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Analysis of ULF lithospheric magnetic activity in Kanto region, Japan

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The magnetic field of crustal origin in ultra low frequency (ULF) band is recently considered as the most prospective for detection of pre-earthquake lithospheric activity. However, at practical implementation of ULF signals detection some serious difficulties arise: 1) intensity of the studied signals is very low; 2) the frequency range of the lithospheric signals completely overlaps with the frequency range of Pc3-Pc5 ionospheric/magnetospheric signals. Also localization of magnetic sources in ULF band is very hard problem.
For separation of the ULF lithospheric magnetic activity from ionospheric/magnetospheric one the polarization ellipse technique with synchronous data processing from two measuring sites and procedure of blind search have been used [1]. The monitored area 90x90x90 km was decomposed into 5832 subblocks 5x5x5 km of total volume about 730,000km3.
The data in ULF range from two fluxgate magnetometers, with sampling rate 1 Hz, located in Kakioka and Kanozan geomagnetic observatories were analyzed. The specificity of Kanto region is a very high man-made electromagnetic interference what significantly complicates the detection of seismogenic signals.
The Kanto region is one of the most seismoactive in Japan. Seismic activity there occurs due to movement of Pacific and Philippine Sea plates. The plate boundaries underneath the Kanto region are just 10-40 km below the surface of the Earth and have a complex structure. Earthquakes EQs can occur there both due to subducting plates and due to active faults in land.
These EQs can be roughly classified as follow:
1) Shallow earthquakes that occur allows active faults at depths of up to 20 km.
2) Earthquakes that occur at the boundary of the land plate and the subducting Philippine Sea Plate at depths 20-50 km.
3) Earthquakes that occur within the subducting Philippine Sea Plate at depths 20-50 km.
4) Earthquakes that occur at the boundary of the subducting Philippine Sea Plate and the Pacific Plate at depths 50-100 km.
5) Earthquakes that occur within the subducting Pacific Plate at depths 50-100 km.
The ULF lithospheric magnetic activity and its connection with a local seismic activity during two years have been studied. The depth, space and time distribution of magnetically active lithospheric zones have been analyzed. It has been found that the zones with increased magnetic activity are in close proximity to the future earthquake focal areas.
The peculiarities of obtained results and possibility of further development of this method are discussed in the presented report.
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[1] F. Dudkin, V. Korepanov, D. Yang, Q. Li, and O. Leontyeva. Analysis of the local lithospheric magnetic activity before and after Panzhihua Mw = 6.0 earthquake (30 August 2008, China). Nat. Hazards Earth Syst. Sci., 11, 3171-3180, 2011.