

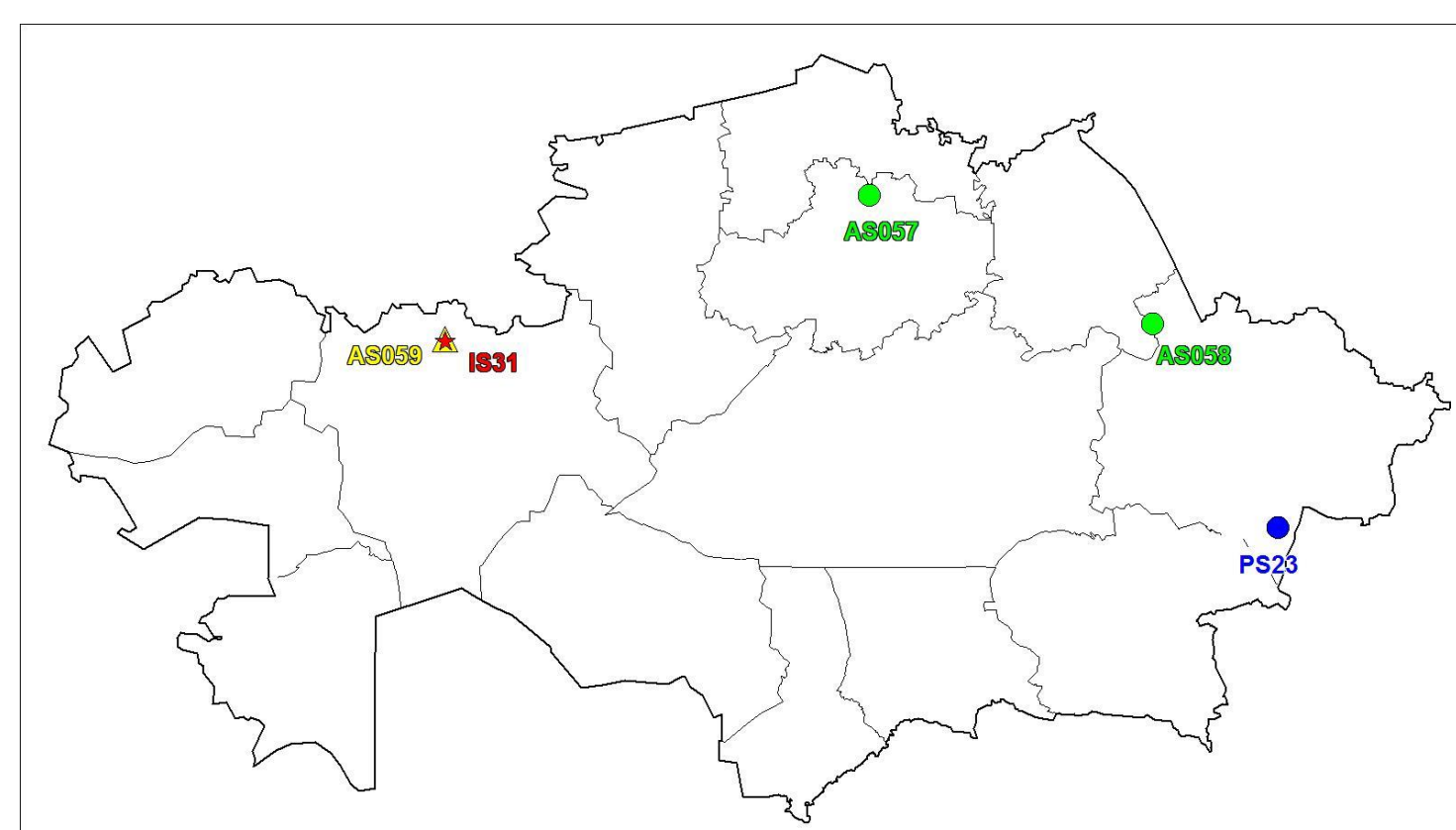


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Abstract

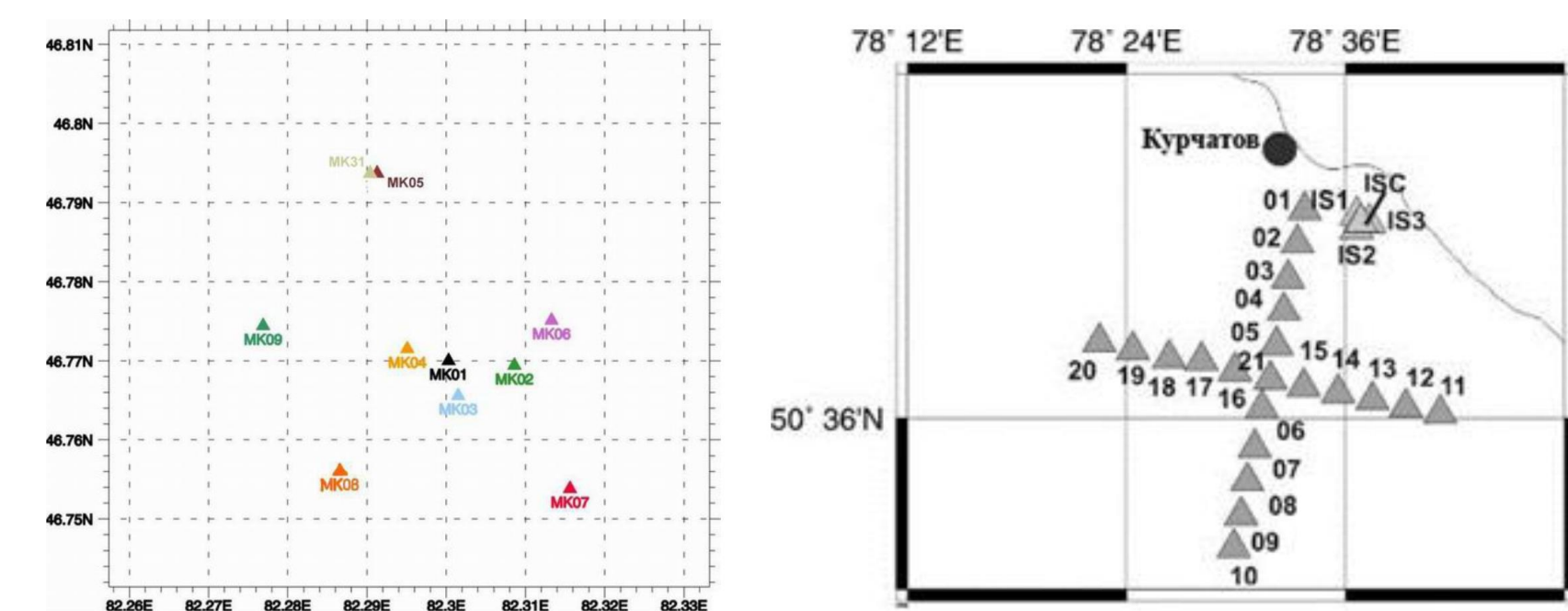
The work shows data on Kazakhstan stations contribution into the REB on the number of associated phases in comparison with other IMS stations. It is shown that all Kazakhstan stations are quite effective in monitoring, and are among the first stations on this sign among all stations. And this is also confirmed by the results of world events epicenters mapping, and by such parameters as minimal magnitude and ratio of events number by Kazakhstan stations to total number in REB bulletin. The region of CA is examined in details in the results of REB and KazNDC bulletins - seismic and infrasound. It is obvious that the number of events in KazNDC bulletin is larger than in REB as KazNDC bulletin is compiled by larger number of regional network stations. REB bulletin for the investigated territory of CA contains 398 seismic events. KazNDC bulletin of seismic events for the same territory contains much more events - 13839. Real location accuracy for CA events in REB can be estimated by GT events only. An example of such estimation is shown, particularly, for the events in the west of Kazakhstan at comparing of data of the special local monitoring network and REB data.

