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Seismic Ionosphere electromagnetic Anomaly Detection and Analysis Research on M∼8.8 Earthquake in CHILE Based on DEMETER Satellite Data

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Earthquake detecting, predicting and warning is the major issues of seismology research. With the development of remote sensing technology and data assimilation techniques, the massive remote sensing data and assimilating data provide long-term, spatio-temporal continuous parameters in land surface, atmosphere and ionosphere.
In order to analyze the electromagnetic parameters' distribution information in frequency and scale and the correlation of different parameters, we adopted the sliding correlation analysis and wavelet multi-scale analysis method, taking Chile earthquake which broke out on February 27, 2010, as a study case. In the study area of 5 °, 10 °, 20 ° and 30 ° from the epicenter, the anomalies in different study areas were analyzed, and it is found that significant anomalies information could be detected in the area from 5 ° to 20 ° from the epicenter. In the range of 30 °, the abnormality is not obvious. The results show that the anomaly information of different parameters of DEMETER satellite data before Chile earthquakes can be detected by different detection methods. The electron density, electron temperature, ion density and Oxygen ions density present abnormally increasing trend, while the electron temperature is abnormally decreasing. The correlation between Oxygen ions and Helium ion, as well as between Hydrogen ions and Oxygen ions is declining before the earthquake.
It is worthy note that all of ionosphere electromagnetic data used in this experiment is beyond the disturbanc of the solar magnetic storm as well as geomagnetic storm. Therefore we can determine that the observed ionosphere electromagnetic anomalies have more probability of relating to the earthquake activity.
To conclusion, the method of this study can effectively detect the singularity and abrupt point of the preseismic signal, as well as the energy anomaly at different scales and frequencies.

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