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Local lithospheric magnetic activity before selected earthquakes in Japan

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The lithospheric ultra-low frequency (ULF) magnetic activity is recently considered as very promising candidate for application to short-term earthquake forecasting. However the ULF lithospheric magnetic field is very weak and masked by much stronger ionospheric and magnetospheric signals. The study of pre-earthquake magnetic activity is a very difficult problem which consists of identification and location of weak signal sources in seismo-hazardous area of the Earth crust with major attention to near-urban areas.

For separation and localization of such sources we used the multi-point observation method with subsequent application of polarization ellipse technique and blind search of seismogenic ULF signals. First time this method was applied to the data from fluxgate magnetometers installed in Sichuan province, China. Sichuan is a region of strongest seismic activity on territory of China. During last century about 40 earthquakes with magnitude Ms_6.5 were happened here in close proximity to heavy populated zones.

The Panzhihua earthquake Mw 6.0 was happened in the southern part of Sichuan province on August 30, 2008 at 8:30:52 UT in a very electromagnetically quiet area. The data from three fluxgate magnetometers placed near clustered earthquake area at a distance 10-55 km from epicentre of main shock have been processed. The separation between magnetometers was in the range 40-65 km. The analysis of correspondent local lithospheric magnetic activity for the total year 2008 showed excellent coincidence of this activity in time and location with the EQ preparation process: the identified precursors and the source structure were found just several days before EQ and in the local fold zone where the EQ occurred.

The same methodology was applied to the magnetic data registered in 2005 in Kakioka-Kanozan area in Japan. The peculiarity of these data is very high man-made electromagnetic noise which complicates much the detection of seismogenic signals. Several EQs with magnitude above Mw 5.0 occurred during the year 2005 with depths ranging from 30 to 60 km. The obtained results and further ways of the new method development are discussed in the report.

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