IMS stations in Kazakhstan



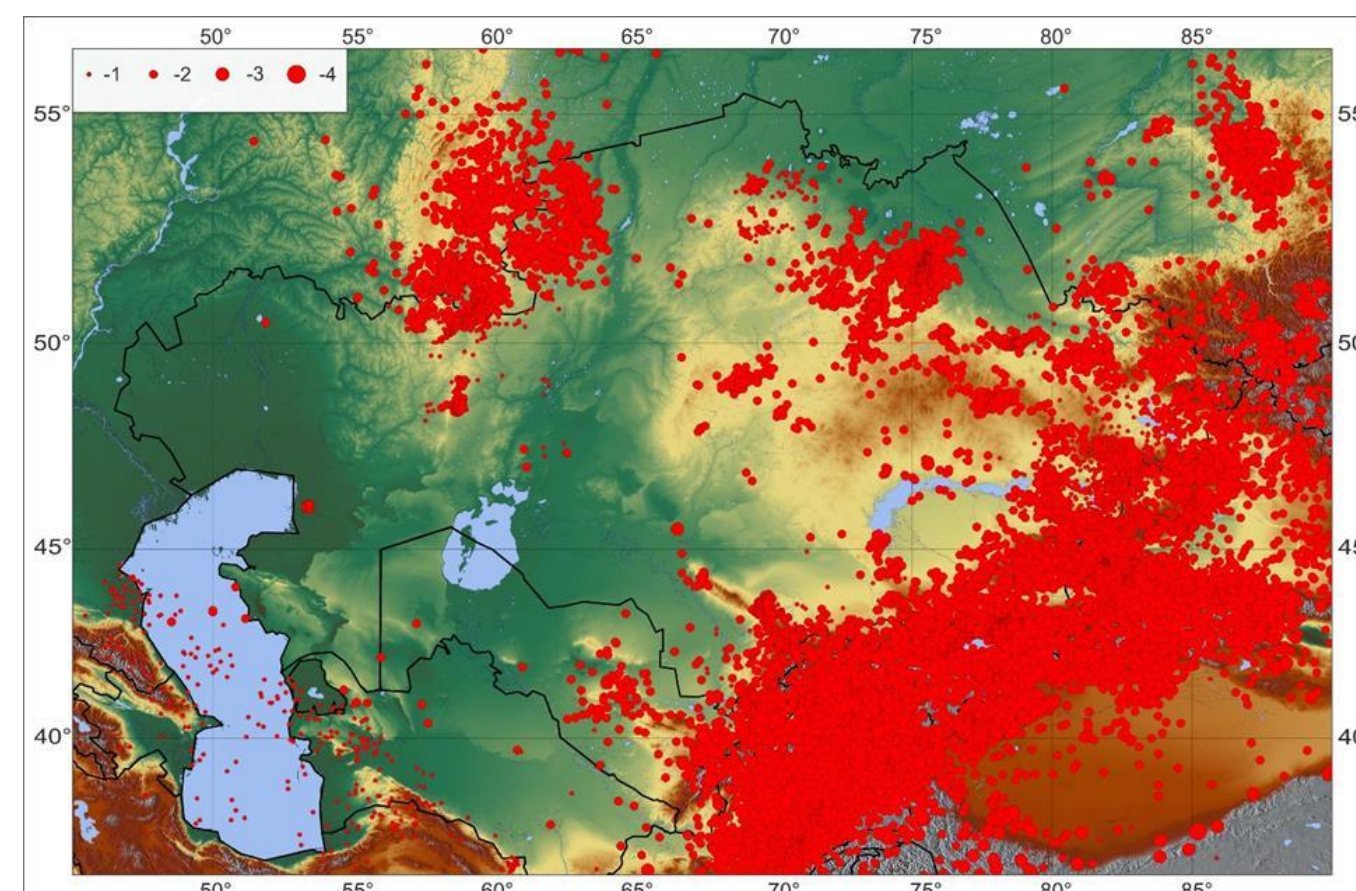
Stations: PS23 - primary seismic array (SA) Makanchi; AS058 - auxiliary SA Kurchatov-Cross; AS057 - auxiliary SA Borovoye; AS059 - auxiliary 3-component station Aktyubinsk; IS31 - infrasound station Aktyubinsk.

Location of Kazakhstan stations included into the IMS system.

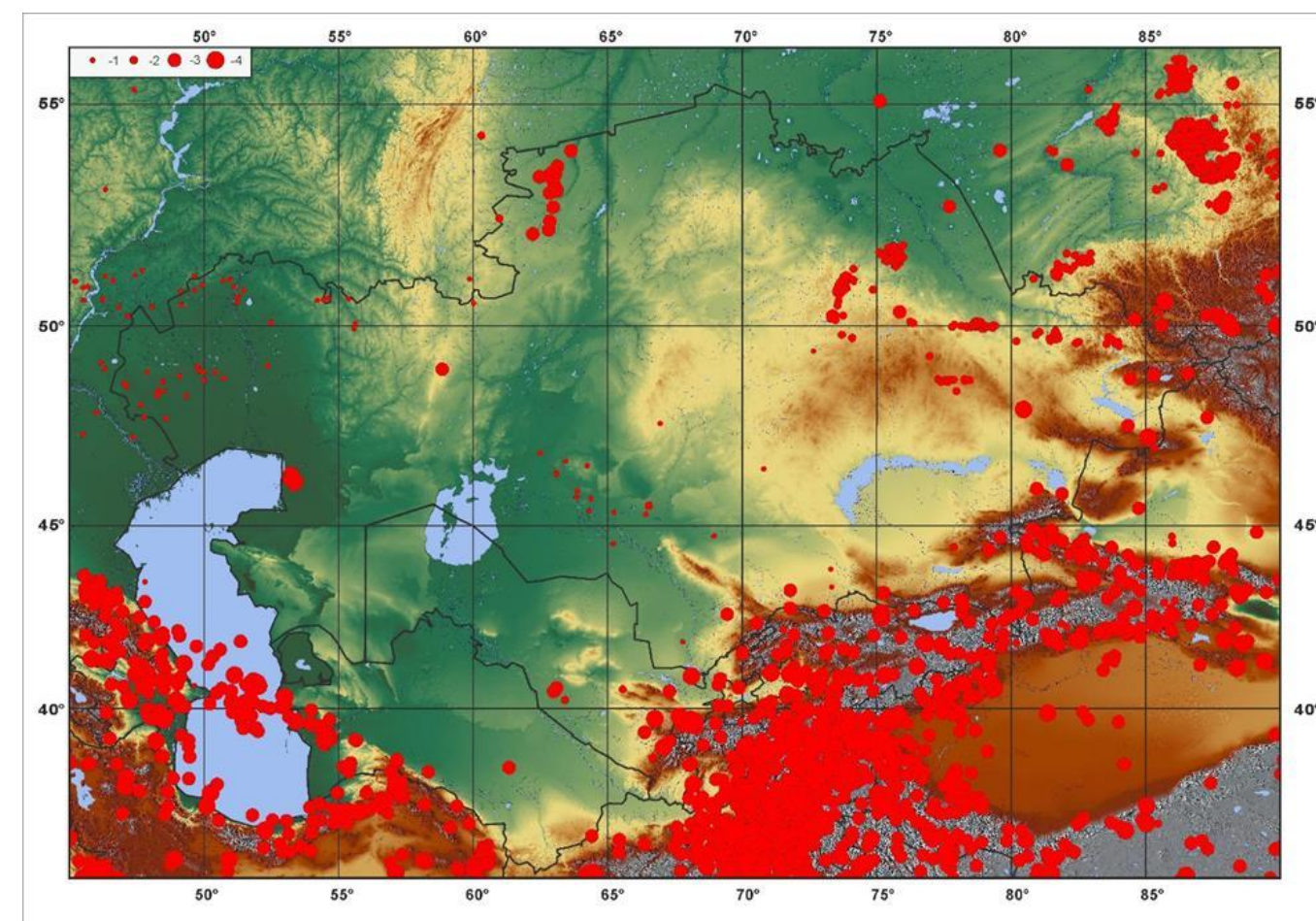


Configuration of primary seismic array Makanchi (left) and auxiliary seismic array Kurchatov-Cross (right).

