Detection of seismo-ionospheric perturbations on the basis of reception of VLF transmitter signals on the satellite, DEMETER.

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There have been recently reported a lot of electromagnetic phenomena associated with earthquakes, which would be promising for the short-term earthquake prediction. This paper deals with the propagation anomaly of VLF transmitter signals observed on the satellite in order to study the seismo-ionospheric perturbations.

The ground-based reception of subionospheric VLF/LF waves, is recently recognized as a promising tool to study the ionospheric perturbations in the lower ionosphere associated with earthquakes. This paper deals with the whistler-mode signals in the upper ionosphere from the VLF/LF transmitters.

The French satellite, DEMETER was launched on 29 June, 2004, and it is working good with the aim of studying seismo-electromagnetic effects. We have chosen two large Japanese earthquakes ((1) Niigata EQ (23 October, 2004; M=6.6, d=16km) and (2) Miyagi oki EQ (16 August, 2005; M=7.2, d=36km)), and the target transmitter is a Japanese LF transmitter (JJY) whose transmitter frequency is 40kHz. Due to a large longitudinal separation of the satellite orbit (2,500km), we have to adopt a statistical analysis over a rather long period (such as 3 weeks or one month) to have reliable data set. By analyzing the spatial distribution of JJY signal intensity during different periods (6 weeks before, 3 weeks before, 3 weeks after, and 6 weeks after the EQ), we have found significant changes in the intensity ; Generally the intensity is depleted before the EQ, which is considered to be precursory ionospheric perturbations of the earthquake. This analysis indicates the important role of satelite observation in the study of lithospher-atmosphere-ionosphere coupling.