Re-examination of electric field data immediately before the occurrence of the 1999 Izmit earthquake

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Electric and magnetic field data obtained at four sites just over the rupture zone of the Izmit earthquake (Mw7.4) attracted our attention with expectation that something anomalous could hopefully be detected before the occurrence of this earthquake. In fact, the quality of data is extremely good in that highly sensitive MT instruments were in operation in addition to one more site at remote site for the so-called remote reference processing of MT data. Our previous analysis indicated, however, that nothing anomalous could be found in the high quality data, although very clear co-seismic changes in both the electric and magnetic fields were seen in all the data sets. These changes were later interpreted in terms of the seismic dynamo effect. This result greatly discouraged us and cast a severe doubt to an optimistic view of earthquake prediction, as was also the case for the 2003 Tokachi-oki earthquake and the 2004 Parkfield earthquake.

On the other hand, there is an interesting report on seismic activity detected also at a site just over the rupture zone; a sequence of small foreshocks had occurred immediately before (one hour) the main shock had occurred. The magnitudes were all below 2.5 but their waveforms are quite similar to each other. This may suggest the possibility of slip of the fault immediately before the rupture. We have so far examined in detail the records during a few hours before the main shock, although no significant anomalies were apparent. In highly sensitive records, variations of non-seismic origin are not unusual and one typical origin is electromagnetic induction by geomagnetic field variations of external origin. These variations can be predicted from two horizontal components of geomagnetic field variations at a remote reference site and hence can be removed by appropriate filtering. This turned out to be quite effective and we could examine the residuals in great detail. The detection level was thus reduced to as low as 10^{-7}V/m in the electric field.