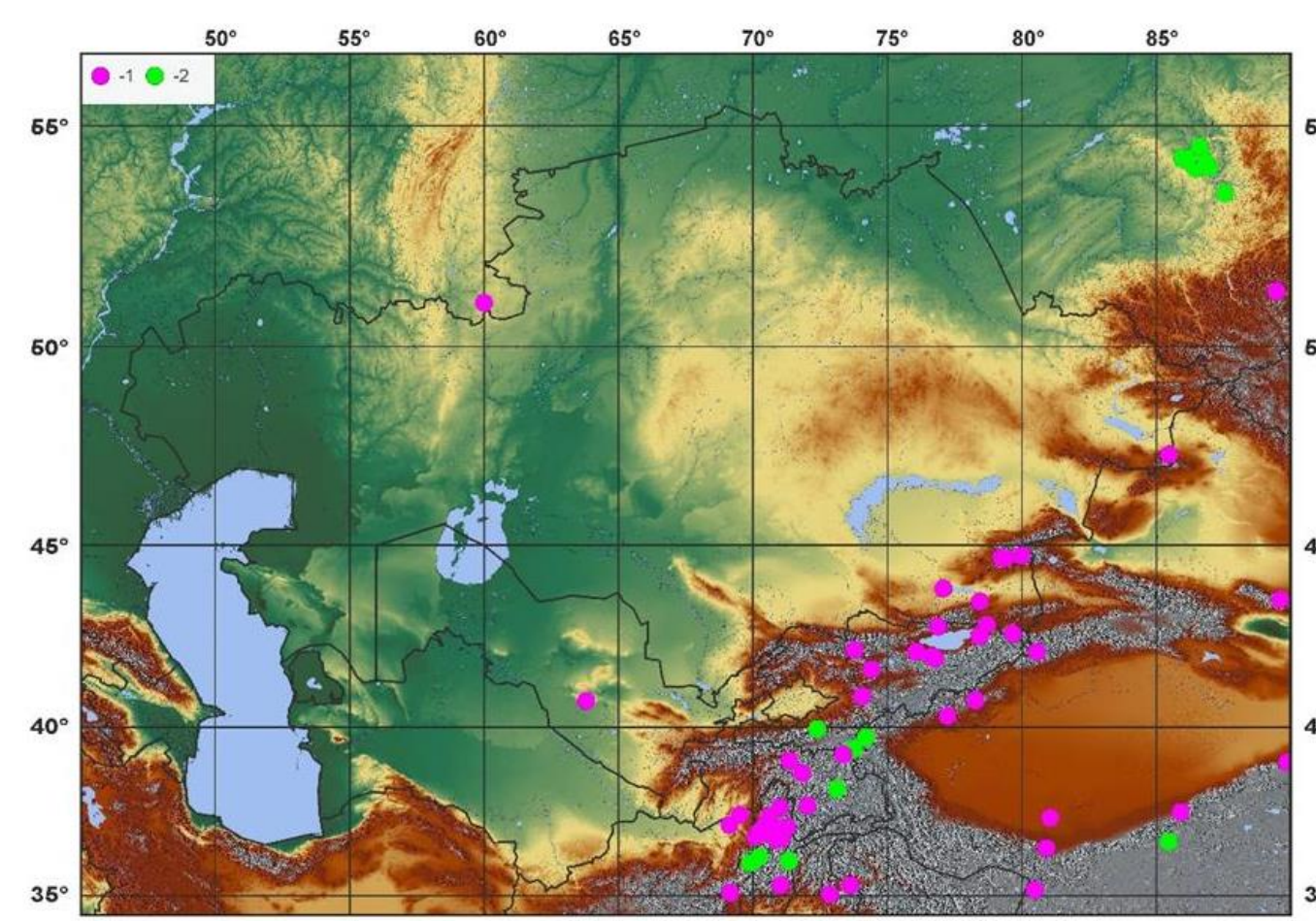
Seismic monitoring



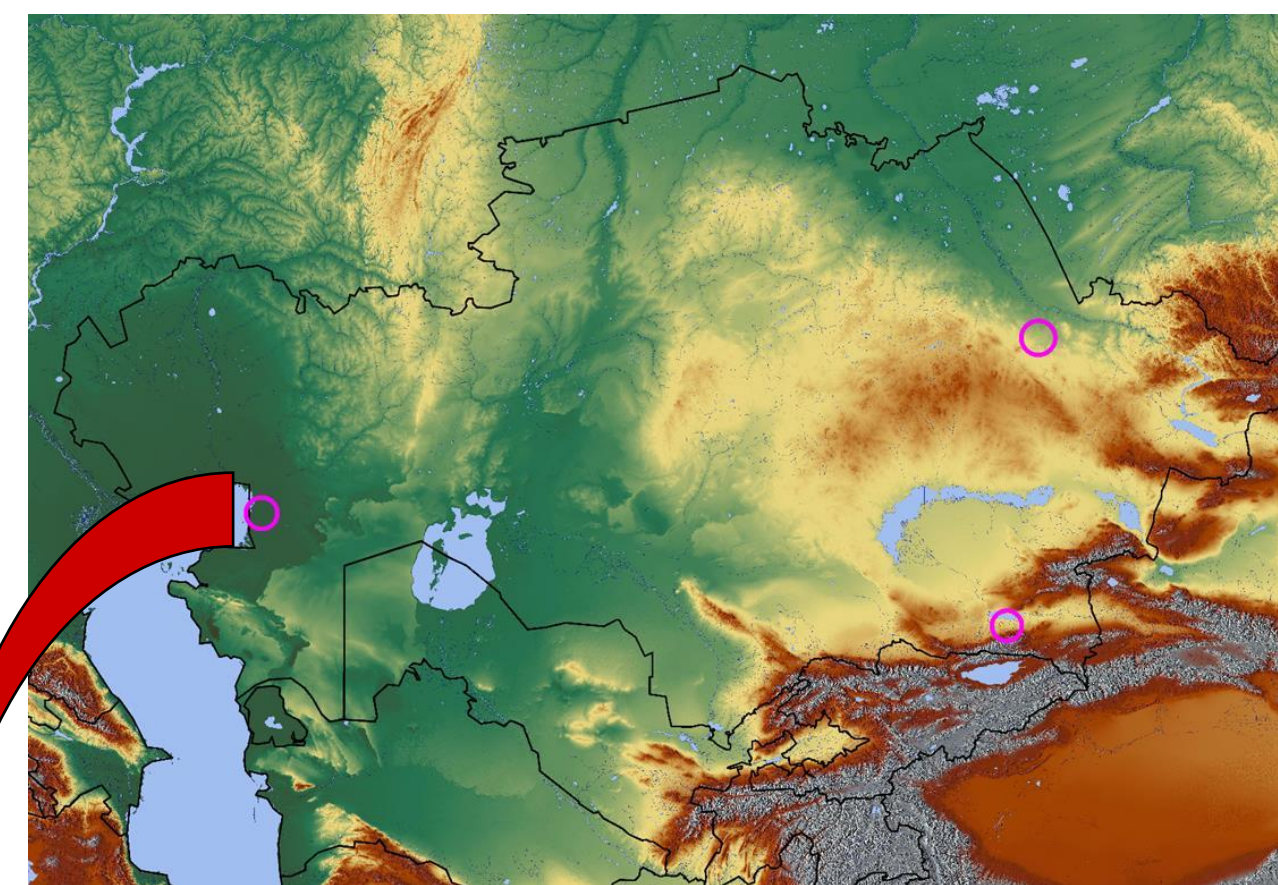
1 - 4 - mpv < 2; 2S mpv < 4; 4S mpv < 6; 6S mpv. The map of CA seismic events epicenters from KNDC bulletin for 2016-2017.



