Short term prediction of shallow great earthquakes by observing electric fields

Kozo Takahashi[1]; Igor V. Matveev[2]; Shinobu Yazaki[3]; Yukio Fujinawa[4]

[1] None; [2] IPE; [3] NIED; [4] REIC

http://www.jpgu.org/meeting/

[Introduction] DEMETER (Detection of Electro-Magnetic Emissions Transmitted from Earthquake Region: http://smsc.cnes.fr/DEMETE micro-satellite launched on 29/06/04 and has observed extraordinary electric fields, which accompany the earthquakes whose magnitude (M) is larger than 4.8 and depth (D) is shallower than 40 km.

S Hyogo Pref. Eq. (1995/01/17, M:7.2, D:22km) belonged in this category of the Eq. of M and D, and before the Eq. the extraordinary fields were observed in wide bands. Furthermore about one week before the Eq., the column of cloud was observed that extended vertically from the source region up in the sky, though strong wind was blowing then. The increase of density of Radium (Ra) and Radon (Rn) was also observed in the spring water in the source region just at the same time when the cloud was observed.

S Iwate Pref. Eq. (13/06/2008 UT, M:7.2, D:8 km), the only one earthquake, which occurred in 17/07/2007 - 31/01/2009 in Japan, of which intensity (I) is larger than 6, also belonged in the category of the Eq. of M and D, and as shown in attached figure, the extraordinary fields were observed before and after the earthquake.

[Background] In cumulonimbus, water drops change into ice crystals in the area of -10 degs, the crystals collide with each other, and the negatively charged surface water on the smaller crystals moves to the lager crystals. The smaller crystals become positive and smaller, and are blown up by ascending air. The potential becomes up to about 30 MV at the cloud top of about 10 km high, and negative ions flow from the ionosphere to the cloud top, that makes the ionosphere positive. On the other hand, the larger crystals become negative and larger, and drop down on the surface.

[Generation of Precursory Electric Fields] Negative ions on the surface flow into the ionosphere along the trace of cosmic ray shower, like lightning discharges zigzag, and the potential of the ionosphere balances with about 1 MV. Though the current is usually weak, when the density of Ra and Rn locally tentatively increases on the surface, the conductivity increases, the current increases, and the current density becomes high enough by Pinch Effect for the electric fields to be observable. Ra and Rn are generated by decay of Uranium (U), and U exists in crystal boundary. If micro-cracks run in the source region, U, Ra and Rn dissolve into pore water, and the pore water mixes in spring water.

So the current must be induced by the micro-cracks before the earthquake in the source region and by the micro-cracks that accompany seismic ground motion.

[Detection of Precursory Electric Fields] Considering that the wave of 1.5 kHz radiates from a half wave dipole of 100 km length, which is the same as the height of the lower ionosphere, that the fields of natural noise are usually inversely proportional to frequency, and that man-made noise is strong in the frequencies lower than 1.5 kHz, the fields of 1.5 kHz is chosen to detect the precursory fields.

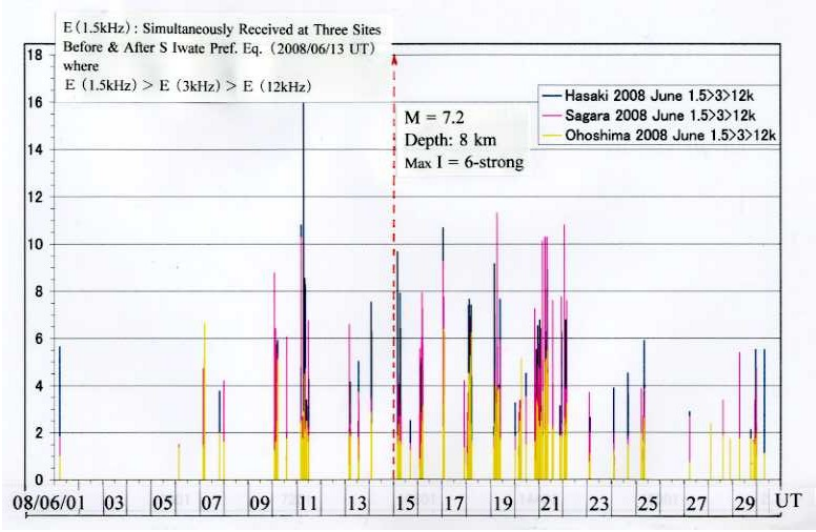
In order to exclude the fields of lightning, the fields of 3 kHz and 12 kHz are also observed, and the pulses are extracted which satisfy the following relations.

E(1.5kHz) stronger than E(3kHz) stronger than E(12kHz)

where E(f kHz) is field intensity of f kHz.

The fields of lightning are the strongest natural noise and are strong within 500 Hz - 50 kHz. The maximum field intensity is usually within 3.8 - 6.3 kHz, so the fields of near lightning do not satisfy the left side of the relations. On the other hand, the fields of distant lightning absorb heavy attenuation loss within 1.4 - 3.0 kHz, and do not satisfy the right side of the above relations.

According to our observation of 1 - 13 kHz, the local temporal man-made noise is not observed within 0.4 ms at two sites of 50 - 100 km distance. So, the man-made noise is excluded by receiving at more than three sites whose mutual distances are 50 - 100 km.


E (1.5kHz) : Simultaneously Received at Three Sites
Before & After S Iwate Pref. Eq. (2008/06/13 UT)
where
E (1.5kHz) > E (3kHz) > E (12kHz)
M = 7.2
Depth: 8 km
Max I = 6-strong
Hasaki 2008 June 1.5>3>12k
Sagara 2008 June 1.5>3>12k
Ohoshima 2008 June 1.5>3>12k
18
16
14
12
10
8
6
4
2
0
08/06/01
03
05
07
09
11
13
15
17
19
21
23
25
27
29
UT