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Fractal analysis results of electromagnetic emissions (ULF and VHF) associated with earthquakes.

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In Japan we face with a danger from earthquakes. It is necessary for us to predict the next earthquake in order to mitigate the earthquake hazard; when and where it will occur. Today we know that the cycle of local big earthquakes is on the order of several decades or a couple of hundred years, but we do not escape from earthquakes even though we do not know that. Therefore we need short-time earthquake prediction. If we obtain the information on the precursory effect of breakdown phenomenon associated with an earthquake, it would be very useful for the short-time prediction of earthquakes.

So, in this paper we attempt to elucidate the mechanism of an earthquake from the standpoint of electromagnetic effects. There are many earthquake precursors, but we focus on ULF and VHF electromagnetic noise, and we analyze them by means of mono- and multi-fractal methods. It is reported that they are an effective method for natural noise associated with earthquakes. In this paper we regretfully speak about only mono-fractal results.

First, we attempt to analyze ULF geomagnetic data to find precursory phenomena associated with Guam earthquake in 1993. As the consequence of our analysis, mono-fractal dimension D started to change significantly from three months before the earthquake. And it is found that the fractal dimension exhibits five maxima 99, 75, 52, 21, and 9-4 days before the earthquake main shock, which suggests the ULF electromagnetic signature of nonlinear evolution (in the sense of self-organized criticality) taking

place in the lithosphere just before the 1993 large Guam earthquake. That is, there take place step-like changes in the lithosphere during the long-term of the order of several months before the main shock.

Secondly, as a result of VHF electromagnetic noise analysis, mono-fractal parameters showed a significant change a few days before the Miyagi prefecture offshore earthquake happened on 16 August 2005. Therefore we are sure that the fractal character of VHF electromagnetic noise changed a lot before the earthquake. In addition, there are active faults near the observatory, where the fractal parameters of electromagnetic noise changed most significantly. In these areas geochemical material (radon etc) is likely to outbreak by fault activity. So we thought that geochemical material was emanated as a result of self-organisation in the lithosphere and consequently these effects appeared as natural VHF electromagnetic noise.