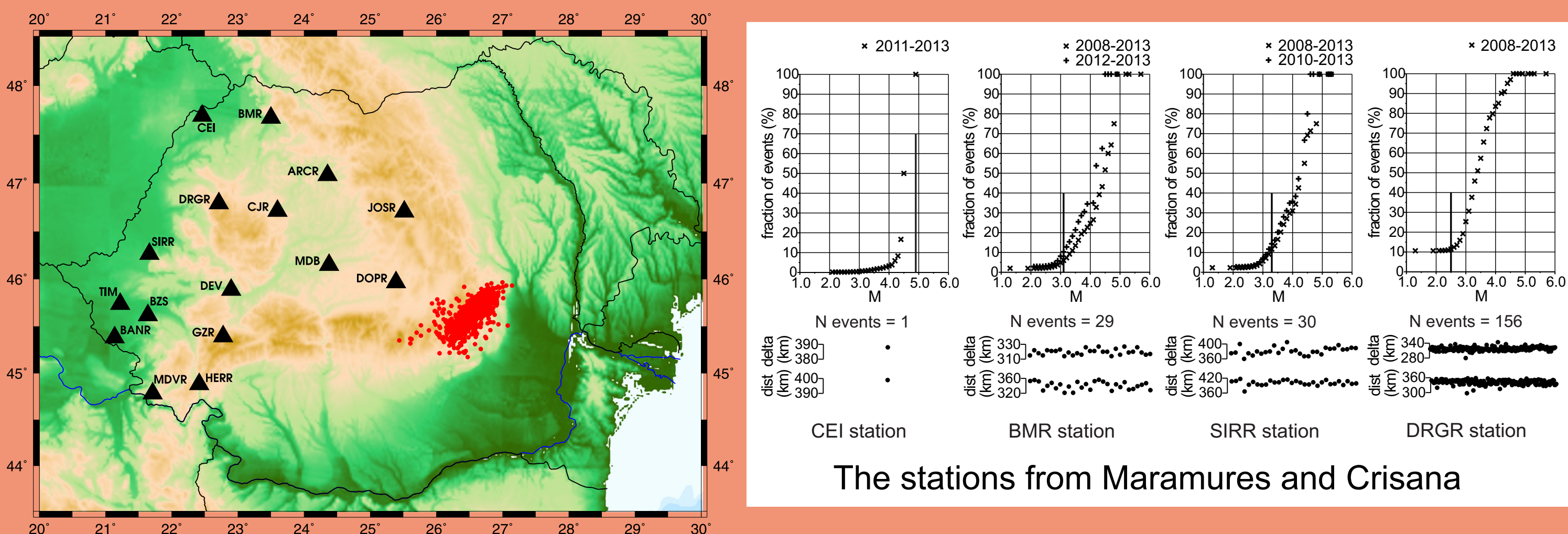
The frequency of occurrence - magnitude distributions, evaluated for each year and for the entire study time period, indicate that the completeness magnitude for the catalogue of Vrancea subcrustal events is around M_L 2.8 at present.

