Mechanism of generating thunders

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1.None

1. Mechanism generating thunders at middle latitudes
At middle latitudes, water drops in cumulonimbus change into ice crystals in the area where the temperature is about -10 deg. The melting temperature of a solid is lower on the surface than the inside, so at about -10 deg. the ice crystals are covered with liquid water film. The inside of the crystals there are free electrons and positive holes, and the electrons can move to the surface water, but the holes can't. So the water film is negatively charged, and the solid part of crystals is positively charged. In the cloud, the crystals collide with each other, the collision is approximately elastic one where lower than -10 deg., and the change of speed of the smaller crystals is larger than that of larger ones. Then the negative charge in the surface film on the smaller crystals moves to the larger crystal, and the smaller crystals become smaller and charged positive, are blown up to the cloud top, and make it high voltage. On the other hand, the larger crystals become larger, negative and drop down on the ground (Fig.1 & 2).
2. Mechanism generating thunders at low latitudes
At low latitude, in the cloud no water crystal exists, so the mechanism differs from that one at middle latitude. The top of thunderclouds has the voltage up to about 100 MV, by the mechanism stated in above Chap.1 (Fig.2), and the electrons and negative ions flow into the clouds from the ionosphere. As a result, the ionosphere has a few MV, so in the cloud upward electric fields of about 1 kv/m are generated. So, water drops are polarized such as the top is negative and bottom is positive. When they collide, the negative charge on the top of smaller water drops, which have higher speed than the larger ones, neutralizes the positive charge on the bottom of the larger water drops, and the smaller ones become positively charged and are blown up to the cloud top (Fig.3), resulting the high voltage.
3. Mechanism generating thunders in the smoke of a volcano
In the smoke billowing from a volcano, the lightning is observed, where ashes, cinders and blocks collide with each other, and where are charged by frictional electricity (Fig.3). By the same reason shown in chapter 2, the charge is polarized and high voltage in the upper part of the smoke is generated. As this high voltage is observed, the explanation mentioned above will be valid.
4. Earthquake prediction by observing electric fields (Fig.2)
The precursory seismic electric fields will be generated by the mechanism as follows:
(1) Before earthquakes, micro-cracks run in the source regions, and into these cracks pore water pours.
(2) Uranium compounds, radium compounds and radon, which exist in crystal boundaries, dissolve into the pore water.
(3) The cracks connect the pore water and spring water, and the radio active materials appear on the surface of source regions.
(4) The active materials ionize the lower atmosphere above the source regions, and the electric conductivity increases there locally and temporarily.
(5) The increase generates the current along the trace of cosmic shower between the surface and the ionosphere.
(6) As the current is intermitting and pulsating, it radiates wide band radio-waves, which are observed as the precursory waves.

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Keywords: earthquake prediction, precursory seismic electric fields, thunder in middle-latitude, thunder in low-latitude , thunder in smoke of volcano

Fig.2 [A Negative Current in the Atmosphere]

