E059-006 Room: C513 Time: May 30 10:15-10:30

General remarks about mechanism of generating precursory seismo-electric fields

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[1] None

To remark about mechanism of generating precursory seismo-electric fields, the following is explained.

(1) No extraordinary electric fields synchronize with the earthquake.
(2) Often the time of observing the fields at a site is different from the observing time at another site.
(3) Even at a far site, the fields are observed without corresponding electric sources in the source region.

Laboratories of China Seismological Bureau showed that before rock failure the electric pulses are emitted prior to acoustic emission, i.e. just before micro-cracks open, and higher frequency pulses are emitted earlier than lower ones. The fields synchronous with rock failure had been observed, but these are generated by frictional heat, and are not observed when rock is slowly failed. So, it is natural that the fields synchronous with a quake are not observed. Though the fields synchronous with quake motion are observed, these are induced fields by antenna motion synchronous with quake motion, and are weak induction fields, which have a spectrum of black-body radiation, from sources adjacent to the antenna. The induction fields decrease inversely with square of distance, so the synchronous fields induced by a quake in the source region are too weak to be observed on the surface.

The precursory fields at frequency lower than 100 Hz are observed within 100 km from the source region. The experiments show these fields are generated before rock failure. Radio waves at lower than 100 Hz are little attenuated in the crust. So, the source region must emit the precursory waves.

The experiments also show that pulses have different spectra, which are emitted at different times before rock failure. Usually, monitoring frequencies are different at different sites. So, when received pulses are different, the receiving times become different.

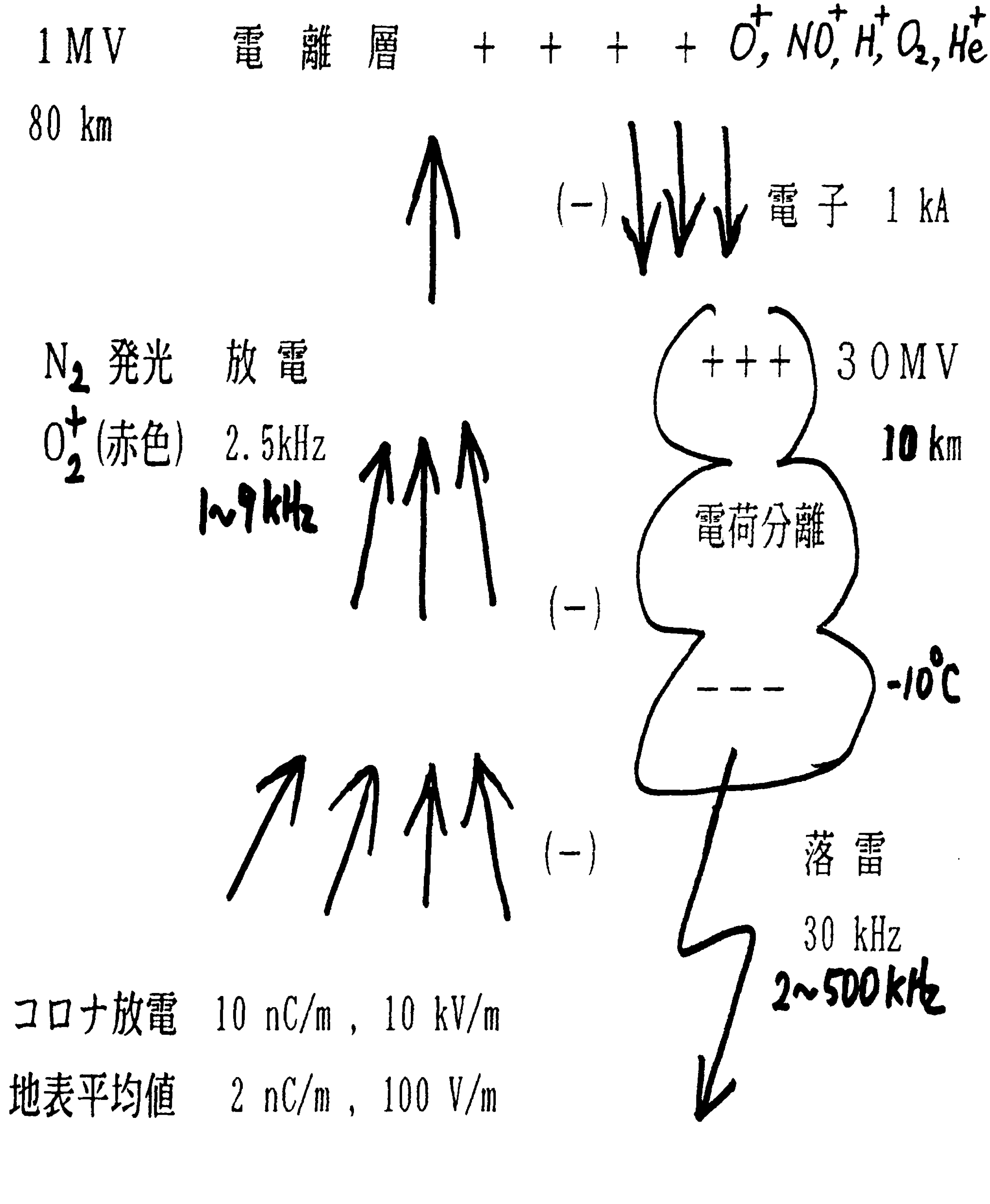
The precursory fields at far distance have been attributed to man-made radio waves or natural noise, whose sources are not in the source region, and which propagate far in an extraordinary ionosphere propagation mode.

The ionosphere has a voltage of about 1 MV, and the earth surface has negative charge, so the vertical fields are about 100 V/m. These fields generate the current from the ionosphere to the surface, St. Elmo's Fire, for example. Before a strong quake, when the source region partly negatively charges, and the fields attain to 10 kV/m, then discharge current starts to flow (Refer to Fig.). These strong fields are observed indirectly, before Earthquake in South of Hyogo Pref. of 17 Jan. 1995, for example. A few days before the quake, cirrocumulus castellanus (vertical cirrus clouds) formed over the source region. These clouds form on the same principle as in a Wilson Cloud Chamber, which has strong fields. The cirrocumulus castellanus forms, where the current in the fields causes Pinch Effect, attracts and condenses the cloud.

Before a strong quake, when the source region charges negatively and discharge starts between the source region and the ionosphere, then the current flows in the lower ionosphere, Pinch Effect produces higher electron density area in the rope shape, and in the adjacent area the electron density becomes lower. The higher electron density area reflects the radio wave at higher than about 10 MHz, like a meteor trail does, and the lower density area less attenuates the wave at lower than about 1 MHz. As a result, in both frequency bands, the precursory fields are observed at far distance.

Positive charge on the source region increases negative ion density in the lower ionosphere, increases little electron density there, and can't be main cause of the long distance propagation before a strong quake.

大気中の負電流環



1MV　電離層　+ + + +　O^+, NO^+, H^+, O_2, He^+
80 km
(−)
電子 1 kA
N_2 発光　放電
O_2^+(赤色)　2.5kHz
1~9kHz
+++　30MV
10 km
電荷分離
(−)
−−−
-10°C
(−)
落雷
30 kHz
2~500kHz
コロナ放電　10 nC/m , 10 kV/m
地表平均値　2 nC/m , 100 V/m