ANALYSIS OF STATION RELIABILITY

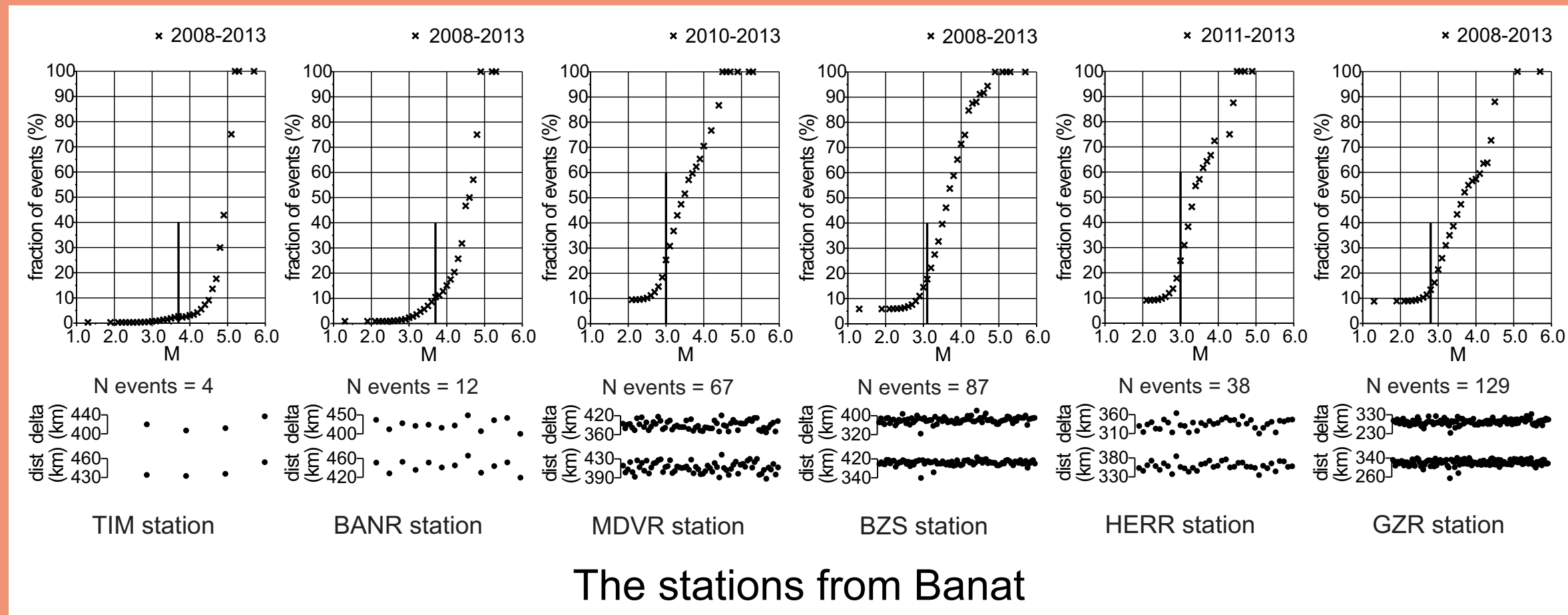
The analysis was performed for each year separately, and for the entire study time interval. Most of the new installed stations improved their reliability after the first months of operation; also, several stations display a noticeable increase of their performance during the investigated period. For the stations exhibiting significant raise of their effectiveness, we consider the best recovery rates in the evaluation.

For each station we display the recovery rate of useful data -- P- and S-wave arrival times -- for events with magnitude greater or equal to a specified value M_L , the total number of earthquakes localized with the station data, and the epicentral and hypocentral distances of these events.

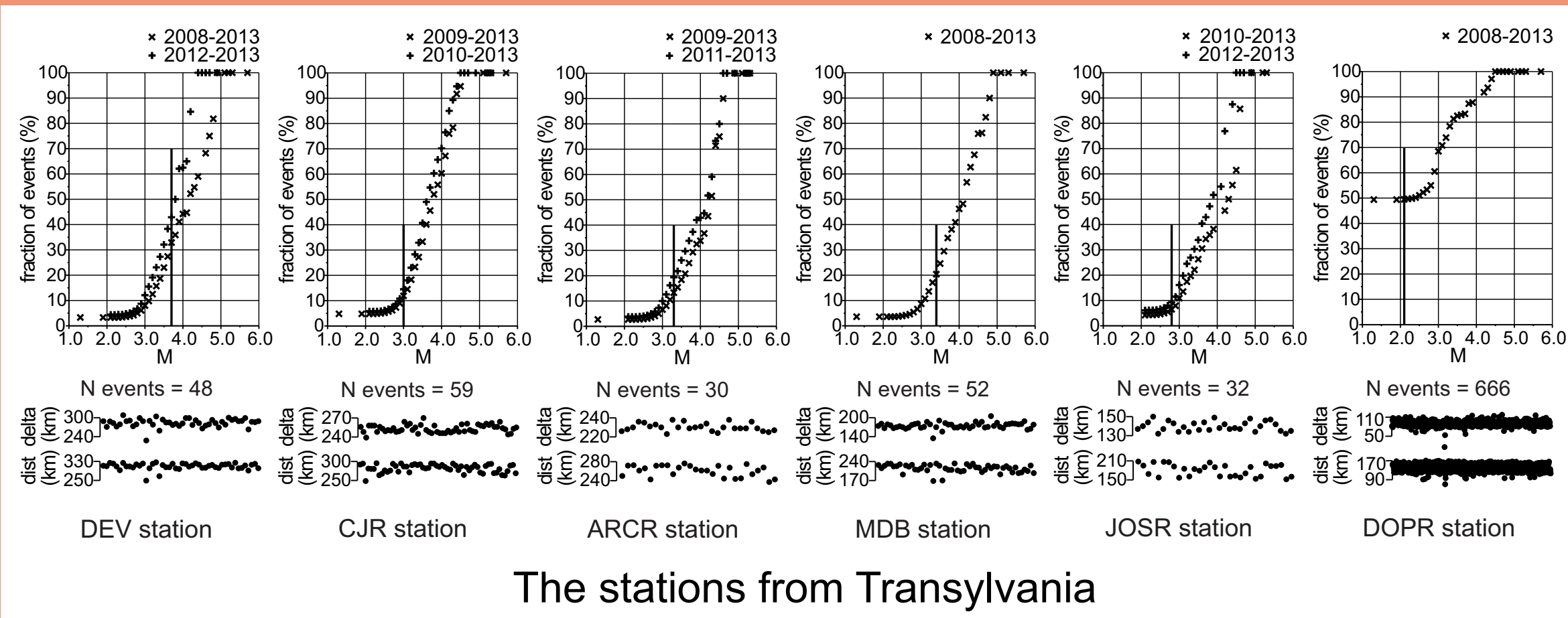
The stations from western and central Romania