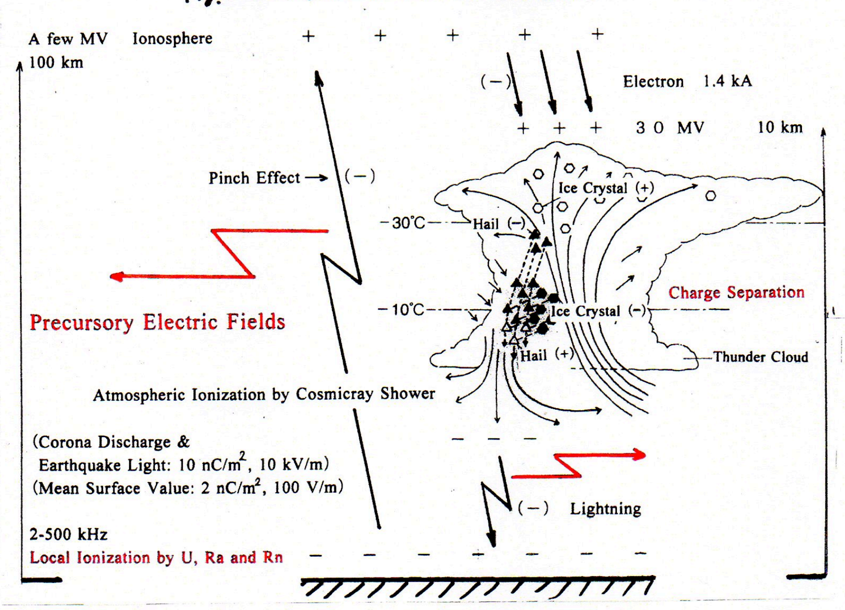

Fig.1

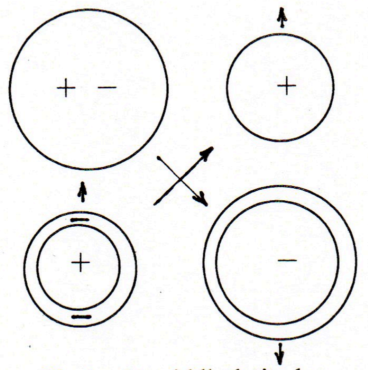

Fig. 1 At middle latitude

Fig.3

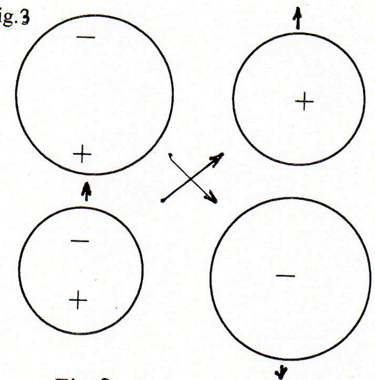

Fig. 3 At low latitude

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Measurements of radon and thoron decay products at Tarobo, a base of Mt. Fuji, Japan

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The atmospheric activity concentrations of the short-lived radon and thoron decay products were measured at Tarobo (1300 m a.s.l.), a base of Mt. Fuji, from July 2014 to Aug. 2015. Radon and thoron concentrations were calculated with energy spectra of *arfa*-ray emitted from radioactive aerosols collected on a filter with a time resolution of 2 or 4 h by using a radon monitor. In addition, size distributions of aerosols from about 10 nm to 5000 nm in diameter were measured with a scanning mobility particle sizer and an optical particle counter. In order to estimate the history of air masses, the backward trajectories from 72 h ago to 48 h ago were computed using the HYSPLIT trajectory model (https://ready.arl.noaa.gov/HYSPLIT_traj.php).
Clear seasonal variations of total counts of decay products were found that monthly averaged values were high between autumn and winter, and low between spring and summer. On the other hand, diurnal variations were not observed clearly. It is supposed that the cause of seasonal variations is due to the deference of air mass. These patterns were compared with the results measured at Jungfraujoch (Gaggeler, *et al*., 1995).

Acknowledgments
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References

Gaggeler, H. W. *et al*., Atmospheric Environment, 29, 607-616, 1995

Keywords: radon thoron decay products, seasonal variation, Mt. Fuji

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Properties of variation of atmospheric electricity parameters (atmospheric electricity field (AEF), atmospheric ion concentration (AIC), and radon concentration) at Asahi, Boso Peninsula, Japan

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The total electron content anomaly preceding the large earthquake is one of the most promising precursory phenomena in the upper atmosphere. Lithosphere–Atmosphere -Ionosphere coupling (LAI coupling) model has been proposed to explain the earthquake-related phenomena in the atmosphere and ionosphere. We evaluate the possibility of chemical channel of LAI coupling through the monitoring of atmospheric electricity parameters such as the atmospheric electricity field (AEF), atmospheric ion concentration (AIC), and radon concentration. In this paper, we will report about the property of atmospheric electricity parameters observed at Asahi station (ASA), Boso Peninsula, Japan. AIC, AEF, atmospheric radon concentration, radon exhalation quantity from the ground, and weather elements have been observed at ASA. First, we compare seasonal variation, daily variation, and response to precipitation of atmospheric electric parameter observed at ASA and those at Kiyosumi station (KYS).
Variations of AIC and AEF before precipitations are quite similar at both stations; AIC increases quickly when a precipitation starts and AEF begins to be disturbed three hours before rain starts. But the variations after stopping precipitation have individual properties. Both parameters keep high values for a few hours at ASA and it takes longer than KYS to back to the normal level. Daily variation in each season also differs in each site. In summer, AIC takes minimum value at 15:00 LT. in the daily variation at ASA. But at KYS, it takes maximum value at 15:00 LT. In winter, AEF decreases from 09:00 LT to noon and gradually increases in daily variation. In other seasons, it takes maximum value at 20:00 LT and fluctuated in relatively large range. Daily variation of AEF in winter is mostly similar to the typical daily variation at KYS for all season.
Radon exhalation quantity variation has a clear negative correlation with 3 hours delay to the air pressure variation. Each season differs in daily pattern. AIC and AEF variations show lag correlation with radon exhalation quantity variation. To extract anomalous radon variation related to earthquakes, we should set a network of Radon monitoring and establish a model of radon variation for the future detailed analysis.

Keywords: atmospheric electricity field, atmospheric ion concentration, radon concentration

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Short burst radiation at the time of lightning observed in Noto peninsula.

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During our observation period, one short and four long bursts were detected. Short burst with 3-millisecond duration was detected on 31 Dec. 2014. At the same time, cloud-to-ground lightning occurred. Considering the AEF polarity, we identified the occurrence of the positive cloud-to-ground lightning, which produced the short burst.

Keywords: Energetic radiation, Winter Lightning, Thunderstorm

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