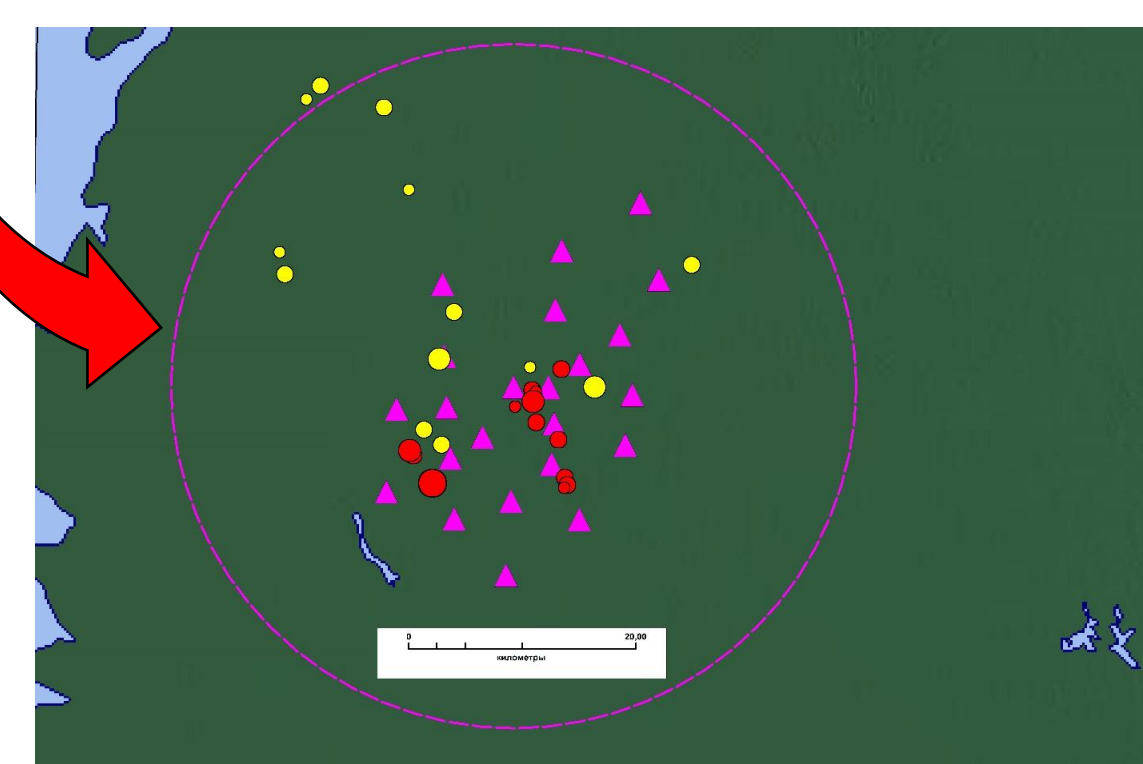
1 - 4 - mb < 2; 2S mb < 4; 4S mb < 6; 6S mb. The map of CA seismic events epicenters from REB bulletin for 2016-2017.



The map of seismic sources epicenters missed in REB catalogue (purple circle) and KNDC catalogue (green circle).



Three regions with reference events to estimate the accuracy of events epicenters determination in REB (circles).

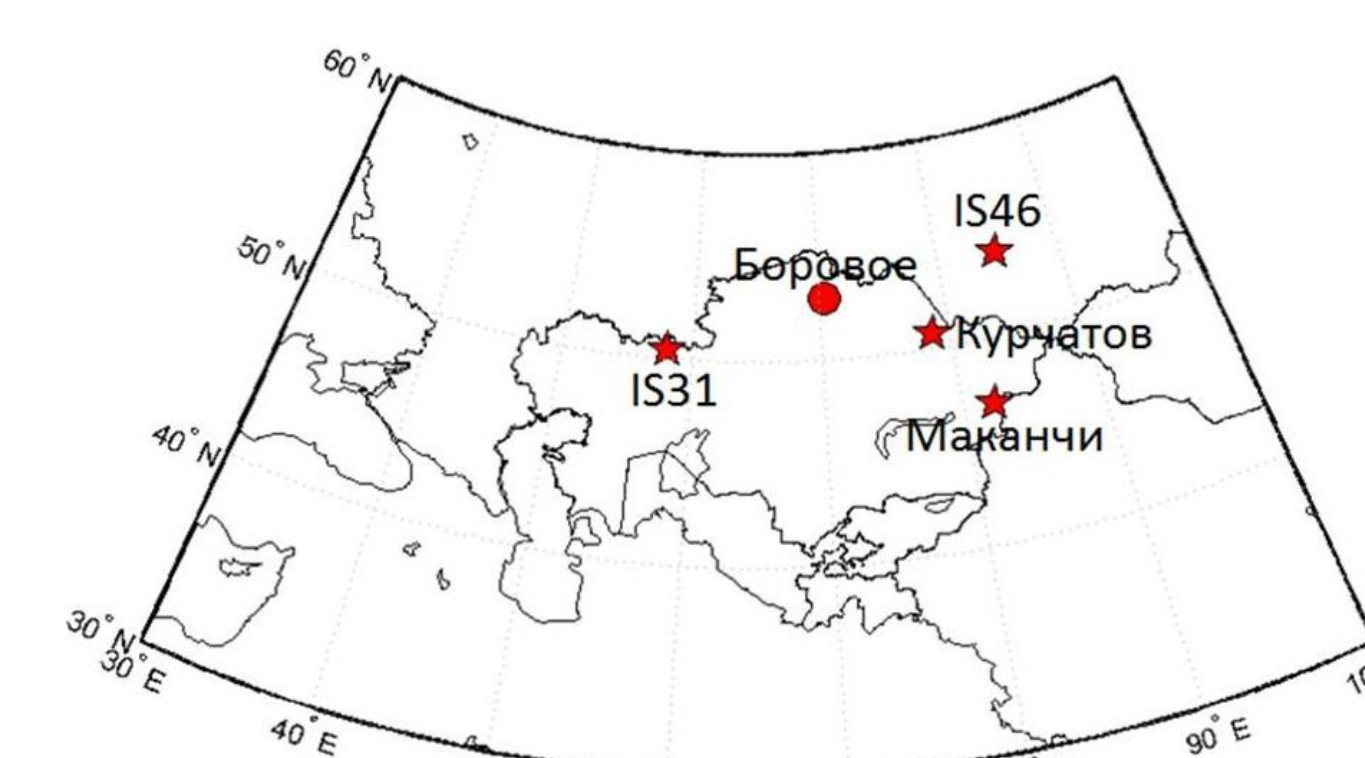


Location of reference events epicenters (red circles) and its epicenters in REB bulletin. Circle radius is 20 km.

