Changes of atmospheric electrical conditions due to preseismic radon emanation: theoretical approach

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There are a lot of reports on seismic precursory phenomena such as changes in gas (e.g., radon-222) concentration in the ground (lithosphere), ions and electric field in the atmosphere, and electron content in the ionosphere. Recent studies have attempted to reveal those mechanisms in the framework of the lithosphere-atmosphere-ionosphere (LAI) coupling. Potential candidate of the LAI coupling trigger is considered to be anomalous radon emanation from the ground leading to ionization of aerial gases. In this presentation, we show the changes in atmospheric electrical conditions (small ion concentration, conductivity, and electric field) in the atmosphere under a quasistatic condition. The changes are calculated from the data on atmospheric radon concentration before the 1995 Hyogo-ken Nanbu earthquake. The preseismic radon emanation causes increase in the ion concentration and the atmospheric conductivity and decrease in the electric field in the lower atmosphere which can explain reported seismic precursors at those altitudes. In contrast, in the rest of the atmosphere, it does not cause the changes of atmospheric electrical conditions. These results suggest that not only the quasistatic systems but also transient electrodynamic ones (e.g., electromotive and hydration effects) in the atmosphere are required for clarifying the ionospheric perturbations in the LAI coupling regime.