The Improving of PI Method and Its Application to the Background Analysis and Anomaly Detection of Electromagnetic Satellite

Wu, A.X.[(1)] and Zhang, Y.X.[(2)]

(1) Beijing Earthquake Administration, Beijing 100080, China
phone: +86-10-62614853; email wu-anxu@163.com
(2) China earthquake networks center, Beijing 100045, China

There existed an obvious background trend by analyzing the spatial and temporal characteristics of the magnetic data recorded by the French DEMETER electromagnetic satellite. If the background field influences are not well eliminated, the short-term changes and abnormal information of magnetic field are difficult to identify and discovery. Thus, in extracting the short-impending anomalies of satellite data, the analysis and elimination of space-time background field should be one of the most critical problems. Although the Pattern Informatics (PI) method (Rundle et al., 2000; Rundle et al., 2000) was mainly used in the seismicity except seismic precursor, but was improved appropriately by using of six important aspects, and introduced firstly into the satellite data processing. Through the appropriate length of time window, sliding step length and a fixed period of time $t_2 - t_1$ for the PI method, the series of space prediction images with time about the three IAP parameters by dynamic tracing can be calculated out. By the background elimination and anomaly analysis in some middle-strong earthquakes (Wenchuan M_s8.0, Yutian M_s7.3, Laos M_s6.6, Gaize M_s6.9, Ning'er M_s6.4, etc), the following conclusions were obtained: (1) The PI method not only can markedly eliminate the space-time background trends, but also remarkably accentuate the short-term changes of satellite data. So the PI method have the strong space-time fusion capability. (2) For the time period $t_2 - t_1$, there do exist obvious anomalies in ionosphere before the above middle-strong earthquakes, and the anomalies had certain instruction value to judging the occurring time and location of those earthquakes. (3) For the different time period $t_2 - t_1$, they contain the basic same and steady quantity information, so the PI method has a positive potential application value in the background analysis and anomaly detection of electromagnetic satellite.