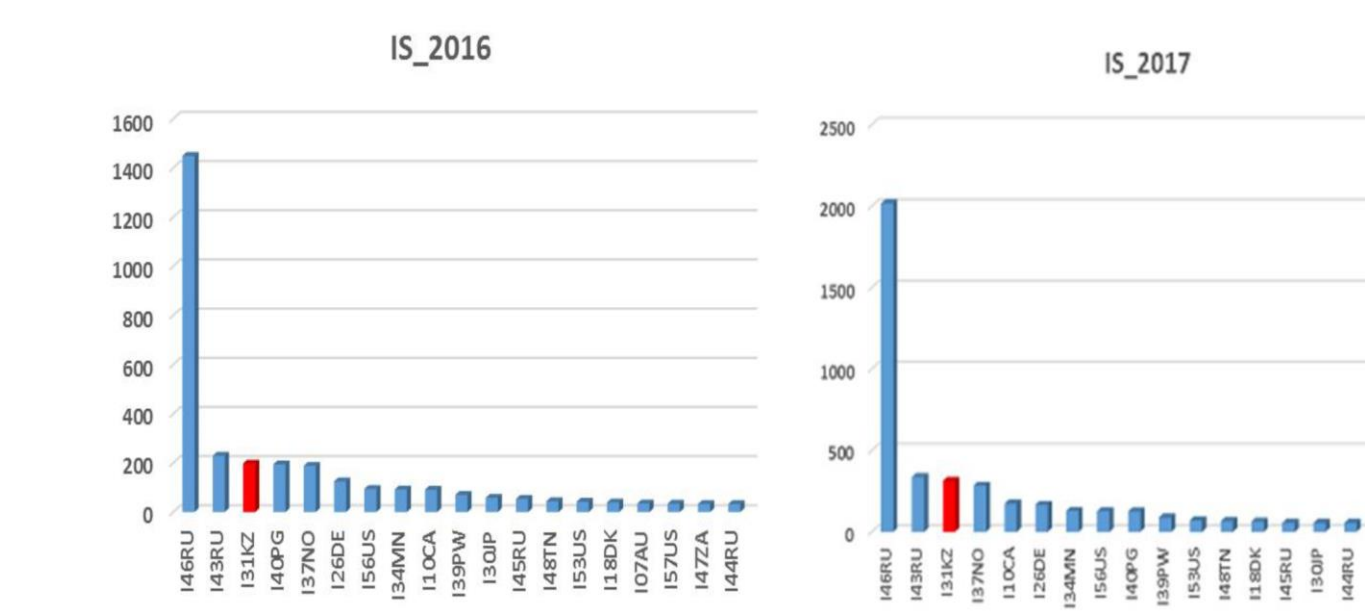


The map of the IMS stations location (green triangles) regarding the epicentral zone in the west of Kazakhstan (red circle).

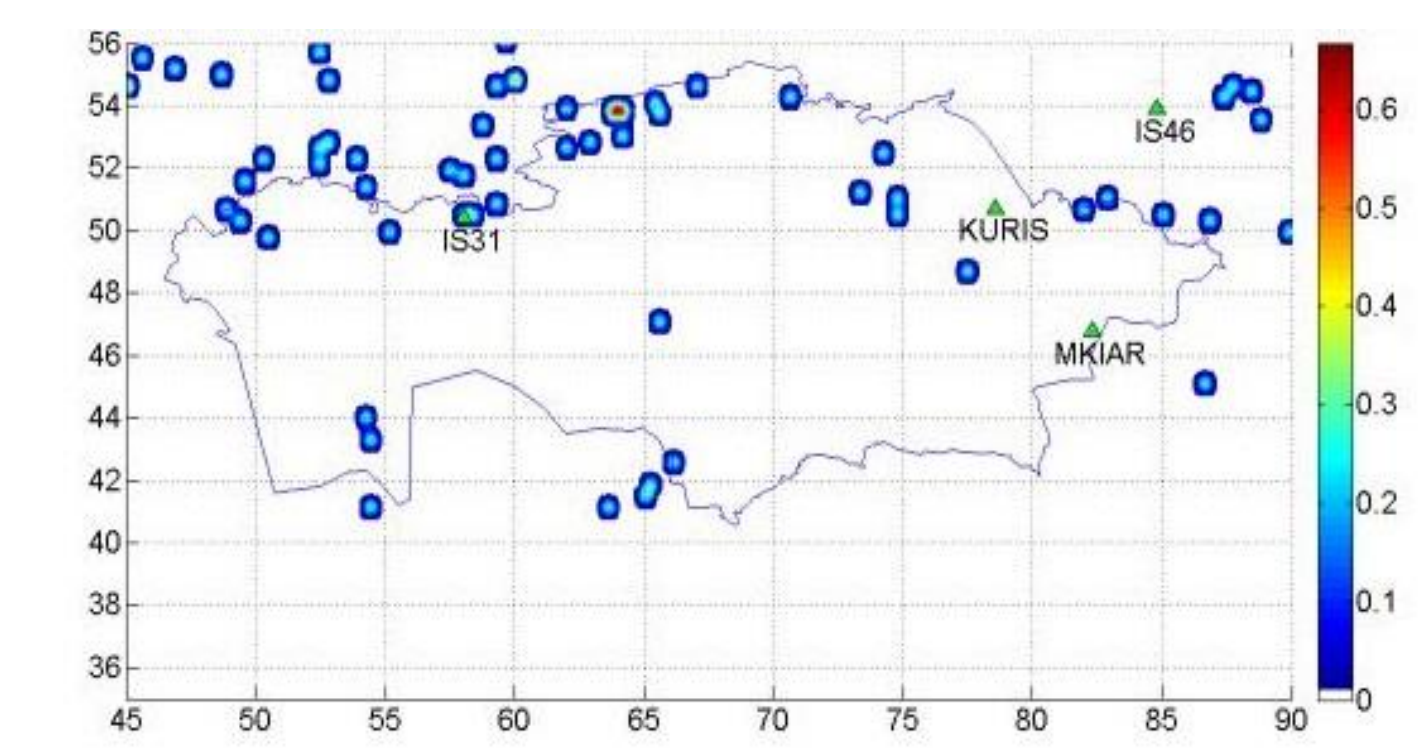
Infrasound monitoring



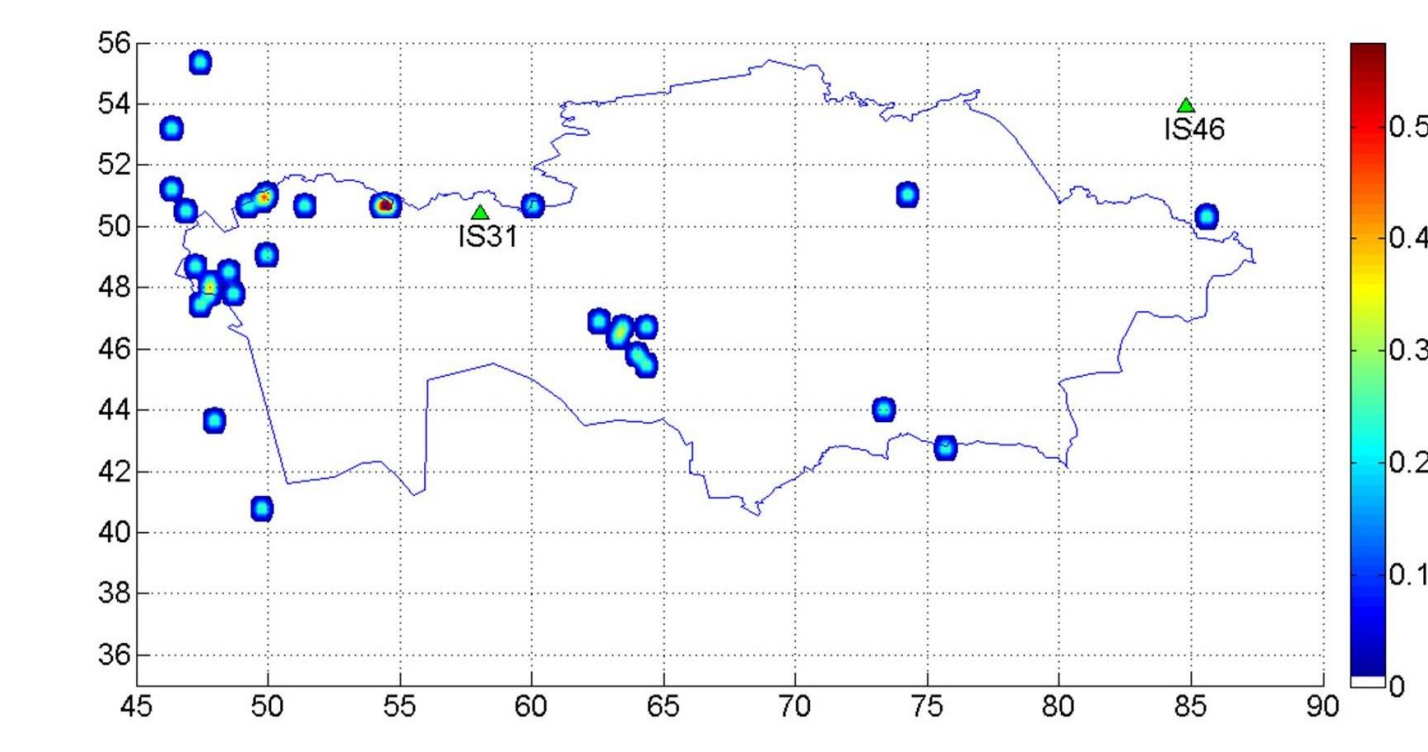
The network of infrasound stations used for the KNDC bulletin compilation. Red stars - infrasound stations that transmit data to the Data Centre in real time. Red circle - infrasound station Borovoye that is being upgraded.