The stations from Maramures and Crisana

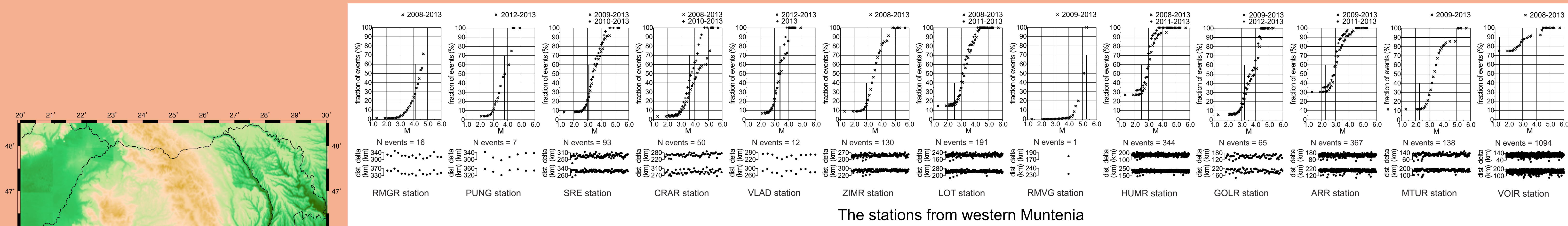


The stations from Banat

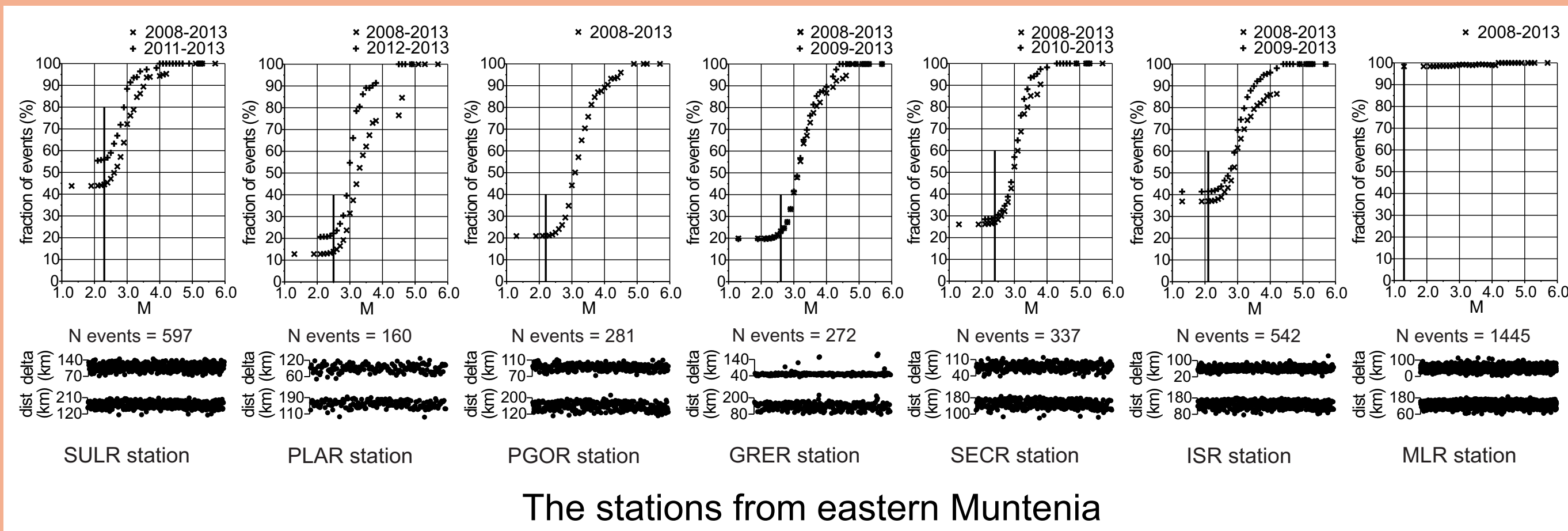


The stations from Transylvania

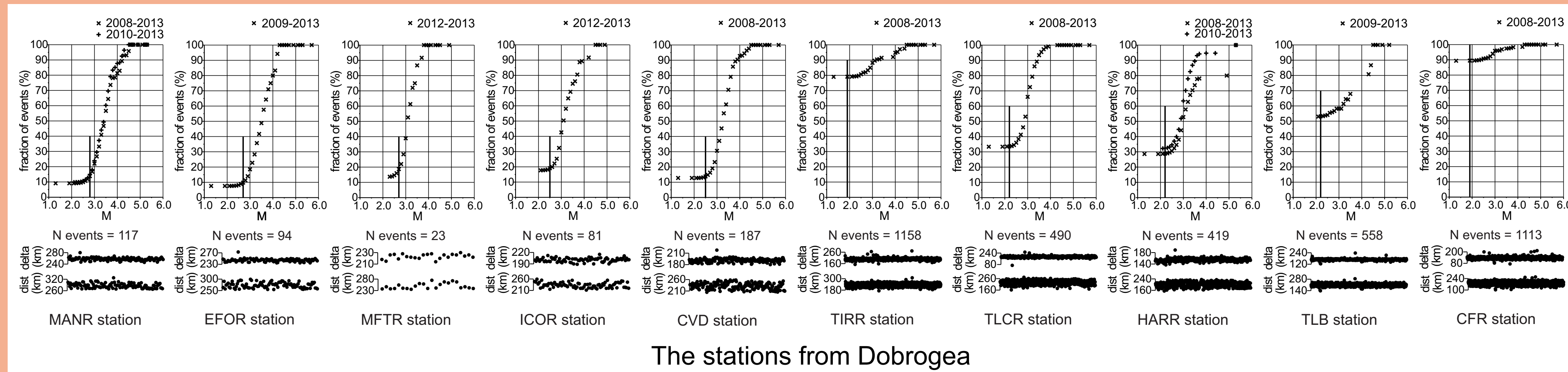
The stations from southern Romania



The stations from western Muntenia

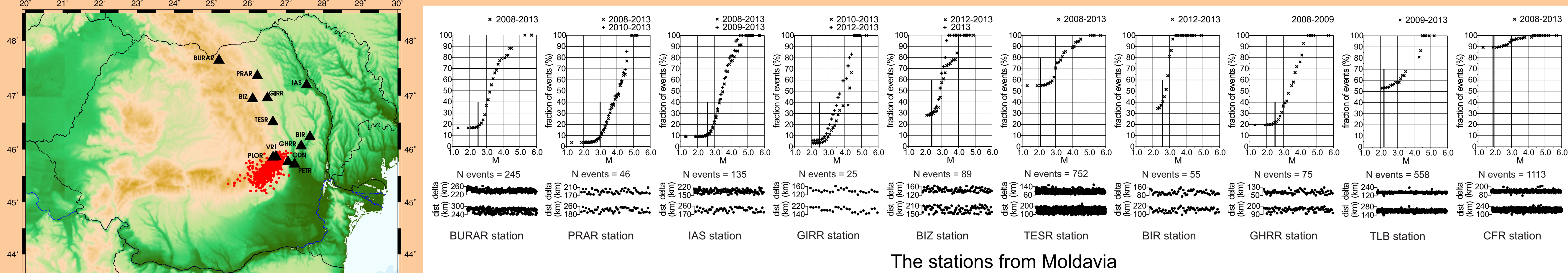


The stations from eastern Muntenia

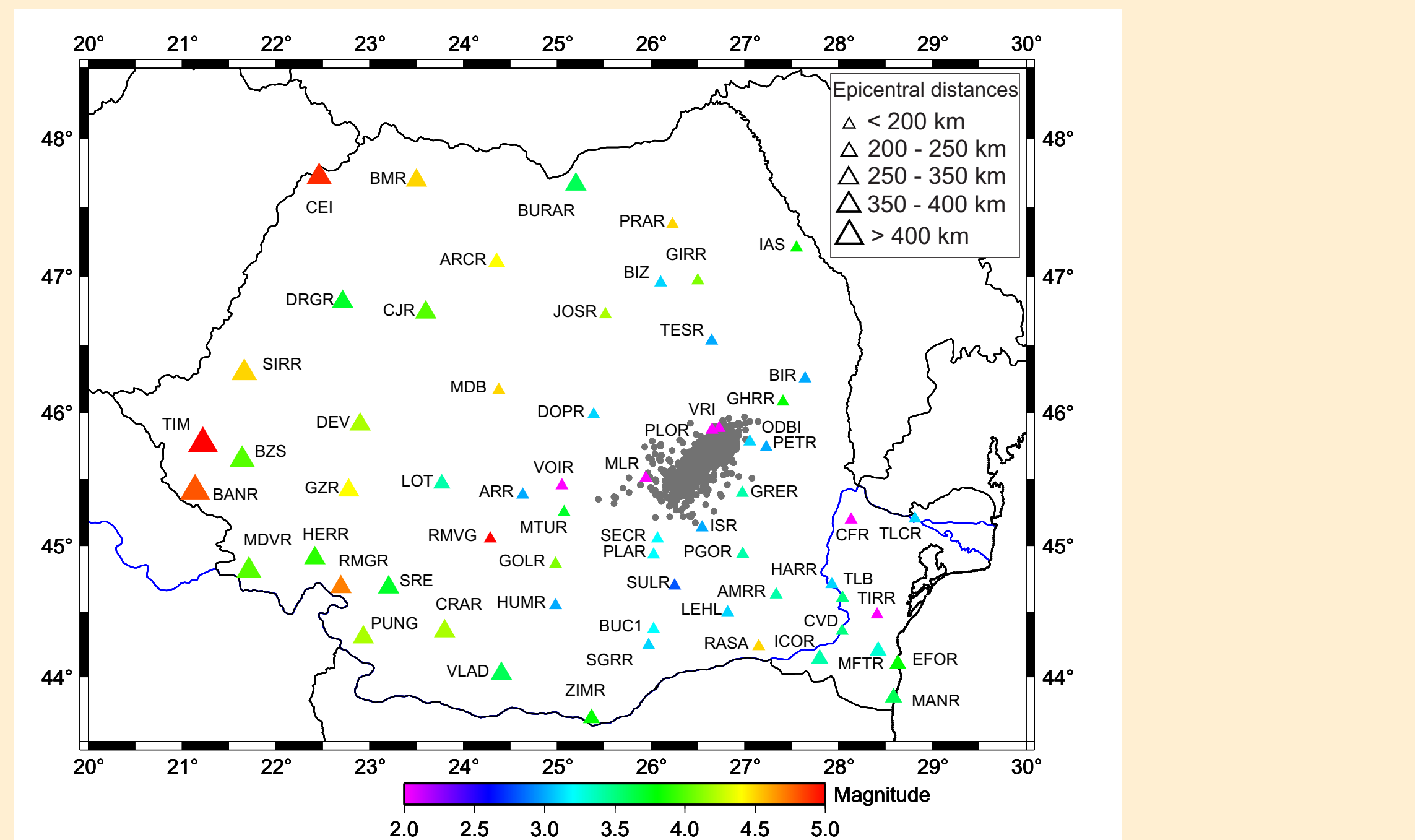


The stations from Dobrogea

The stations from eastern Romania



The stations from Moldavia



Individual station performance

DISCUSSION

The performance over all stations, estimated using our evaluation criterion, can be summarized as follows:

- The stations placed at epicentral distances up to 200 km from Vrancea region are, in general, reliable for the earthquakes with local magnitude 3.0 or greater (recovery rate of useful data above 65%).
- The stations located at larger distances, in the range 250 to 350 km, are reliable for events with $M_L \geq 4.0$, while the stations situated at distances between 350 and 400 km are effective for seisms with magnitude ≥ 4.5 .
- The most distant stations, with epicentral distances exceeding 400 km, are rarely used in the localization of the events with local magnitude below 5.0.
- Only few stations exhibit high recovery rate of shocks with $M_L < 3.0$.

The analysis points also out variations in the reliability of the stations. Thus, several stations achieved recovery rates notably higher than the average values reached at similar epicentral distances; on the other hand, significantly underperforming stations are evidenced as well.

Our study provides a measure of the station usefulness in monitoring the subcrustal seismicity from the bend of the Eastern Carpathians. The evaluation offers important elements for decisions regarding the effectiveness increasing and future development of the Romanian seismic network.

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