

Seismological meaning of total duration time T_e of VHF scattering waves observed before earthquakes.

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A new observation system established in Hokkaido, northern Japan to confirm a suspected relationship between anomalous radio-wave propagation and impending earthquakes has been documenting anomalous VHF-band radio-wave propagation beyond the line of sight prior to earthquakes since Dec., 2002. During such events, radio waves transmitted from an FM radio station were scattered, such that they could be received by an observation station beyond the transmitting station's line of sight. A linear relationship was established between the logarithm of the total duration time of the anomalous transmissions (T_e) and the magnitude (M) or maximum seismic intensity (I) of the impending earthquake for M4- to M5-class earthquakes that occurred at depths of about 50 km beneath the Hidaka Mountains in Hokkaido, Japan in June 2004 and March 2008. We found empirical formulas between T_e and M and h , and T_e and I_{max} :

$$\text{Log}(T_e) = (0.0098h + 0.6)M - (0.16h + 1.7) \quad (1)$$

$$\text{Log}(T_e) = 0.68 I_{max} + 0.4 \quad (2)$$

From seismology, empirical formulas were obtained between aftershock area A , fault area S and seismic moment M_0 ($= mDS$) and M :

$$\text{Log} A = 1.02 M - 4.0 \quad (\text{Utsu and Seki, 1955}) \quad (3)$$

$$\text{Log} S = 0.72 M - 5.8 \quad (\text{Takemura, 1998}) \quad (4)$$

$$\text{Log}(mDS) = 1.32 M + 9.9 \quad (\text{Aki, 1966}) \quad (5)$$

These empirical formulas are suggested that T_e related to the time of fault creation and action of tectonic stress.