Distribution of IMS infrasound stations by the number of associated phases in REB bulletin.



The map of infrasound events density from KNDC bulletin located by 4 stations, 2017

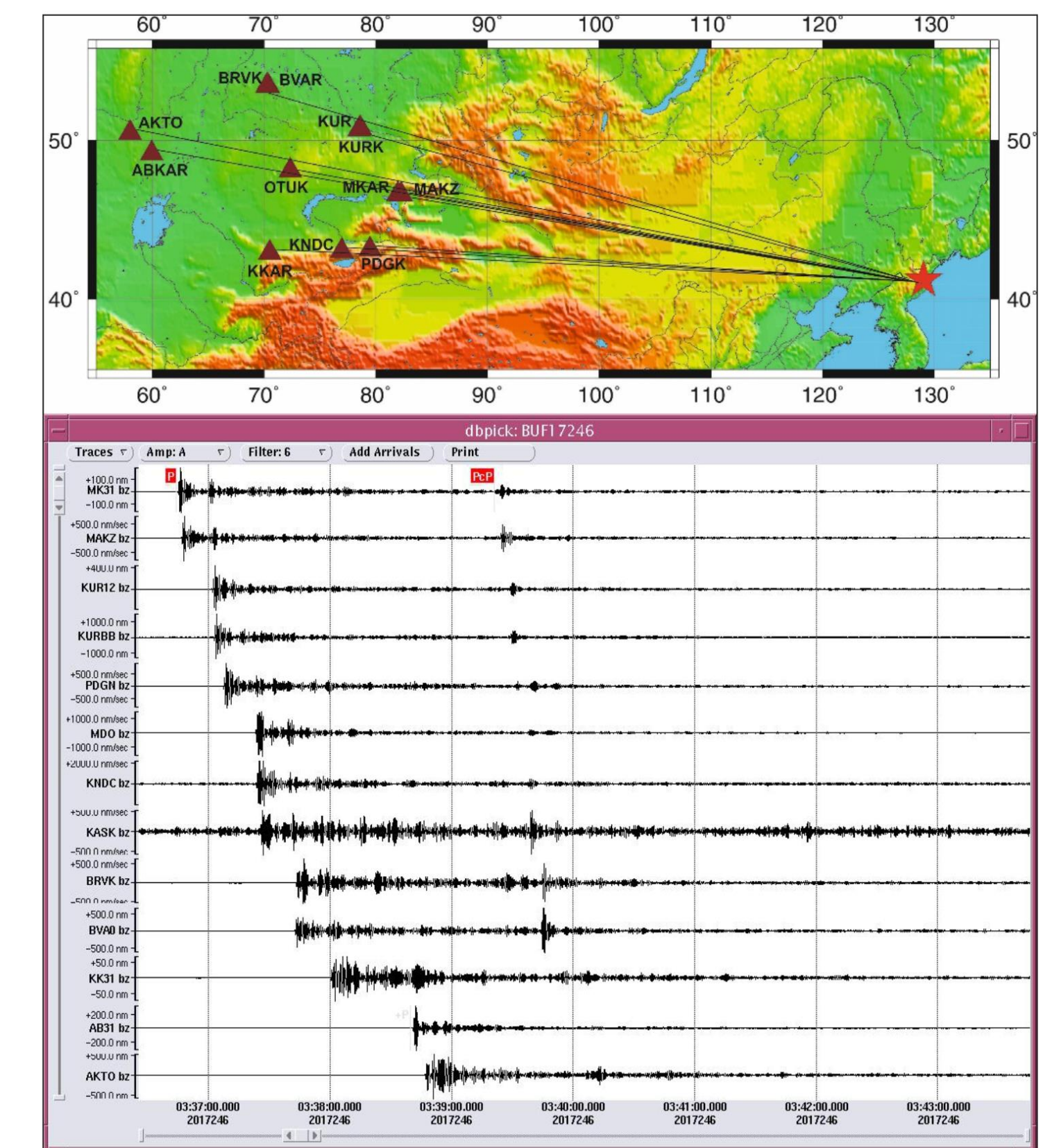


The map of infrasound events density from REB bulletin located by 4 stations, 2017

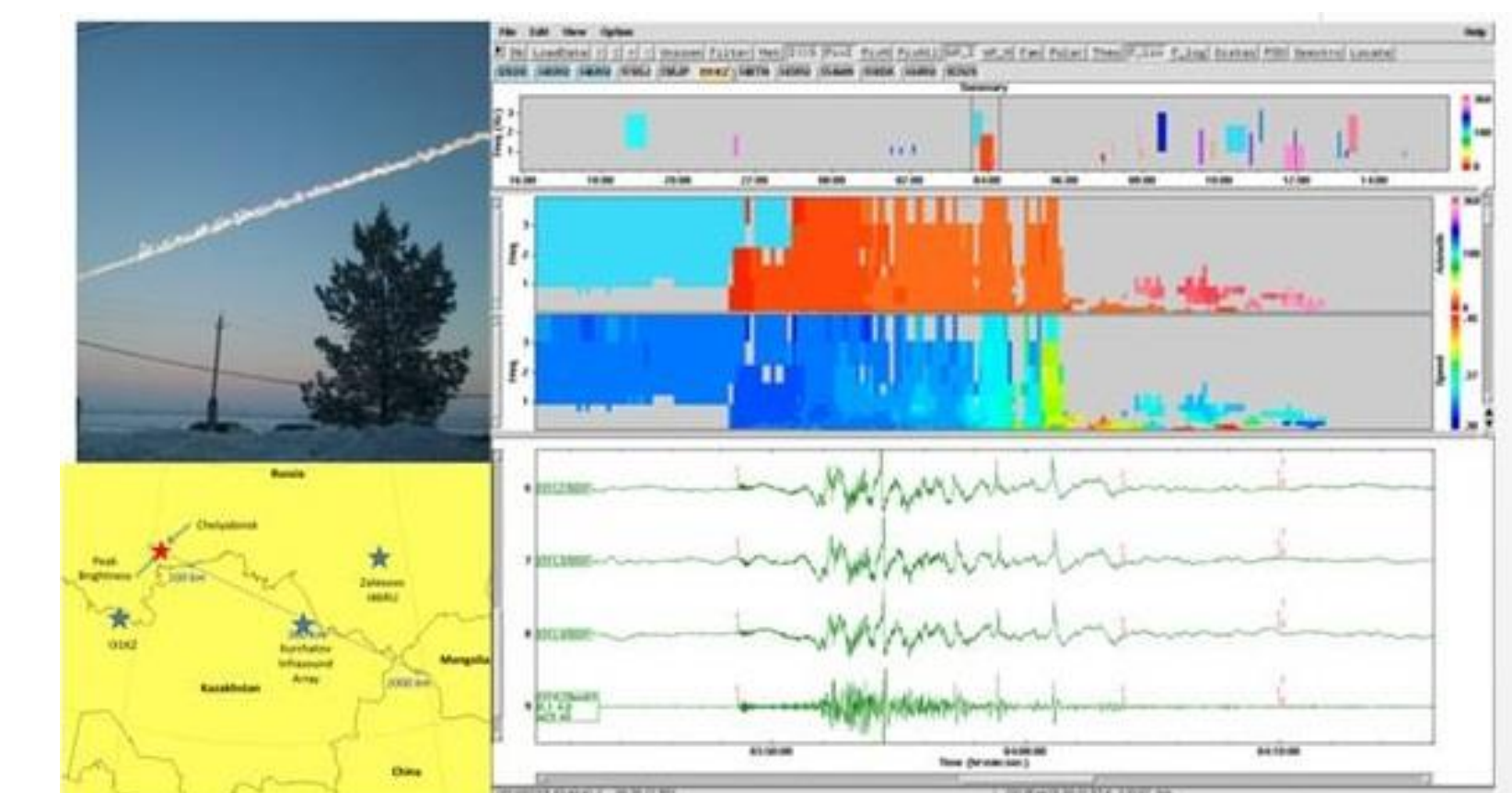


The network of IMS infrasound stations used for events processing in REB bulletin

The most important events recorded by Kazakhstan seismic and infrasound stations in support of the CTBT.

