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Short-Term Earthquake Prediction by the Relation between Atmospheric Ions and Radioactive Aerosols

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It has been indicated before that the atmospheric ions are effective in the short-term earthquake prediction (Tributsch, 1978). In addition, sudden changes of atmospheric-ion concentration had been confirmed before Kobe Earthquake in 1995 (Satsutani, 1996). Moreover, the conduct of atmospheric ions is greatly concerned with the electric field in the atmosphere. For example, we have the reports that say the atmospheric electric field was decreased before Matsushiro earthquakes and the earthquake of Colorado (Kondo, 1968, Wahlin, 1990).

On the other hand, the trial of the practical use of radon for the earthquake prediction is active. It is found out that precursors appear at the radon concentration in groundwater or soil before many earthquakes, such as the 1995 Kobe Earthquake and 1978 Izu-Oshima-kinkai earthquake (Igarashi et al., 1995, Wakita et al., 1980, Koizumi, 1997).

At the seismo-environmental laboratory of Okayama University of Science, continuous measurement of atmospheric-ion concentration has been carried on since 1998. Moreover, measurement of the radon daughter nuclides in the atmosphere (radioactive aerosols) has also been carried on since 2001. By these two kinds of measurement, we are searching for the possibility to the short-term earthquake prediction. This time, we studied the short-term earthquake prediction by the relation between an atmospheric ions and radioactive aerosols with the data obtained from two kinds of this measurement.

At this laboratory, atmospheric-ion concentration is measured using a Gerdien condenser. And the measurement ion, which is differ in the electrical mobility and polarity, is small, intermediate, and large ions. We took the statistics of the old data and analyzed it. As a result, it was cleared that an atmospheric ions vividly showed the diurnal variation and the seasonal variation. Small ions showed high concentration before or after dawn, intermediate ions and large ions showed low concentration. In contrast, from the evening to night, small ions showed low concentration and intermediate ions and large ions showed high concentration. This diurnal variation is the same as the measurement result by Horrak (2001). Therefore, we think that the pattern of the diurnal variation of atmospheric-ion concentration was established. Furthermore, it is nearly checked that the atmospheric ions had different concentration level in summer and winter.

The main generation factor of the atmospheric ions is ionization in the atmosphere by radioactive aerosols, such as radon daughter nuclides, which occupies 60% of the ionization (Ogawa, 2002). It also means the radon daughter nuclides in the atmosphere are important. The data obtained by the latest measurement showed that there must be the correlation between the diurnal variation of atmospheric-ion concentration and the radiation intensity of the radon daughter nuclides. Moreover, it is also similar to the diurnal-variation data of the radon concentration in the atmosphere measured by Yoshioka (2002). Therefore, we think that there is credibility of measurement data.

As a conclusion, we guess that the regular diurnal variation of atmospheric-ion concentration and the radiation intensity of atmospheric radon daughter nuclides are greatly confused just before earthquakes. However, it is necessary to consider weather-factors. For example, as for atmospheric-ion concentration, the influence of humidity is becoming clear by the latest research. We want to catch the signal before earthquakes by continuing to measure both.