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Remote Detection of Electric Field Variations Generated at Propagating Seismic Wave Front

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Seismic waves are usually observed by detecting field changes of elastic waves at the observation site. Here we present the first success of detecting seismic wave by means of remote measurement of electric field variations. The most clear electric signal was observed at the time of a moderate earthquake of M4.7 occurred in the western part of Ibaraki Prefecture, Japan on June 14, 2002. Clear electric field variation was observed from the very beginning of fault rupture at about 100 km far point from the observation site. The field changes evolved as the P wave approaches to the site, and a different phase of the variation was also detected in accordance of the S wave arriving and leaving the site. It is suggested that the propagation speed of the signal is more than 100km/s, probably equal to the radio wave speed in the earth. There are six similar examples during about 10 months' observation period indicating that the phenomenon is real.

The finding indicates the possibility of an independent and remote sensing sensor in seismology. As an important application in the practical point of the earthquake early warning, the method can provide another critical several seconds compared with the ordinary method of seismic wave measurement. The several seconds can contribute considerable amount of reduction of seismic hazard.

The generation mechanism is suggested to be electro-kinetic effects at the increased pressure changes at the seismic wave front.