Mechanism of generating 1.5kHz waves just before great earthquakes

Kozo Takahashi[1]

[1] None

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

Charge separation is brought in the area of minus 10 degrees in cumulonimbus clouds whose ice crystals collide with each other, because the water film, which contains negative ions, on the smaller crystals moves to the lager crystals, the smaller crystal becomes positive, and the positively charged smaller crystals are blown up by an ascending air current. The voltage becomes up to about 30 MV at the cloud top of about 10000 m high. As the electric conductivity between the cloud top and the ionosphere is relatively larger than that between the cloud bottom and the ground surface, and as the potential at the cloud top is much higher than at the ionosphere, so electrons and negative ions flow from the ionosphere into the cloud top. On the other hand, the negative ions generated by corona discharge on the ground, for example, flow into the ionosphere. As the result, the voltage at the ionosphere balances with about 1 MV (Refer to Figure).

Before great earthquakes, whose magnitude is larger than 5.4, the extraordinary electric fields are often observed on the surface above the source regions. In the source regions, when micro-cracks run, charge separation is induced on the fresh surface, and when void water flows, the charge separation is also induced resulting streaming potential. These charge separations generate free electrons and positive holes, and the electric fields, which show diffusion potential, are induced on the surface caused by the difference between the diffusion speed of an electron and the speed of a positive hole in the crust. But these fields are too weak to induce the observable negative current between the surface and the ionosphere, because the lower atmosphere is an excellent insulator, and discharge starts there only when the fields are stronger than 10 kV/m. Such strong fields have not ever been observed before the earthquakes.

By the way, the isolation in the lower atmosphere is broken temporarily and locally by cosmic ray showers. By the showers, the zigzag pattern of lightning is thought to be drawn, because the lightning current flows along the traces of the showers, where the isolation is broken. When the showers fall over the areas above the source regions, where the fields are stronger than the surrounding area, the difference of field strength can become the trigger to induce the current between the surface and the ionosphere, which flows along the trace of the showers. If the current continues, pinch effect makes the current density high enough to ionize the atmosphere. If the atmosphere is then supersaturated, an earthquake cloud builds, as a fog forms as in a cloud chamber. If it is daytime and clear then, the earthquake cloud is visible.

If discharge happens between the surface and the ionosphere, the radio pulses are generated, in the same way as usual discharge through a gap generates the pulses whose half wave length is around the gap width. As the distance between the surface and the lower ionosphere is about 100 km, so the wave whose half wave length of 100 km, i.e., 1.5 kHz wave, will radiate before the earthquake. But this wave had not been detected until this wave was discriminated from manmade noise and lightning fields.

The precursory 1.5 kHz pulse wave will be detected by discriminating the wave from the noise by considering following experimental results. The manmade noise at 1.5 kHz is not simultaneously received at three or more sites whose mutual distances are about 100 km. The spectrum of lightning fields is well-known. The precursory 1.5 kHz pulses are extracted, in the following earthquakes, by observing 1 - 13 kHz simultaneously at three sites.

SE Off Kii Penisula Eq. 04/09/05, M: 7.3, Depth: 44 km, epicentral distance: 180 - 420 km), period of anomaly: 0.4 - 1.8 days.

Mid Niigata Pref Eq. 04/10/23, M: 6.8, Depth: 13 km, epicentral distance: 230 - 290 km, period of anomaly: 0.3 - 3.3 days.