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Statistical Analysis of the Correlation between Microwave Emission Anomalies and Seismic Activity Based on AMSR-E Satellite Data

kai qin (1), Lixin Wu (1), Angelo De Santis (2), and Bin Zhang (1)

(1) China University of Mining & Technology, China (qinkai20071014@163.com), (2) Istituto Nazionale di Geofisica e Vulcanologia, Italy

Pre-seismic thermal IR anomalies and ionosphere disturbances have been widely reported by using the Earth observation system (EOS). To investigate the possible physical mechanisms, a series of detecting experiments on rock loaded to fracturing were conducted. Some experiments studies have demonstrated that microwave radiation energy will increase under the loaded rock in specific frequency and the feature of radiation property can reflect the deformation process of rock fracture. This experimental result indicates the possibility that microwaves are emitted before earthquakes. Such microwaves signals are recently found to be detectable before some earthquake cases from the brightness temperature data obtained by the microwave-radiometer Advanced Microwave-Scanning Radiometer for the EOS (AMSR-E) aboard the satellite Aqua. This suggested that AMSR-E with vertical- and horizontal-polarization capability for six frequency bands (6.925, 10.65, 18.7, 23.8, 36.5, and 89.0 GHz) would be feasible to detect an earthquake which is associated with rock crash or plate slip. However, the statistical analysis of the correlation between satellite-observed microwave emission anomalies and seismic activity are firstly required. Here, we focus on the Kamchatka peninsula to carry out a statistical study, considering its high seismicity activity and the dense orbits covering of AMSR-E in high latitudes. 8-years (2003-2010) AMSR-E microwave brightness temperature data were used to reveal the spatio-temporal association between microwave emission anomalies and 17 earthquake events (M>5). Firstly, obvious spatial difference of microwave brightness temperatures between the seismic zone at the eastern side and the non-seismic zone the western side within the Kamchatka peninsula are found. Secondly, using both vertical- and horizontal-polarization to extract the temporal association, it is found that abnormal changes of microwave brightness temperatures appear generally 2 months before the M>6 earthquakes. Since the microwave emissions observed by AMSR-E are affected by various factors (e.g., emission of the earth's surface and emission, absorption and scattering of the atmosphere), further study together with the surface temperature, soil moisture and atmospheric water vapor will remove the weather and climate influences.