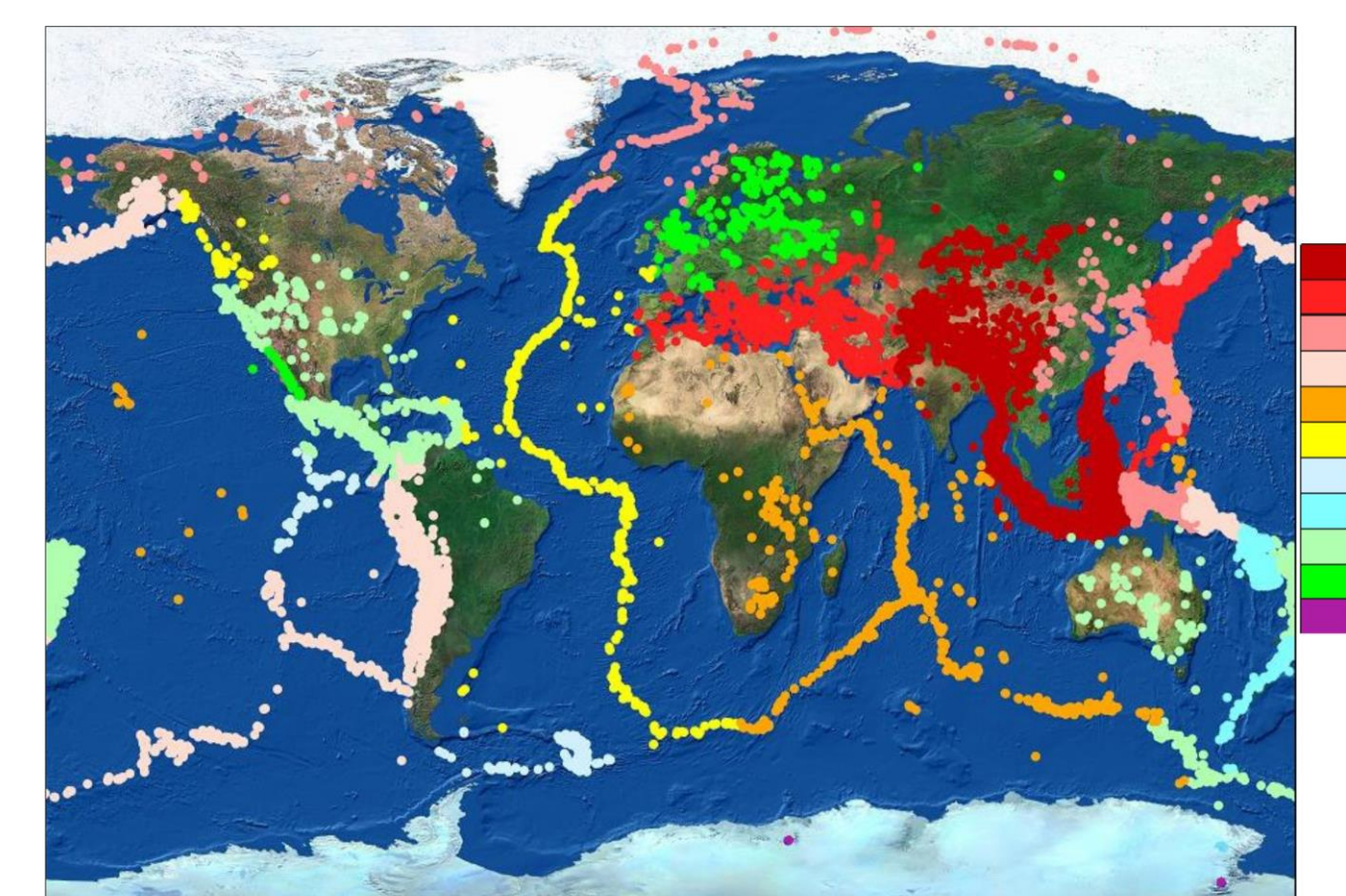


The stations network and a record of nuclear explosion conducted by North Korea in 3.09.2017

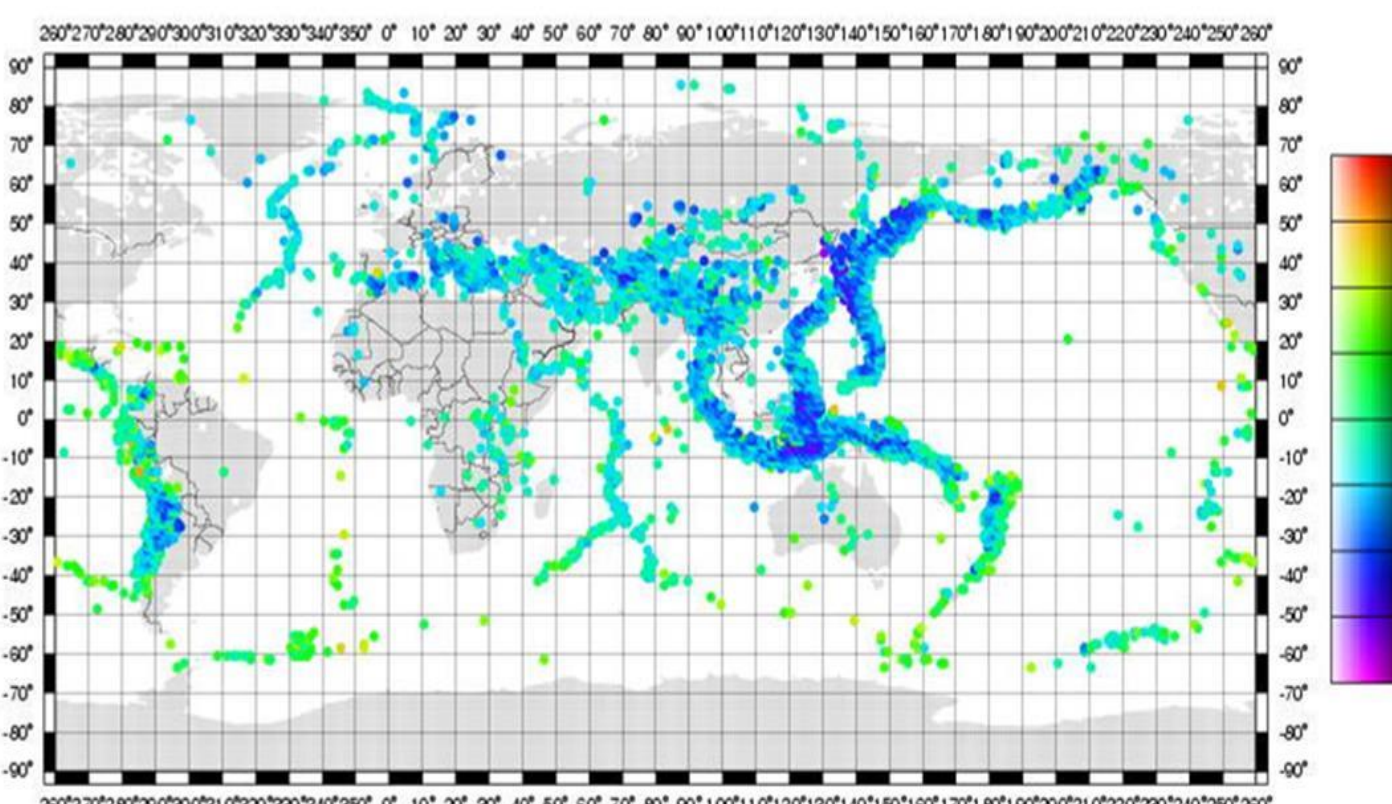


The blast of Chelybinsk bolide recorded by Aktyubinsk station, 15.02.2013.

