

Seismic precursors accompanying the current between the surface and the ionosphere just before great earthquakes

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[Introduction] One week before S Hyogo Pref. Eq. (1995/01/17 M:7.2), the column of cloud was observed which extended vertically from the source region up in the sky, even though strong wind was from the west then. We consider the cloud is generated by current between the surface and the ionosphere along the track of cosmicray showers, according to the same principle as Wilson cloud chamber. This phenomenon happens only when the electric conductivity on the surface becomes locally high, that happened, because the density increased of Radium (Ra) and Radon (Rn) on the source region then.

Ra and Rn are generated by decay of Uranium (U), which 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 micro-cracks are essential for inducing the current, which is accompanied by many precursors.

[Background] In cumulonimbus, the potential becomes up to about 30 MV at the top of about 10000 m high (Refer to J117, Kozo Takahashi), that makes the ionosphere positive. Negative ions on the surface flow into the ionosphere along the track of cosmicray showers, like lightning zigzags along the track, and the potential of the ionosphere balances with about 1 MV.

[Precursor related to electric fields] The current between the surface and the ionosphere is invisible, except St. Elmo's Fire, because the conductivity in the lower atmosphere is low. But when the density of Ra and Rn increases, the current density can become high enough by Pinch Effect for the electromagnetic fields to become observable.

I. Precursory Electric Fields

The distance between the surface and the lower ionosphere is about 100 km, so 1.5 kHz wave, whose half wave length is 100 km, will radiate, when discharge happens between the surface and the ionosphere. The attached figure shows one of the observed 1.5 kHz fields, where the fields of 3 kHz and 12 kHz are also observed to discriminate the precursory fields from lightning (Refer to J117, K.Takahashi & I.Matveev). The manmade noise is eliminated by simultaneously receiving at four sites whose mutual distances are about 100 km.

The induced fields by the current have wide bands, because the discharge between the surface and the ionosphere has many paths, and the radiated waves are pulses.

II. Precursory Earth Current and Potential

When micro-cracks run in the source region, and U, Ra and Rn dissolve into pore water, then conductivity of pore water increases, and distributions of current and potential change in the source region. These currents and potential, together with the current between the surface of the source region and the ionosphere, affect the surface current and potential, which will be observable just before great earthquakes.

III. Precursory Ionospheric Anomaly and Propagation Anomaly

When the current flows between the surface and the ionosphere, the same amount of current also flows in the ionosphere, and Pinch Effect makes the ion density in the ionosphere partially, locally, and temporarily high. The high density causes anomaly in the ionosphere, and the anomaly causes propagation anomaly.

IV. Anomalous Behavior of Animals before Earthquakes

Some animals show anomalous behavior in strong electric fields, e.g. 10 kV/m. These strong fields must have occurred partially, locally, temporarily and impulsively on the source region. They will be observed only when we can precisely predict the time, location and magnitude of great earthquakes. The occurrence of strong fields is possible, because the current flows between the surface and the ionosphere, whose potential is about 1 MV, when the surface conductivity becomes partially, locally and impulsively high, caused by high density of Ra and Rn.

