

## VHF radio wave transmission anomaly associated with 2011 off Urakawa EQ (Mw6.2) observed at multiple sites

MOGI, Toru<sup>1\*</sup>, MORIYA, Takeo<sup>1</sup>, KAKINAMI, Yoshihiro<sup>1</sup>, TSUKADA, Mariko<sup>1</sup>

<sup>1</sup>ISV Hokkaido Univ.

We have observed VHF band radio-wave propagation anomaly beyond the line of sight prior to earthquakes (EQ echo) since September 2003 at Erimo area in Hokkaido, northern Japan. EQ echoes have documented more than 40 times at the Erimo Observatory (ERM) prior to earthquakes that occurred in the Hidaka mountains since then. To confirm a region where the EQ-echo simultaneously observed for each earthquake, we have installed four observation sites with approximately 8 km spacing in the Erimo area since September 2011. Four way antennas were installed at every 90 degrees to detect an arrival direction of EQ echoes at RSK (8km away from ERM in NW) and TYO (8km away from ERM in SE) site and six way antennas (every 60 degrees) were installed at FYS (16km away from ERM in NW). We also installed the electric field mill to monitor a static electric field of atmosphere at FYS and TYO.

The EQ-echoes have been observed simultaneously in these sites associated with off Urakawa EQ (Mw 6.2) that occurred at 19:25, 24 Nov. 2011. Larger EQ echoes were documented on 21 and 22 November, which were 2 or 3 days before the earthquake, at FYS, ERM and TYO in every direction. Although some of EQ echoes were observed in same time at these sites, but some of them were appeared with time rag of duration in each EQ echo among these sites. We discussed what these time rags mean by considering possibilities of generation and moving of scattering objects.

Keywords: Radio wave transmission, earthquake forecasting, seismo-electromagnetics