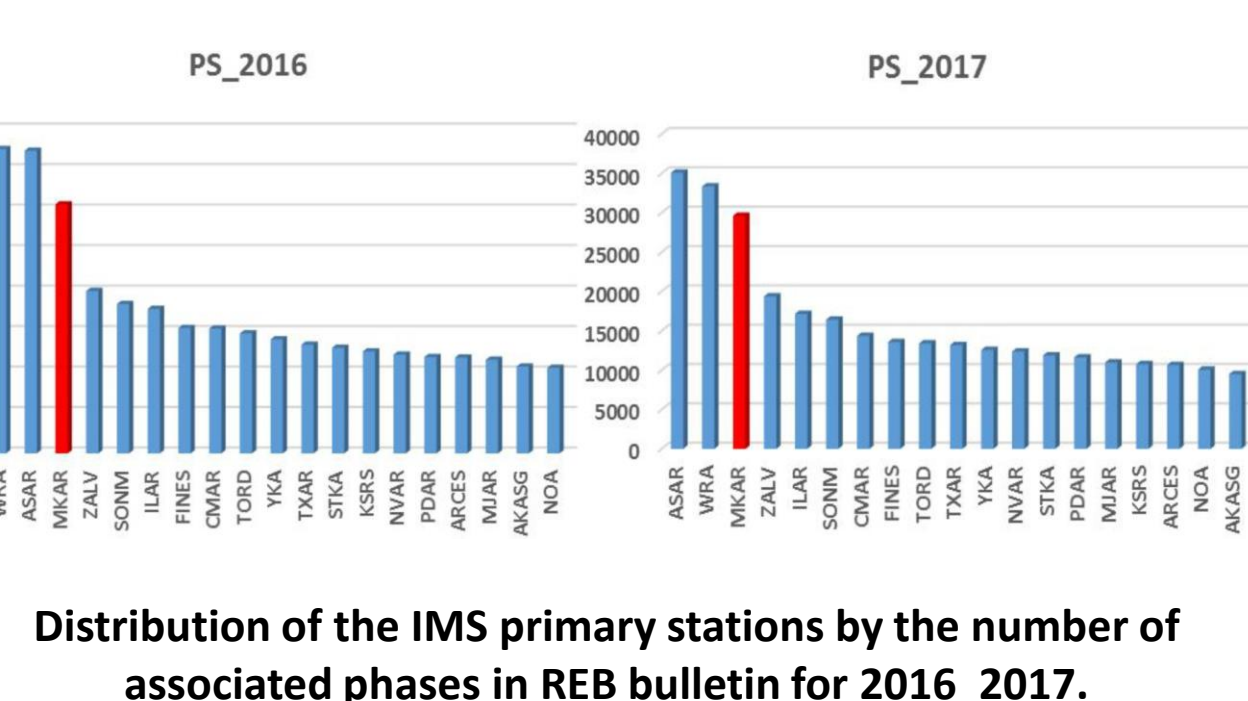
Efficiency of Kazakhstan part of the IMS



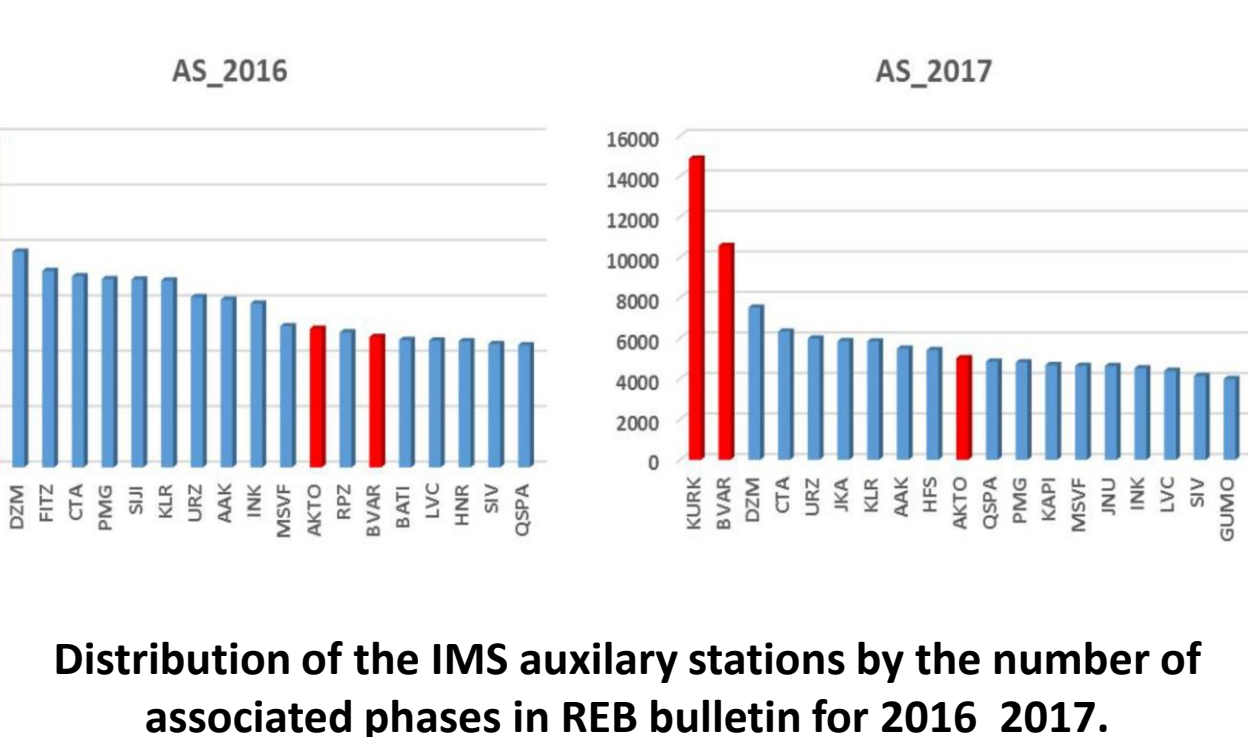
The map of epicenters showing a share of Makanchi station participation in REB bulletin forming for different seismic regions of the world. A color shows a share of events from given region recorded by Makanchi station to total quantity in REB.



The map of minimal magnitudes of seismic events by Makanchi station data.



Distribution of the IMS primary stations by the number of associated phases in REB bulletin for 2016 2017.



Distribution of the IMS auxiliary stations by the number of associated phases in REB bulletin for 2016 2017.

CONCLUSION

- All four IGR seismic stations included into the IMS monitoring system are very effective for detection and processing of events, and for compilation of the IMS REB bulletin.
- The analysis of the bulletins for Central Asia territory showed the representativeness of REB bulletin for magnitude mb=3.7 and quite good accuracy at the events location. The comparison of mb and mpv values for the same events from two bulletins showed systematic decrease of body wave magnitudes in the global bulletin comparing to the regional.
- By data of 2016 and 2017 there are missed events which magnitude was higher than reference for both bulletins. Both bulletins supplement each other quite well.
- The infrasound station Aktyubinsk IS31 showed high efficiency on its contributing to REB bulletin among 60 IMS stations by the number of associated signals.
- Kazakhstan monitoring stations recorded successfully all six nuclear explosions conducted by North Korea, its data were used by different agencies and international data centers.

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