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TOWARDS DETECTING EARTHQUAKE DEFORMATIONS BY MICROWAVE RADIOMETER

Abstract

Earthquake detection is important for social well being. Much effort has been devoted to finding an effective means of detection. Interferograms formed by the data of a satellite-borne synthetic aperture radar (SAR) enables us to detect slight land-surface deformations in connection with volcanic eruptions or earthquakes. However at current, since the time lag between two scenes of SAR used to form interferograms becomes longer than the reccurent period of a satellite aboard it (several tens days), it is not clear enough when land-surface deformations occur in volcanic eruptions or earthquakes.

In order to solve this problem, we have investigated another approach to detect land-surface deformations with shorter time resolution from the data of satellite-borne sensors. It was recently confirmed that microwave energy is emitted when rocks are fractured in laboratory experiments. We first extrapolated the experimental results and estimated how much the power of microwave energy generated by rock failures in an earthquake is received by a satellite-borne radiometer. As a result, it was concluded that this microwave energy is detectable enough for a satellite-borne radiometer. Microwave energy can penetrate the ionosphere, so it can be observed by satellite-borne sensors without ionospheric effects, but a large ambiguity exists in the underground propagation of microwaves. This conclusion was obtained under some assumptions for the underground propagation of microwaves. However, if land-surface deformations are detected by SAR, they are accompanied by rock failures. If rocks are crushed by land-surface deformations, the ambiguity in the underground propagation of microwaves is reduced, and microwave energy generated by rock failures becomes increasingly likely to be detected by a satellite-borne microwave radiometer.

Based on this concept, we developed an algorithm to evaluate microwave energy generated by rock failures on the land surface, and verified the algorithm using the data of the Advanced Microwave Scanning Radiometer for Earth Observation System (AMSR-E) for some earthquakes which occurred after the observation by AMSR-E was started. In this paper, the development process and the verification result of the algorithm is presented.